DIMENSIONS OF EARNINGS INEQUALITY IN AUSTRALIA

By

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Alexis S. Esposto
Henderson Scholar

Declaration

'I Alexis Sergio ESPOSTO, declare that the PhD thesis entitled "Dimensions of Earnings Inequality in Australia", is no more than 100,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work'.

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Abstract

Over the last three decades, Australia and many other industrialised nations have seen major social and economic changes. For Australia, two of these have been increasing inequality of earnings and the growth in alternative forms of employment arrangements. For the US and a number of other countries, the prevailing explanation for the increase in inequality centres on the notion of skill-biased technological change (SBTC). This view is based on the consensus that technical change favours more skilled workers, as new technologies evolve and are introduced into workplaces. This explanation relates the increases in earnings inequalities to a shift in demand towards highly skilled workers and away from less skilled workers, and centres around the concept and measure of skill.

In this context, this thesis investigates three central issues that relate to dimensions of inequality in the Australian labour market. First, has there in fact been increasing skill bias in the demand for labour, and how should skill best be measured in addressing this issue? Second, if increasing skill bias is confirmed, is there any evidence that this increase in relative demand for high skill labour is an important explanatory factor in the rise in earnings inequality? Third, can the increasing role of casual and part-time work in Australia be interpreted as, in substantial part, a response to skill bias in the demand for labour, and as indicative of rising inequality in the labour market?

The main findings of the thesis are as follows. For the first question, there is evidence of skill-bias in the demand for labour both in the long and short term in total and full-time employment. Although there was clear evidence of skill bias in full-time employment for men and women, the extent was not homogenous across different job types.

Secondly, earnings inequality continued to increase in occupations for men and women between 1989-1995 and 1997-2002, irrespective of the type of inequality measures employed. Moreover, in trying to explain the causes of increasing earnings inequality in full-time work, the analysis found that the O*NET measures of skill and knowledge provided some tentative evidence that supports the skill bias hypothesis in Australia. Thirdly, in the exploration of the relationship between skill bias, alternative job types and earnings inequality, the thesis finds some indicative evidence to suggest

that the process of job type creation may imply a new dimension of increasing earnings inequality in the Australian labour market.

The broad implications of these findings are tied to both increasing earnings inequality in full-time earnings and in household income inequality. This is particularly so for those households whose majority of members are low skilled and are dependent on casual and part-time work, and who on average work a small number of hours.

Part A:

Overview, Literature and Issues

Chapter 1
Thesis Overview

1.1 Earnings Inequality, Technological Change and Skill

Since the mid-1970s there has been an increase in earnings inequality in many countries, including Australia, and a substantial international literature has grown up analysing that increase. For the US and some other countries, the prevailing explanation has been one form or another of skill-biased technological change (SBTC). That is, changes in the pattern of demand, relative to supply, in favour of individuals with higher skill levels have led to increased relative earnings in high skill jobs, and these changes have been primarily driven by technological change, whether exogenous or endogenous (Acemoglu, 2002). In much of the literature the proxy used for skill is years of education, and a key piece of evidence for the prevailing view in the US is that a substantial part of the increase in the variance in earnings across individuals is explained by observable factors, including education. That part of the change in the variance that must be explained by unobservable factors is often interpreted as reflecting unobservable variations in skill and/or ability.

Some countries in Europe have seen smaller increases in earnings inequality over the period, but have experienced higher rates of unemployment than countries such as the US. A common explanation of this has been that SBTC leads to increasing earnings inequality when labour markets are flexible, as in the US, but to higher unemployment among lower skill workers when labour markets are relatively rigid (Atkinson, 1999).

Australia saw a significant rise in earnings inequality since the mid-1970s, and this continued through to 2002 (whereas the rise tapered off in the US after 1996), together with a strong decline in unemployment after 1992. Existing studies have, on the whole, found skill-bias in the demand for labour in Australia, using either occupation or education as a proxy for skill, that is, they have found that the rate of growth of the demand for skilled labour has been greater than that for unskilled labour. There has been little evidence that skill factors have played an important role in explaining the increase in earnings inequality. Indeed, Borland and Kennedy

(1998b) and Borland and Wilkins (1996) found that observable factors, including education as a proxy for skill, explain none of the increase in the variance of earnings across individuals. Australia has also seen rapid growth in part-time and casual work. If this is a more cost-effective way for employers to obtain quality adjusted labour hours, especially for lower skill workers, it is possible that the growth in these forms of employment is itself partly a response to SBTC.

1.2 The Issues

This thesis investigates three main issues arising in this context. First, has there in fact been skill-bias in the demand for labour in Australia, and how should skill best be measured in addressing this issue? Second, if skill-bias is confirmed, is there any evidence that this increasing relative demand for higher skill labour is an important explanatory factor in the rise in earnings inequality? Third, can the increasing role of part-time and casual work in Australia be interpreted as, in substantial part, a response to SBTC and as indicative of rising inequality in the labour market?

In addressing these issues, the definition and measurement of skill is crucial. Many different proxies for skill are used in the literature, although the number of years of education is the most common. But education and skill are different concepts: it should be an open question whether extensive education, of a given form, does indeed generate skills relevant to employment. The other main approaches to skill used in the Australian literature involve the Australian Standard Classification of Occupations (ASCO) skill classification at the major group or one-digit level (nine occupations) and the five skill level classification of occupations (skill levels I-V) created by the Australian Bureau of Statistics (ABS). Both of these have real limitations: they are at a very aggregate level; they lack any clear intellectual rationale, and hence any way of determining whether the average level of skill within a category, and indeed the difference in skill levels between categories, changes over time; and there is no way of ranking or assessing different degrees of skill within categories. Valuable analyses can also be carried out using earnings as a proxy for skill but this precludes any subsequent investigation of the role of changing skill-bias in increasing earnings inequality. Thus, in order to address these three issues, considerable effort has been devoted to exploring an alternative approach to skill.

1.3 Data and Analysis

The limitations of the data available in Australia greatly complicate the task of addressing these issues. For example, the unit record data on individuals from the Income Distribution Survey, necessary for detailed analysis of earnings inequality, provide only limited information (such as years of education, age and occupation at the ASCO one- or two-digit level) on the characteristics of individuals relevant to the assessment of skill levels.[1] It is thus much less rich than, for example, the Current Population Survey in the US, where usable data at a highly detailed level (i.e. similar to the four-digit level of ASCO 2nd edition) for industry and occupation are available. Given these limitations, and the availability of some detailed data on employment and earnings by occupation, we largely use an approach based on occupations in this thesis. One justification for this approach is that, for the US, over half of the change in the variance in earnings across individuals over the 1972 to 2002 period can be explained in terms of changes in average earnings in, and the distribution of employment across, detailed occupations. Even here there are substantial problems, specifically, the lack of comparability of earnings data across revisions in the occupational classifications over time in Australia.

1.3.1 Consistent employment data by detailed occupation, 1971-2001

Three main data construction, assembly and analysis activities are reported in this thesis. First, a detailed concordance was established at the four-digit occupational level for employment for seven censuses from 1971 to 2001. This makes use of detailed link files to assemble estimates of employment across some 340 ASCO 2nd edition occupations for the 1971-2001 period, by linking the Classification and Classified List of Occupations (CCLO) structure (which applied for 1971-1981) and ASCO 1st edition structure (which applied for the 1986 and 1991 censuses) to ASCO 2nd edition structure. This provides a consistent series of employment by occupation for 1971-2001, by males and females, and for full-time and part-time work. Unfortunately these methods cannot be applied to derive a consistent earnings series as is done with occupations, as there is no method available for determining the

[1] The Income Distribution Survey also contains information on occupations at the two-, three- and four-digit level of ASCO, but on advice from the ABS this cannot be released for cross-tabulation purposes with variables such as age, educational level and years of experience, due to issues of confidentiality.

distribution of earnings in groups that shift between occupations in the classification change.

1.3.2 Applying O*NET measures to Australian data

Second, to provide an alternative basis for analysing issues concerning skill, a database was created by linking detailed data from the US Occupational Information Network (O*NET) to this Australian employment data at the four-digit occupational level. The O*NET database provides hundreds of numerically scaled descriptors of the attributes and characteristics required in specific occupations, and it is assumed in this assignment that the attributes and characteristics determined for occupations in the US can also be applied to the corresponding occupations in Australia. While later revisions to the O*NET data are available, only one set of data on the attributes and characteristics of individuals for a given occupation are available within the time period being addressed here (1971-2001). Thus these data, from the 1st edition of O*NET (1998), are used as the single reference point for Australian occupations.

From within the full range of the O*NET descriptors, three are chosen as especially relevant: generalised work activities (GWAs), knowledge and skills. *GWAs* are the underlying job activities and behaviours that are involved in the accomplishment of major work functions. Data are available on 42 descriptors which are organised in a hierarchical taxonomy and can be reduced to nine categories (such as searching for information, undertaking physical work or administering). *Knowledge* is defined in the O*NET as a collection of discrete but related facts, information and principles about a particular area of work, and is acquired by formal education, training or experience. Scores are provided, for each occupation and in several dimensions, on the role of 33 areas of knowledge. *Skills* are defined in the O*NET more narrowly than in the general economic debate, namely, as 'a set of general procedures that underlie the effective acquisition and application of knowledge in various domains of endeavour' (Mumford and Peterson 1995, chap. 3, p. 4). They are thus specifically tied to the acquisition and application of knowledge. Numerical scores are available for 46 skill descriptors for each occupation.

In each of the three areas, and for each occupation and each detailed descriptor, scores are available (on a 0-100 range) for both the level and the importance of the variable

for that occupation. Thus, for example, biology might be an important area of knowledge for both veterinary scientists and assistants, but the level of biological knowledge required will be much higher for scientists than assistants. To create simple measures from this wealth of data, we use the average of the cross-product of the level and importance variables for each occupation as a key indicator. For example, the knowledge intensity of the occupation is measured as the average, over the 33 knowledge areas, of the product of the level and importance scores for each knowledge area for that occupation.

One limitation of using these measures to analyse skill, and changes in skill, over an extended period of time is that the 1998 O*NET scores for each occupation are applied to each census year from 1971-2001. Thus this approach does not take account of skill changes within detailed occupations, but measures only changes in the skill composition of employment as a result of changes in the distribution of employment across occupations. While recognising this limitation, we make two points. First, the other measures commonly used (other than years of education) have similar problems at a much more aggregate level. For example, when the two-digit occupation scale is used, there is no way of assessing whether the skill level of, say, 'managers and administrators' has changed over time. Nor is it possible to assess changes in skills over time within and between skill levels I-V. Second, by using the detailed four-digit occupational classification, our measure reduces some of these problems. A good deal of skill change will be reflected in changes in employment patterns across detailed occupations rather than change within occupations. Nevertheless, this limitation must be kept in mind in interpreting the results. On the other hand, one strength of the O*NET approach is that the measures enable a numerical ranking to be made of all occupations in terms of scores on each of the three variables, thus facilitating various forms of analysis.

1.3.3 Earnings by detailed occupation

Third, to undertake some analysis of the possible impact of SBTC on earnings inequality, we assembled detailed data on average earnings within four-digit occupations for two periods: 1989-1995 and 1997-2002. As explained earlier, it is not possible to assemble consistent data on earnings across changes in the occupational

classification structure. The 1989-2002 period was chosen partly because the data on permanent and casual employment are available only from 1989.[2]

1.4 The Findings – Skill-Bias in Australian Labour Demand

The findings in relation to the first question that this thesis addresses - has there been skill-bias in the demand for labour in Australia over the 1971-2001 period, and indeed how should skill best be measured in addressing this issue - are provided for the O*NET measures in Chapters 7 and 8 and brought together for all measures in Chapter 9. Throughout this analysis it is assumed that the Australian labour market adjusts over time to balance demand and supply for skill, so that the employment data can be treated as lying on the demand curve.

1.4.1 The O*NET approach to measuring skill: full-time work

One key finding from all approaches is that changes in the skill composition of employment differ markedly for males and females, and for full-time and part-time work. For the O*NET variables, trends across the three measures (knowledge, skills and work activities) were remarkably similar. The findings on these variables are reviewed first, with the common trends across the three variables emphasised.

For full-time work, the aggregate employment-weighted indices[3] for each of the three O*NET variables show an increase of 18.1 to 23 per cent for males and of 38.2 to 57.9 per cent for females respectively over the 1971-2001 period (see Table 1.1). For each measure the increase for females was about double that for males, and was more evenly distributed over the period, whereas the increase for males was concentrated in the 1981-1991 period. These employment-weighted indices are interpreted as measuring the average intensity of employment in the particular variable (GWA intensity, knowledge intensity or skill intensity). For all three variables the average intensity of male full-time employment was much greater than that of female full-time employment in 1971, but for two of the three variables (GWA intensity and knowledge intensity) the average level for females had by 2001 surpassed that for males.

[2] As advised by the ABS.
[3] The way these indices are calculated is described in detail in Section 6.5 of Chapter 6.

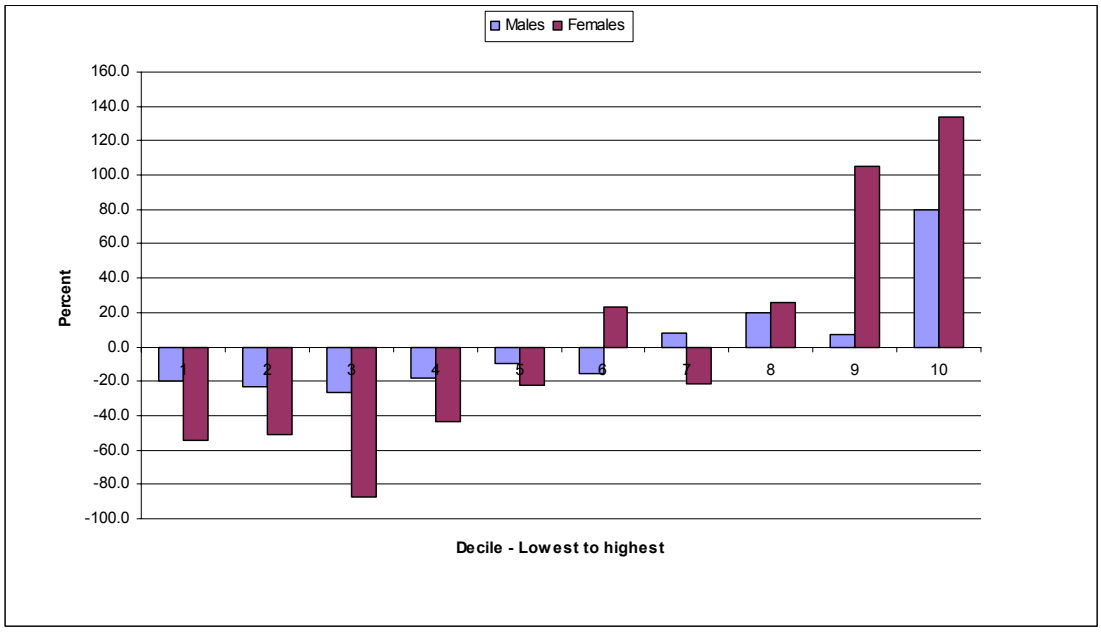
Table 1.1 Employment-weighted indices for three O*NET variables: full-time employment, males and females, 1971-2001 (indices 1971=100)

	Males			*Females*		
	Work Intensity	*Knowledge*	*Skills*	*Work Intensity*	*Knowledge*	*Skills*
1971	100.0	100.0	100.0	100.0	100.0	100.0
1976	101.3	102.8	102.1	106.8	105.9	108.4
1981	103.1	104.2	104.2	112.3	113.2	115.9
1986	106.9	108.5	108.4	116.4	117.6	122.4
1991	114.4	116.9	118.2	126.7	127.9	139.3
1996	115.6	116.9	120.3	134.2	133.8	151.4
2001	118.1	119.7	123.0	139.0	138.2	157.9

Source: Estimates of the author, based on O*NET and ABS data.

For each variable, and for both males and females, these changes have been particularly driven by employment growth in occupations clustered towards the top of the 'skill' distribution. For example, Figure 1.1 shows the growth in male and female full-time employment over the 1971-2001 period for each decile relative to the total employment growth for the period and is calculated using Equation 6.3, in Chapter 6. That is, occupations are ranked in terms of GWA intensity in 1971 and divided into deciles by employment in that year, and the relative rate of growth of employment in the resulting groups of occupations is shown in Figure 1.1.

Figure 1.1 Change in male and female full-time employment arranged by GWA intensity, 1971-2001



Source: Tables 7.3 and 7.5.

For males, the variations in growth rates across the deciles are modest (in a range from –27 to 20 per cent over 30 years) except in the highest decile, where the relative increase has been nearly 80 per cent in terms of worker activities. Indeed, over 50 per cent of the growth in the work intensity index for full-time males arises from the growth in employment in five occupations, all in the top decile – computing professionals, general managers, sales and marketing managers, project and program administrators and information technology managers. For women, 23 per cent of the GWA index for full-time females is attributed to the growth in employment in occupations in the top decile of the employment distribution. For the second highest decile, 30 per cent of the GWA index increase for full-time females is attributed to the growth in employment in ten occupations.

These results are indicative of a process of increased relative demand for skill in full-time work over the 1971-2001 period. For men, the increasing skill-bias is less pronounced than for women, is particularly focused on the 1981-1991 period and is concentrated in a small number of high skill occupations. It is also possible to use these techniques to explore what dimensions of skill – what areas of knowledge, what O*NET skills and what GWA requirements – have been particularly influential in increasing demand. These dimensions are reviewed in Chapters 7 and 8. In general, in full-time work the derived demand for knowledge in the areas of health services and education and training has grown most rapidly, as has the demand for systems skills and for activities involved in coordination and management.

1.4.2 The O*NET approach to measuring skill: part-time work

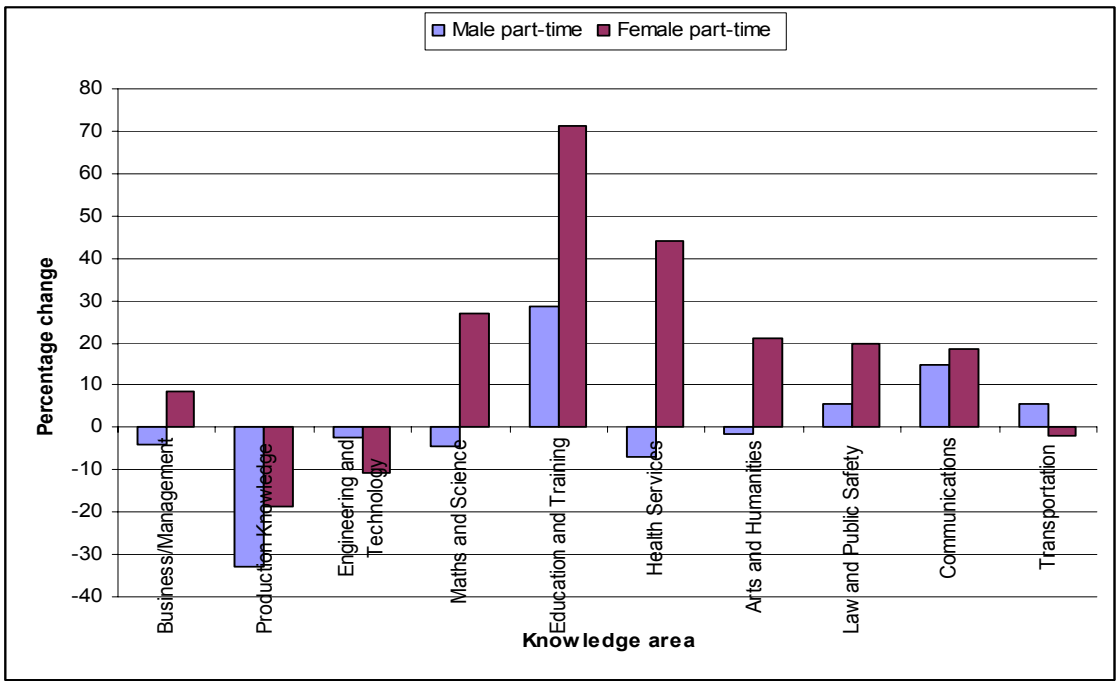
The picture is quite different for part-time work, which has grown very rapidly over the period. For males, the aggregate indices for all three variables fell steadily, apart from a small increase between 1996 and 2001, and are significantly lower in 2001 than in 1971 (Table 1.2). For females there has been some increase, but most of that increase had taken place by 1981; between 1981 and 2001 the three indices for female full-time work rose by only about 3 per cent. A possible explanation for the decline in the aggregate indices for males in part-time employment and the increase for female part-time employment can be seen by inspection of Figure 1.2, which shows the changes to the knowledge requirements of part-time employment.

Table 1.2 Employment-weighted indices for three O*NET variables: part-time employment, males and females, 1971-2001 (indices 1971=100)

	Males			*Females*		
	Work Intensity	*Knowledge*	*Skills*	*Work Intensity*	*Knowledge*	*Skills*
1971	100.0	100.0	100.0	100.0	100.0	100.0
1976	98.2	98.6	98.6	102.7	104.4	103.8
1981	95.2	98.6	93.2	108.1	111.8	112.3
1986	93.4	95.8	91.9	108.1	113.2	111.3
1991	91.6	94.4	89.2	108.7	113.2	112.3
1996	90.4	91.5	85.8	109.4	113.2	114.2
2001	91.6	93.0	87.2	110.7	114.7	116.0

Source: Estimates of the author, based on O*NET and ABS data.

Figure 1.2 Change in knowledge requirement for part-time employment, 1971-2001



Source: Table 8.16.

Of particular interest is the decline in knowledge areas that require production and engineering and technology knowledge for men and women. In contrast, the relative importance of knowledge of education and health can be seen by the strong increase in these areas, particularly for women. While knowledge areas such as mathematics, science, health services, arts and humanities, and business management increased for women, these declined for men, perhaps indicating that part-time employment is far more knowledge intensive for women than it is for men. Similar trends are also exhibited in Chapters 7 and 8 in the areas of O*NET skill and worker activities.

1.4.3 Other approaches to measuring skill

Chapters 7 and 8 suggest that the O*NET measures of GWAs, knowledge and skill are useful measures that provide important information about the process of upskilling occurring in the Australian labour market. Another way of investigating the process of upskilling in job types in Australia can be done using occupational data, based on ASCO 2nd edition. To analyse upskilling of the labour force ASCO 2nd edition major group of occupations can be clustered into five skill categories as suggested by the ABS. The nine occupational categories and five skill categories of ASCO are shown in Tables 1.3 and 1.4 and are explained in more detail in Chapter 3. These tables show the percentage change in employment and ASCO skill level relative to total employment growth in each job type. In terms of occupational growth, male and female full-time employment experienced increases in the top three occupations and declines in all others.

Table 1.3 Change in employment by occupation relative to total employment growth in each job type, Australia, 1971-2001

ASCO Major Group	*Male Full-time*	*Female Full-time*	*Male Part-time*	*Female Part-time*
Managers and administrators	23.4	125.2	-56.3	-15.6
Professionals	87.3	145.9	-8.9	51.1
Associate professionals	23.4	81.3	-11.4	-3.1
Tradespersons and related workers	-14.1	-25.0	-4.6	-18.2
Advanced clerical and related workers	-28.3	-27.6	-17.7	-7.1
Intermediate clerical, sales and service workers	-8.9	-14.6	13.4	8.4
Intermediate production and transport workers	-18.1	-62.5	3.2	-29.8
Elementary clerical, sales and service workers	-15.8	-45.0	124.6	25.2
Labourers	-37.8	-60.9	10.2	-50.4

Note: Estimates for the 1971 data are derived by applying the concordance methodology described in Chapter 6. Occupations are aggregated to ASCO 2nd edition major group. 'Inadequately described' and 'not stated' are not included in calculations. *Source:* ABS census employment data for 1971 and 2001.

For part-time male employment the top five occupations declined considerably, while the lowest three occupations experienced employment growth. Female part-time employment experienced a mixed pattern of growth with relatively strong increases in three occupations, namely, professionals, intermediate clerical, sales and service

workers, and elementary clerical, sales and service workers. All other occupations experienced declines.

Table 1.4 Change in employment by skill relative to total employment growth, Australia, 1971-2001

Skill Level	*All employees*	*Male full-time*	*Female full-time*	*Male part-time*	*Female part-time*
I Managers/Professionals	49.8	51.6	140.4	-31.4	35.5
II Associate Professionals	20.4	23.5	81.3	-11.4	-3.1
III Skilled vocations	-22.2	-14.7	-26.8	1.0	-10.5
IV Intermediate skills	-13.2	-14.6	-23.8	3.2	4.0
V Elementary skills	-13.3	-31.9	-52.6	42.2	-14.9

Note: Estimates for the 1971 data are derived by applying the concordance methodology described in Chapter 6. Occupations are aggregated to ASCO 2nd edition major group. 'Inadequately described' and 'not stated' are not included in calculations. *Source:* ABS census employment data for 1971 and 2001.

These changes indicate that over the long term full-time employment has experienced clear signs of upskilling trends characterised by increases in employment creation in skills I and II and declines in the other three skill categories. These trends were not present in part-time employment. Changes in part-time employment for men showed clear signs of deskilling, while for women these changes were characterised by a mixed pattern of upskilling and deskilling.

1.4.4 Skill-bias changes for permanent and casual work

Over the last three decades the Australian labour market has experienced enormous change. A major feature of this has been the increasing diversity in the nature of work and types of employment, particularly the rise in casual employment. Chapter 9 analyses whether skill-bias has been different for casual and permanent employment. Table 1.5 shows that upskilling has not been homogenous for or casual and permanent employment. Changes to hours worked and employment show clear signs of upskilling in permanent employment, whereas for casual employment there appears to be a polarisation between high skill (high paid) jobs and low skill (low paid) jobs both in terms of hours worked and employment growth.

Table 1.5 Growth in employment and hours worked by skill, relative to total employment and hours worked growth, for permanent and casual employment, Australia, 1989-2002

	Change in persons		*Change in hours*	
Skill level	*Permanent*	*Casual*	*Permanent*	*Casual*
I Managers/Professionals	36.8	54.2	37.0	30.9
II Associate Professionals	12.6	-39.3	15.2	-24.8
III Skilled vocations	-28.0	-30.8	-25.8	-28.9
IV Intermediate skills	4.2	10.7	1.5	15.6
V Elementary skills	-23.0	3.2	-28.7	0.4
Memorandum Item				
Total growth in employment and hours	*11.2*	*78.4*	*9.3*	*91.2*

Source: ABS 1989 and 2002 issues, cat. no. 6310.0, provided by the ABS. Author's calculations.

1.4.5 Conclusion

The main conclusion that can be drawn from the analysis in Chapters 7, 8, and 9 is that, broadly speaking, Australia is experiencing skill-bias in the demand for labour. This has occurred both in the long run (between 1971 and 2001) and in the shorter run (between 1989 and 2002). Much of this has been driven by employment growth concentrated in the top of the O*NET GWA, knowledge and skill and ASCO skill distributions. Upskilling has not been uniform across job types, being quite evident in full-time employment but not so in part-time work over the 1971-2001 period. Furthermore, a distinction needs to be made in terms of male and female part-time employment. Unlike full-time employment, where both males and females showed clear signs of upskilling, part-time employment exhibited signs of upskilling for females, but deskilling for males.

The analysis of skill-bias in casual and permanent employment showed that upskilling has not been homogenous. Permanent employment showed clear signs of upskilling, whereas casual employment showed signs of polarisation between high skill (high paid) jobs and low skill (low paid) jobs. These signs were evident both in terms of employment growth and growth in hours worked.

1.5 The Findings – Skill-Bias and Earnings Inequality in Full-Time Earnings

1.5.1 Approaching the role of skill-bias through the analysis of detailed occupations

Chapter 10 investigates whether there is any evidence that skill-bias in full-time employment is a significant factor in increasing inequality in full-time earnings. For the reasons noted above, the study takes a different approach to that found in the Australian literature by concentrating on increasing earnings inequality in terms of occupations rather than the more general approach that focuses on the analysis of earnings inequality in terms of individual earnings (e.g. Juhn et al., 1993, for the US; and Borland and Wilkins, 1996, for Australia). The analysis begins by first measuring the increased earnings variability across occupations between the 1989-1995 and 1997-2002 periods. As explained earlier, because earnings concordances cannot be constructed using occupations that belong to two separate occupational classifications (i.e. ASCO 1st edition and ASCO 2nd edition), two time periods are investigated separately, namely, 1989-1995 and 1997-2002. Earnings inequality is measured across occupations at the four-digit level using the results of the Employee Earnings, Benefits and Trade Union Membership survey (EEBTUM) (ABS cat. no. 6310.0). To measure earnings inequality across occupations the percentile difference in current weekly earnings is calculated for males and females, together with four commonly used measures of inequality: the Gini coefficient, the mean log deviation, half the squared coefficient of variation and the variance. The analysis shows that the dispersion of earnings for males and females across occupations had widened between the two periods under investigation (1989-1995 and 1997-2002), regardless of the type of distributional measures employed. The increase in the dispersion of occupational earnings for men and women was quite similar, but the changes in the dispersion of occupational earnings were not as pronounced for women as it was for men. For example, in 1989, the 95th percentile of occupations for men earned 1.3 times more than the 70th percentile. By 2002, this had increased to 1.5 times. At the 90th percentile, occupations for men earned 1.8 times more than the 10th percentile, but by 2002 the earnings gap had increased by nearly 2.5 times. For women, this had increased from 1.7 times in 1989 to 2 times in 2002. At the bottom half of the distribution, the 50th to 10th percentile had increased from 1.2 times to 1.3 times,

whereas in occupations for men, this had increased from 1.2 to 1.4 times between 1989 to 2002. The pattern of increasing inequality in the distribution of occupational earnings over the two periods for men and women is also verified by changes in the summary statistics employed in the analysis. For male and female occupations, each of the summary measures of the distribution of earnings across occupations (i.e. the Gini coefficient, the mean log deviation, half the squared coefficient of variation and the variance) show that the dispersion of occupational earnings increased in the two periods.

In seeking evidence of the role of skill-bias in increasing earnings inequality, Chapter 10 assesses the role of the O*NET measures of skill and knowledge in explaining this increased dispersion of earnings across occupations in Australia. In this investigation, a decomposition analysis is adopted similar to that undertaken by Borland and Wilkins (1996), which is explained in more detail in Section 10.4.2. It shows that for the 1989-1995 period, changes in the distribution of and return to skill and knowledge account for much of the increase in occupational earnings inequality for men. This is evidenced by the increase in the $90^{th}/10^{th}$ percentile difference in log earnings between 1989 and 1995, which is largely attributed (55 per cent explained) to changes in the distribution of and return to skill and knowledge. Similarly, 25 per cent of the increase in the variance of log weekly earnings is explained by changes in the return to observable skill and knowledge. This suggests that much of the increase in the dispersion of occupational earnings for men is due to changes in the distribution of and returns to our skill and knowledge measures. For women, observed factors more than explain the increase in earnings inequality at the $90^{th}/10^{th}$ percentile of the earnings distribution. In contrast to males, the increase in the variance of log weekly earnings more than explains changes in the return to observable skill and knowledge, also indicating that much of the increase in female occupational earnings inequality in the top of the distribution for the period is accounted for by changes in the distribution of and returns to our skill and knowledge measures.

For the 1997-2002 period, similar results are obtained for men and women. For example, at the $90^{th}/10^{th}$ percentile one-third of the increase in occupational earnings inequality for men can be explained by our skill and knowledge measures. For women, changes in the distribution of and return to skill and knowledge are account

for much of the large increase in dispersion in the female occupational earnings distribution. Evidence for this can be seen at the $90^{th}/10^{th}$ percentile where 64 per cent of the increase is explained by our observable factors. Unlike other research addressing the distribution of earnings across individuals, (e.g. Borland and Kennedy, 1998b; and Borland and Wilkins, 1996) these findings show that much of the increase in male and female occupational earnings inequality is due to changes in the distribution of and returns to our skill and knowledge measures.

1.5.2 Conclusions

Two conclusions are arrived at from this analysis. The first is that these findings provide some evidence, using average earnings across occupations rather than across individuals, that support the skill-bias hypothesis for full-time work in Australia. This is, however, indirect evidence only, and no substitute for a full analysis using data on individual earnings. The second is that the application of our O*NET measures of skill and knowledge does provide a valuable resource in the analysis of labour market change in Australia.

1.6 The Findings – Skill-Bias, Alternative Jobs Types and Earnings Inequality

The final chapter of the thesis explores the third question outlined above, namely, whether the increasing role of part-time and casual work in Australia can be interpreted as, in substantial part, a response to SBTC, and as indicative of rising inequality in the labour market. Responding to the first part of this question involves testing the hypothesis, presented in Chapter 3 and analysed in detail in Chapter 11, that one way in which employers have responded to the process of skill-bias in the demand for labour is to reduce wage costs by arrangements such as casual and part-time work. This can be seen as an extension of Atkinson's concept of the Transatlantic Consensus whereby SBTC leads to increased earnings inequality in flexible labour markets such as the US and to increased unemployment in the more rigid labour markets in many countries in Europe (Atkinson 1999). The hypothesis is that, in Australian conditions, it has led inter alia to increased growth in alternative, lower cost, forms of employment.

1.6.1 Testing the job type response hypothesis

Five empirically testable implications of this hypothesis are derived in Chapter 11, and are tested for the 1997-2002 period using data obtained from the Employee Earnings, Benefits and Trade Union Membership survey, (ABS cat. no. 6310.0). The five implications of the hypothesis and the corresponding evidence are summarised below. It is important to note that many other factors than those contained in the hypothesis may be shaping the data trends detailed below. For example, given the high level of aggregation of the data, it is likely that compositional effects within particular skill levels and job types are significant. This may mean that observed changes in the hourly wage rates and in employment may reflect changes in the composition of a particular skill level or job type, rather than more fundamental economic factors. Thus I am concerned to investigate only whether the data are consistent with these five empirical implications of the hypothesis, rather than to establish the hypothesis in any stronger sense.

(i) Opening wages: The first implication of the hypothesis concerns the relative level of opening wages, here 1997. It suggests that, across skill levels, hourly rates of pay for permanent employees are higher than those for casual employees, and those for full-time workers are higher than those for part-time workers. That is, for given skill levels and using the notation described in the footnote[4]:

$$w_m > w_c \text{ and } w_f > w_p ,$$

and, more specifically:

$$w_{fm} > w_{fc};\ w_{pm} > w_{pc};\ w_{fm} > w_{pm} \text{ and } w_{fc} > w_{pc}.$$

The data assembled in Tables 11.1 to 11.3 in Chapter 11 show that, in 1997, the ratio of the hourly wage rate for permanent full-time work to that for casual full-time work was substantially greater than one in each of the five skill categories, and that the same is true for part-time permanent and casual work. Across all skill levels the average value of this ratio in 1997 for full-time work was 1.50, and for part-time work

[4] Here w is the wage level of a particular group, measured in terms of the hourly wage rate, and Δw is the percentage change in that rate over a specified period; e is the employment level of a particular group, measured in terms of either persons employed or hours worked, and Δe is the percentage change in employment over a specified period; subscripts h and l refer to high and low skill, subscripts m and c refer to permanent and casual job types, and subscripts f and p refer to full-time and part-time job types respectively.

it was 1.38. Thus this implication is consistent with the data for permanent and casual work. It terms of the other inequalities, the data shows that in 1997 the hourly wage rate for a full-time permanent worker was higher than that of a permanent part-time worker for four out of five skill levels, and that the average ratio was 1.09. By contrast, the cost of employing a casual worker on a full-time basis in 1997 was significantly lower, in four of the five skill categories, than that of employing such a worker on a part-time basis. Thus the implication that $w_{fc} > w_{pc}$ across skill levels is not consistent with the data. However, the overall ratio of full-time casual to part-time casual hourly rates in 1997 was 1.07, reflecting the heavy concentration of part-time casual worker in low wage jobs.

(ii) Pattern of change in wages: The second implication of our hypothesis considers the pattern of change in wages for different job types. This proposition suggests that the growth in wages is expected to be strong in high skill occupations relative to less skilled occupations in each job type. Hence, for all job types and for all skill levels:

$$\Delta w_h > \Delta w_l \, .$$

Also, for given skill levels, wage growth is predicted to be faster for casual than permanent employment and for part-time than full-time employment, because of the increased relative demand for employment in these job types arising from the postulated response to SBTC. That is, for given skill levels:

$$\Delta w_c > \Delta w_m, \text{ and hence } \Delta w_{fc} > \Delta w_{fm} \text{ and } \Delta w_{pc} > \Delta w_{pm}; \text{ and}$$
$$\Delta w_p > \Delta w_f, \text{ and hence } \Delta w_{pm} > \Delta w_{fm} \text{ and } \Delta w_{pc} > \Delta w_{fc}.$$

The data analysed for the 1997 to 2002 period point to a general trend whereby, for all job types, the hourly wage rate grew more rapidly in high skill than low skill occupations. While this trend is clear for each of the four job types, in each case there is an exception of one pair of comparisons between skill levels. For example, for permanent full-time work the average hourly wage rate for skill level III rose slightly more rapidly than for skill level II (8.7 per cent as opposed to 8.2 per cent).

In terms of the wage rate growth for given skill levels across job types, the growth in real hourly wage rates was greater in total casual than in total permanent work across all skill levels, with the differences particularly pronounced at high skill levels.

However, this finding is largely driven by strong growth in skill differentials in permanent employment work, and is not apparent in part-time work. Indeed, at lower skill levels the change in hour wage rates between 1997 and 2002 was generally much lower than for permanent part-time work.

Similarly, the growth in hourly wage rates was higher in total part-time work than in total full-time work across all but one of the skill levels, but this finding is largely driven by full-time work, for which it holds for all skill levels.

(iii) Employment change: The third implication relates to changes in employment and total hours worked. In terms of changes in employment across skill levels, it is predicted that, for full-time permanent employment:

$$\Delta e_h > \Delta e_l ,$$

but there is no clear prediction for other job types. As a result of the lower wage cost and substitution effects it is predicted that, for given skill levels:

$$\Delta e_c > \Delta e_{m,} \text{ hence } \Delta e_{fc} > \Delta e_{fm} \text{ and } \Delta e_{pc} > \Delta e_{pm}; \text{ and}$$
$$\Delta e_p > \Delta e_f, \text{ hence } \Delta e_{pm} > \Delta e_{fm} \text{ and } \Delta e_{pc} > \Delta e_{fc}.$$

The data analysed broadly confirms the first aspect that for full-time permanent employment the growth in employment in high skill occupations is stronger than that in low skill occupations. The only exception here is employment in skill level IV grew more rapidly than that in skill level III.

In terms of growth in casual and permanent employment, the implication is strongly confirmed across skill levels for total and for full-time work, but is not generally confirmed for part-time work. For the comparison of part-time and full-time work, the implication is strongly confirmed for total and permanent work, but not for casual work.

(iv) Wages in low skill occupations: This implication relates to the assumption of downward inflexibility of real wages in the face of declining relative demand for skill. For all job types it is predicted that the change in real hourly wage rates at low skill levels is not less than zero. This prediction is particularly relevant for full-time permanent employment where, according to the hypothesis, the relative demand for labour should be weakest at low skill levels.

This implication is confirmed by the data analysed. The real hourly wage for full-time permanent workers in skill level V rose slightly over the 1997-2002 period. Real wages for skill level V employees in casual full-time and in permanent part-time jobs rose significantly, and for those in part-time casual jobs it fell by a very small margin (0.1 per cent). Given the margins of error surrounding this aggregate measure of real wages, this result is taken as consistent with the implication.

(v) Decline in demand for low skill occupations: This implication states that there will be a relative, and perhaps an absolute, decline in the demand for full-time permanent employment in low skill occupations, because of skill-bias generally, the higher relative cost of permanent employment and the downward inflexibility of wages for such employment.

The data analysed confirms this implication. The growth in hours worked in full-time permanent employment is strong at high skill levels and negative in low skill ones. For example, total hours worked in full-time permanent employment in skill level V fell by 6.5 per cent between 1997 and 2002, but rose by 19.3 per cent for skill level I.

1.6.2 Conclusion – job type response hypothesis

In terms of the overall hypothesis that the growth in alternative job types may be in substantial part a response to SBTC, in labour markets in which wages for a given job type are inflexible downwards but in which variation in employment across job types is possible, the evidence of the 1997-2002 period is fully consistent with the hypothesis for casual work but much less so for part-time work. That is, it is consistent with this evidence to view the growth in casual work as in significant part a response to skill-bias in the demand for labour, but the picture is much less clear with the growth of part-time work.

1.6.3 Growth in alternative job types and earnings inequality

Finally, Chapter 11 also explores whether the rapid growth of alternative job types may imply new dimensions of increasing earnings inequality in the Australian labour market not captured by the analysis of full-time earnings. In examining this question the distribution of changes in hours worked, hourly rates and total earnings between 1997 and 2002 across the two ABS measures of skill, namely, the nine aggregate occupations and the five ASCO skill levels, were measured for each job type (full-

time and part-time casual and permanent employment) and total employment. In terms of employment, earnings, hours worked and hourly rates of pay for all job types in total between 1997 and 2002, the data again show strong evidence of increasing inequality. The pattern of change in terms of total earnings and total hours worked for all Australian occupations shows strong increases in the top three, slowing growth in the middle and a decline in the lowest (labourers and related workers). In terms of ASCO skill, changes to total earnings and total hours worked show a strong bias towards highly skilled occupations, with the least skilled occupations (skill IV and V) experiencing modest increases in both total earnings and total hours worked. These changes at the level of total employment are consistent with those revealed by analysis of full-time employment and earnings only.

In terms of job types, the analysis shows a number of important points. First, within full-time work there are major differences between permanent and casual full-time work, with the increase in the dispersion of total earnings across occupations or skill levels being much greater in permanent rather than casual full-time work. Second, the increase in the dispersion of earnings over 1997-2002 in both types of part-time work, and especially in casual part-time work, is greater than in total full-time work. In casual part-time work, for example, the average growth in earnings in skill levels I and II was 40.6 per cent while the average growth in earnings in skill levels IV and V declined by 6.9 per cent. Furthermore, the difference in growth rates between high and low skill levels was much greater in casual part-time work than in all other job types. For example, the increased dispersion of earnings in casual part-time work relative to total full-time work can be attributed to changes in hourly rates. Hourly rates in the top two skill levels have increased much more rapidly, relative to those in the bottom two skill levels. This is particularly the case in casual part-time work.

1.6.4 Conclusion

These findings point perhaps to newer dimensions of earnings inequality in the Australian labour market. If this is the case, then they may impact on the distribution of income across households. If this growth in alternative job types is partly driven by skill-bias in the demand for labour, this could provide another avenue whereby skill-bias leads to increasing inequality in earnings and is likely to impact on household income inequality.

1.7 Thesis Structure

The thesis is divided into four parts and consists of eleven chapters. Part A is made up of three chapters. Chapter 1 is the introduction and overview of the thesis and sets out the background to the research, the research issues, the thesis structure and the main conclusions arrived at. Chapter 2 reviews the literature and discusses the extent and causes of increasing earnings inequality both in Australia and overseas, for full-time earnings and describes the role of the SBTC hypothesis in Australian and international literature. It also identifies two limitations of the literature. The first is that most studies of earnings inequality have concentrated on full-time earnings, while ignoring other dimensions of inequality. The second limitation centres on the concept of skill, which is poorly defined and inadequately measured in studies of inequality in full-time earnings. Chapter 3 discusses the various ways in which skill has been measured in studies of earnings inequality, discusses the major changes that have occurred in the labour market in Australia over the last three decades and presents a hypothesis that describes its behaviour.

Part B of the thesis consists of three chapters and deals with issues of data assembly. In trying to identify a different measure of the concept of skill, the O*NET system is explained in Chapter 4. A detailed description of the data and measurements used here is given in Chapter 5, with specific mention as to how the concordances were prepared, using employment data obtained from the census to align the CCLO, ASCO 1st edition and ASCO 2nd edition occupation data. A detailed explanation of how job assignments were conducted between Australian and US occupations using the O*NET database and ASCO is also provided. Chapter 6 describes in more detail the three measures used drawn from the O*NET to describe labour market change and upskilling in Australia. The three components of GWA, knowledge and skill used in the empirical research are explained and the manner in which the methodology used in the analysis of labour market change is discussed.

Part C of the thesis examines the changing composition of Australian employment between 1971 and 2001. Chapter 7 looks at changes in the GWA composition. This is done by analysing changes in the overall GWA of male and female part-time and full-time occupations. The second part of the chapter addresses whether the GWA content of jobs is increasing, and whether this increase is more prominent in the male

full-time or part-time or female full-time or part-time categories of employment. Chapter 8 expands on the analysis conducted in Chapter 7, by looking at the worker requirements of Australian occupations using the O*NET measures of skill and knowledge composition of Australian employment. This is done by analysis of changes in the overall skill and knowledge intensity of male and female full-time and part-time occupations. The second part of this chapter addresses whether the skill and knowledge content of jobs is changing, and whether these changes can be interpreted as a form of upskilling of the labour market.

The final part of the thesis presents an analysis and findings for the questions under investigation. Chapter 9 provides an analysis of skill-bias in the demand for labour for different job types. The approach taken is to include in the analysis the distinction between casual and permanent employment for male and female full-time and part-time work. This chapter also addresses the conflicting evidence of skill-bias in the demand for labour in Australia and the distinction in the concept of skill-bias found in the ASCO definition of skill and the different measures derived form the O*NET.

Chapter 10 addresses the question of whether evidence can be found that skill-bias in full-time employment is a determining factor in increasing earnings inequality in Australia and to what extent. The analysis takes a different approach to that found in the Australian literature. Given data limitations, it analyses the dispersion of full-time earnings across occupations rather than across individuals. Finally, Chapter 11 revisits and explores the hypothesis presented in Chapter 3, that there may be in Australia a third expression of skill-bias, namely, the growth of alternative forms of employment other than full-time permanent jobs. The other aim is to enquire whether the trend towards greater part-time and casual work in Australia is itself indicative of rising inequality in the labour market.

Chapter 2
Increasing Earnings Inequality and Skill-Bias: The International and Australian Evidence

2.1 Introduction

Since the mid-1970s nearly all OECD member countries, including Australia, have experienced fundamental economic and social change. These have manifested themselves in a variety of ways, including rapid technological change, freeing up of capital markets, increasing overseas trade and massive changes to the labour market. Throughout this period, and especially during the 1980s and the 1990s, the Australian labour market experienced persistent levels of high unemployment and increasing inequality in the distribution of earnings. Alongside this there has been a rapid growth in different types of employment.

VandenHeuvel and Wooden (2000), for example, document trends in the diversity of new employment arrangements. Today many Australians are increasingly employed in jobs that involve part-time arrangements, hours of work that vary from week to week, or combinations of both. Added to this has been the rapid increase in casual employment which can be terminated at short notice[1] or where contracts stipulate the duration of employment, hence reducing its continuity. Many people have opted to become self-employed, while many firms have chosen to outsource their labour operations. Another development has been the increasingly important role that women are playing in the labour market. Between 1961 and 1999 the participation rate for married women rose from 17.3 to 54.4 per cent, while for single women it remained relatively stable. By

[1] There is an ongoing debate as to how the legislation covering casual employment can be operationalised. Although the intent of the legislation is to expedite the termination of casual employment at short notice, in practice (in many workplace awards) many casual employees with unbroken tenure (often after a period of one year) can claim legal protection.

contrast, the participation rate of men steadily declined, particularly for those aged 55-64 years (e.g. Norris, 2000, p. 34; Borland, 1997, p. 6).

These phenomena have contrasted starkly with the experience of the 1950s and 1960s in which most OECD countries, particularly Australia, Canada, the US and the UK, experienced increases in employment and mean wages with little change in the dispersion of wages (Vickery, 1999, p. 7).

Differences between the Australian and international experience can be attributed to a particular set of factors and operations of the labour market that attach to the Australian context. As argued in this chapter, there are factors that affect the demand and supply for skilled labour which together with institutional arrangements impact on dimensions of earnings inequality.

During the 1990s the world's most powerful economy, the US, experienced an impressive employment record against a background of persistent high unemployment in the majority of OECD member countries, including Australia. From the beginning of 1990 to the fourth quarter of 1997, total employment rose by 10.9 per cent, and the unemployment rate fell by 0.9 per cent to 4.6 per cent in 2001 (Katz, 1998, p. 1).

In OECD Europe, unemployment increased to 10.1 per cent between 1990 and 1997, falling to 8.6 per cent[2] in 2001. The UK followed a similar path, with the jobless number rising from 6.8 to 7.1 per cent between 1990 and 1997 but declining to 4.8 per cent in 2001 (OECD, 2002, p. 304). Over the same period, unemployment increased in Australia from 7.0 per cent in 1990 to 8.5 per cent in 1997, declining to 6.7 per cent in 2001 (OECD, 2002, p. 304).

Strong employment growth in the US, the UK and to some extent Australia in the later part of the 1990s was accompanied by large increases in earnings inequality, particularly in the UK and Australia. Wages have increased more rapidly for those with more education and in high-skilled occupations, but the dispersion of wages within demographic and skill groups has also increased (Atkinson, 1999; Borland, 1998; Katz, 1998; Machin, 1996 amongst others). Nevertheless, trends in the overall earnings

[2] This measure refers to the average unemployment rate of 30 OECD member countries (OECD, 2002, p. 304).

inequality for these three nations have not shared similar paths, especially in the later 1990s. Card and DiNardo (2002) show that earnings inequality in the US can be divided into three distinct episodes. The first relates to the 1960s and 1970s when inequality was relatively constant. During the 1980s, the situation changed significantly with rapid rises in earnings inequality occurring more prominently in the early part of the decade. This trend continued until the end of the 1980s when wage inequality steadied. As the US entered the 1990s, wage inequality began to stabilise: 'Indeed, none of the three series … show a noticeable change in inequality between 1988-2000' (Card and DiNardo, 2002, p. 17). For the UK, the situation is different, particularly as it relates to the late 1980s and 1990s. Between 1977 and 1999, earnings inequality increased among all employees, men and women, young and old alike. It rose in each of the seven year time periods, including 1977-1983, 1984-1990 and 1991-1997, the largest increases occurring in the first two periods (McKnight, 2000, p. 18). For Australia, the picture appears to be more consistent with that of the UK rather than the US experience. The labour market has seen a widening of earnings differentials between workers at the top and bottom of the distribution of earnings between 1975 and 1999 (Borland et al., 2001, p. 7). Other studies utilising different measures have arrived at similar conclusions (e.g. Saunders, 2000; Norris and Mclean, 1999; Borland and Kennedy, 1998b). [3]

Borland et al. (2001) argue that Australia is entering a social crisis that can be traced back to three interrelated features of the economic development of the past quarter of a century, and of the 1990s in particular.

> The first of these is increased inequality in earnings in the different types of jobs that are available, and in particular within full-time jobs. The second is the continuing change in the type of jobs available, especially the rise in part-time casual jobs, and the increasingly unequal distribution of better paid jobs. The third is the growing polarisation of households into work rich and work poor, with many couples having access to several jobs and working long hours in total, while an increasing proportion of couples have little work. (Borland et al., 2001, p. 4)

Increases in earnings inequality have been well documented both in Australia and overseas, and economists have put forward a number of explanations. The prevailing

[3] Although the comparisons may not necessarily involve the same populations or for that matter the same time periods for the UK, the US and Australia, the concern here is to highlight the broader trends exhibited in earnings inequality.

view is known as the Transatlantic Consensus, a term coined by Atkinson (1999). These explanations centre around the notion that increased inequality arises out of a shift in demand from unskilled to skilled labour, and as a result revolves around the notion of skill. The most widely accepted view within this type of explanation is the SBTC, where 'technical change leads to more rapid growth in the demand for skilled labour relative to that for unskilled labour, and perhaps also relative to the growth of supply' (Sheehan, 2001, p. 45). A different view within the same framework is that maintained among others by Wood (1994) who ascribes the rise in the relative demand for skilled labour to the liberalisation of international trade and increased competition from developing countries. Whatever generates increasing earnings inequality, it is important to examine the extent of earnings inequality that some advanced economies (including Australia) have experienced since mid-1970s.

2.2 The Extent of Earnings Inequality: The International and Australian Evidence

2.2.1 Earnings inequality versus income inequality

It is important to note at the outset that the focus of this thesis is on earnings inequality rather than income inequality. The study of earnings inequality has implications for equity in society, and changes to the distribution of earnings have potentially direct and indirect effects on the way in which a society functions. As such, these changes can strongly impact on income distribution (Borland, 1999, p. 178). Income derived from wages represents the primary source of income for most Australian households. According to Saunders (1995, p. 3), almost two-thirds of income received in 1989-1990 was in the form of wages, salaries or supplements. The study of changes to the distribution of labour market earnings amongst full-time wage and salary earners at different points in time can tell us a lot about equity issues in society. Furthermore, by definition, income is a much broader concept than earnings and encompasses regular and recurrent cash receipts including monies received from wages or salaries, government pensions and allowances, profit or loss from own business or partnership, property income, and other regular receipts such as superannuation, workers' compensation, child support and scholarships (Saunders, 2001, p. 154). The concept of

income inequality is far broader than earnings inequality, and the many issues in which income interacts with the labour market are well beyond the scope of this thesis.

2.2.2 Some common measures of earnings inequality

There is no single measure of the degree of inequality in a given distribution of earnings or of how inequality has changed over time. A number of techniques have been used to capture the spread of earnings of full-time employees in studies of earnings and income inequality. One of these is the Gini coefficient (see for example among many studies Burtless, 1990 in the US and more recently for Australia, Pappas, 2001). The coefficient or Gini ratio is a summary statistic and can be seen geometrically as the area under the Lorenz curve. The coefficient ranges from 0 to 1. At zero, the incomes are equal, which means that the Lorenz curve is equal to the 45-degree line. At the other extreme, where the Gini coefficient equals 1, inequality is at its highest possible level. Other measures include the variance of the natural log of earnings, which is a standard measure of the dispersion of earnings. This method was used amongst others by Harrison and Bluestone (1990) to examine wages in the US. One of the most popular measures currently used is the percentile ratio, where earnings towards the top and bottom of the distribution are expressed, for example, relative to median earnings (the amount at which exactly half of the employees earn more and half earn less). To obtain the percentile ratios, employees are ranked on the basis of their earnings from highest to lowest. They are then divided into ten equal parts or deciles, each containing 10 per cent of all employees. Each decile is made up of employees starting at 10 with the lowest, increasing to the highest decile becoming a breakpoint that provides useful measures of the dispersion of earnings. The most widespread measure used is to compare the ratio of the top with the bottom ($90^{th}/10^{th}$ ratio), the ratio of the top with the median ($90^{th}/50^{th}$ ratio) and the ratio of the median with the bottom ($50^{th}/10^{th}$ ratio). As these ratios increase, then the statistic indicates that inequality is rising in a particular part of the distribution (Saunders, 2000, p. 145).

2.2.3 The extent of earnings inequality: the case of the US and the UK

Earnings inequality in the US came into prominence after it was shown that the distribution of earnings ceased to be stable after the 1970s and began to show strong

signs of increasing inequality in the 1980s (Levy and Murnane, 1992, p. 1336). The shape of the income distribution was quite unlike that seen during the 1960s:

- during the 1950s and 1960s, the average wage grew rapidly and its dispersion around the mean changed little;
- since the mid-1970s and well into the 1990s, these patterns changed in the sense that mean wages grew slowly and inequality increased rapidly (Gottschalk, 1997, p. 21);
- between the end of the 1980s and 2000, wage inequality stabilised (Card and DiNardo, 2002, p. 17).

Between 1963 and 1989, the average weekly wage of working men in the US grew by about 20 per cent. As shown by Juhn et al. (1993), these gains were not equally shared. Wages for the least skilled (measured as the 10^{th} percentile of the wage distribution) fell by almost 5 per cent, whereas the wages of the most skilled (measured as the 90^{th} percentile) grew by 40 per cent.

> The net result of this divergence in earnings between the most skilled and the least skilled has been an enormous increase in wage inequality. According to our calculations, the variance of log weekly wages increased by about 72 per cent from 1963 through 1989. These findings are broadly consistent with the findings of others who have recently looked at inequality. (Juhn et al., 1993, p. 411)

Gottschalk (1997) in a later study for the 1963-1993 period finds that inequality increased both in years when unemployment was falling and when it was rising. Furthermore, unemployment levels were similar in the 1990s to those of the 1980s, yet inequality levels were higher. He concludes that changes in inequality in the US over a 20-year period were not cyclical, but were of a secular or long-term nature. Gottschalk (1997) further analysed changes in between-group and within-group inequality. Explanations of between-group inequality examine changes in the dispersion of earnings based on observable traits of workers such as gender, race, education and experience. Explanations of within-group inequality analyse changes in the dispersion of earnings of workers who possess the same traits.

When analysing between-group inequality, he discovered that the less educated had lost ground relative to the more educated, and more experienced workers had gained relative to younger and less experienced workers. This did not explain the whole picture, as

inequality increases were also found within groups of employees with the same traits. More than half of the increase in earnings inequality was within groups but 'inequality occurred even among workers of the same race and gender, with similar levels of education' Gottschalk (1997, p. 33). The increase in inequality within groups accounted for 50 per cent of the total increase for men and 23 per cent for women (Gottschalk, 1997, p. 32). According to Card and DiNardo (2002), these long-term trends appear to slow down considerably. Between 1988 and 2000 the US experienced stability in terms of wage inequality, a trend not seen in either the UK or Australia.

Machin (1996) shows a similar picture for the UK, where wage inequality grew rapidly after the late 1970s. The experience between 1966 and 1992 was as follows:

- between 1966 and 1972, there was no change in the wage structure, with similar rates of wage growth experienced in the 10^{th}, 50^{th} and 90^{th} percentiles;
- a compression of the wage structure occurred between 1972 and 1975, with real wage growth positive for each percentile, but higher for the 10^{th} percentile;
- between 1975 and 1978, real wage rates fell for all groups in the context of the Social Contract;
- between 1978 and 1992, a rapid increase in wage inequality occurred, with almost no wage growth at the 10^{th} percentile and increases at the 90^{th} percentile (Machin, 1996, p. 50);
- in 1977, employees in the top 10 per cent of the earnings distribution earned 2.8 times the amount of those in the bottom 10 per cent. By 1997, the top 10 per cent earned nearly 4.0 times the amount of those in the bottom 10 per cent (McKnight, 2000, p. i).

In regard to changes in earnings due to skill and age differences (between-group effects), Machin found that workers with certain observable attributes (such as education and age) did better in terms of wages and employment in the 1980s than those who did not possess those characteristics. Machin (1996) also found that within-group inequalities were a cause of increasing earnings inequality in the UK. This is a similar finding to that of Gottschalk (1997) in the US. Unlike the findings reported by Card

and DiNardo (2002) for the US, inequality in the UK continued to rise in the later part of the 1990s.

2.2.4 Comparison of earnings distributions across nations[4]

In this section, I report on work conducted by Gottschalk and Smeeding (1997) who use data collected from the Luxembourg Income Study (LIS) across a variety of countries during the late 1980s and early 1990s[5] to compare levels of earnings inequality. Table 2.1 shows summary measures of the earnings distributions in the nine countries for which the LIS database provides consistent data on annual before-tax earnings for males and females aged between 25 and 54. The figures in Columns 4, 5, 8 and 9 show the P10 and P90 values respectively as percentages of the median wage. Thus, the P10 value of 63.9 for German male workers shows that those at the 10^{th} percentile earned nearly 63.9 per cent of the wage of those at the median of the earnings distribution. Table 2.1 also details the $90^{th}/10^{th}$ and $80^{th}/20^{th}$ ratios as summary measures of total inequality. For German males, the figure at Column 6 indicates that, at the $90^{th}/10^{th}$ ratios, those at the highest decile (P90) earned 2.5 times more than their counterparts at the 10^{th} decile. Similarly, for the $80^{th}/20^{th}$ ratios, German males at the 80^{th} percentile earned 1.8 times more than those at the 20^{th} percentile.

The results in Column 6 show that the US and Canada stood out as the economies that had the most unequal earnings distributions for male and female full-time full-year workers at the $90^{th}/10^{th}$ ratio, with values of 5.7 and 4.6 for males and 4.8 and 5.2 for females. For the same group of workers, the Netherlands and Germany were the most equal for males at the $90^{th}/10^{th}$ ratio, while for females the Netherlands and the UK experienced the least earnings inequality.

In summary, according to the figures presented by Gottschalk and Smeeding (1997), the US experienced the highest levels of inequality for both males and females in

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[4] Cross-national studies of earnings inequality are difficult to do. The reason for this is that data comparability across nations is extremely difficult to obtain because of differences in approaches to measuring techniques employed.

[5] Gottschalk and Smeeding (1997) use wage and salary income synonymously with earnings because the LIS database does not contain separate measures of hourly rates. All estimates shown in Table 2.1 refer to annual earnings except for the UK where wages and salaries are measured on weekly surveys. The years shown by Gottschalk and Smeeding are limited by data availability in the LIS. As a result, cyclical conditions may affect the rankings of countries, especially those with small differences in inequality.

comparison to all other countries in the study, while Australia ranked third best in terms of earnings inequality for both males and females. When looking at the $80^{th}/20^{th}$ ratios in Column 7, the picture for male Australians remains the same, revealing the third lowest earnings inequality behind Germany and the Netherlands. Australian women experienced the second lowest earnings inequality, where Dutch females had the most equal earnings. The US again had the highest earnings inequality for both males and females.

Table 2.1 Earnings distributions in selected OECD countries in the mid-1980s and early 1990s: percentile of median and decile ratios

Country	*Year*	*Per cent with zero earnings*	*P10*	*P90*	*P90/P10*	*P80/P20*	*P10*	*P90*	*P90/P10*	*P80/P20*
			Full-Year, full-time workers (i)				*All workers (ii)*			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Males										
Australia	1989	20.8	56.8	160.6	2.8	1.9	54.0	161.6	3.0	1.9
Canada	1987	13.2	38.0	174.9	4.6	2.3	36.3	176.0	4.7	2.6
Finland	1987	15.1	n.a.	n.a.	n.a.	n.a.	28.1	169.7	6.0	2.1
[West] Germany	1984	16.3	63.9	162.0	2.5	1.8	58.0	16.9	2.8	1.9
Israel	1992	28.3	n.a.	n.a.	n.a.	n.a.	47.5	216.5	4.7	2.7
Holland	1987	22.3	71.5	172.8	2.4	1.4	69.3	168.7	2.4	1.7
Sweden	1992	11.1	48.2	166.4	3.5	1.8	43.4	167.0	3.9	1.8
UK	1986	29.5	61.4	188.1	3.1	2.1	60.7	186.3	3.1	2.1
US	1991	16.7	33.6	193.1	5.7	3.0	28.1	203.7	7.2	3.5
Females										
Australia	1989	35.9	49.2	156.3	3.2	1.9	23.2	183.0	5.7	3.4
Canada	1987	30.6	34.7	179.1	5.2	2.6	27.9	181.8	6.5	3.2
Finland	1987	16.8	n.a.	n.a.	n.a.	n.a.	32.8	152.2	4.6	2.3
[West] Germany	1984	47.9	45.9	156.0	3.4	2.0	23.1	180.6	7.8	3.4
Israel	1992	47.4	n.a.	n.a.	n.a.	n.a.	35.3	228.3	6.5	3.0
Holland	1987	62.0	72.6	173.5	2.4	1.7	29.9	185.1	6.2	3.1
Sweden	1992	12.3	37.9	153.2	4.0	2.2	30.7	156.6	5.1	2.4
UK	1986	50.1	64.9	181.0	2.8	2.0	34.6	223.0	6.4	3.5
US	1991	25.7	40.0	190.0	4.8	2.5	17.7	206.0	11.6	4.0

Source: Gottschalk and Smeeding (1997, p. 643). (i) Full-year: 50 full-time weeks or more a year; Full-time: 35 or more working hours a week. Full-year-full-time workers cannot be identified in the data for Finland and Israel. (ii) All workers with non-zero wage and salary income.

2.2.5 The extent of earnings inequality: the Australian experience

Changes in earnings inequality in Australia

In terms of changes to the earnings distribution, the picture for Australia shows some similarities and some differences to the one presented above and to the experience of many other OECD economies. Changes in the distribution of full-time earnings can be summarised as follows:

- earnings inequality increased from the mid-1970s onwards. Increases in inequality have been somewhat larger for male employees than female employees, who have had larger increases in real weekly earnings;
- earnings inequality increased rapidly for both male and female employees between 1975 and 1982. Since then, there has been a steady growth in inequality for males, whilst for females inequality also increased during the 1990s;
- increases in earnings inequality appear to have been smaller than in the US or the UK, but larger than in a range of Scandinavian and other European countries;
- all these findings are robust to choice of measure of earnings inequality, choice of data source and type of earnings variable (Borland, 1998, p. i).

A number of studies utilised earnings data to describe changes in earnings inequality for the period between the 1970s and 1990s (e.g. Watts and Mitchell, 1990; Borland and Wilkins, 1996). Borland and Wilkins (1996) use grouped data on the distribution of earnings obtained from two ABS data sources. The first is Weekly Earnings of Employees Distribution[6] (ABS cat. no. 6310.0). This provides information on the distribution of weekly earnings in main job of full-time male and female employees. The second data source used is the Distribution and Composition of Employee Earnings and Hours Australia (ABS cat. no. 6306.0) which details information on the distribution of weekly earnings in main job of full-time non-managerial adult male and female employees. The authors showed that between 1975 and 1994 real weekly earnings of a

[6] This survey is currently known as the Employee Earnings, Benefits and Trade Union Membership survey (EEBTUM).

male employee at the 25th percentile increased by 1.3 per cent, whereas earnings of an employee at the 75th percentile increased by 19.3 per cent. Women experienced a similar pattern, but the earnings inequality differences were not as pronounced.

Studies conducted by King et al. (1992), Gregory (1993) and McGuire (1994) also using the above data sources arrive at similar conclusions. For example, McGuire (1994, p. 50) found that there has been a continued increase in earnings dispersion among full-time employees since 1975, and that after experiencing increasing real earnings from 1975 to 1985, all groups of workers except higher paid women have suffered falling real earnings. Borland and Kennedy (1998b) used the Income Distribution Survey (IDS) (ABS cat. no. 6553.0) to report that between 1982 and 1994-1995 overall earnings inequality increased in Australia for both males and females. Norris and Mclean (1999) show that there has been a consistent increase in earnings inequality since 1975. For men the increase at the highest decile was greatest between 1975 and 1980, whereas for women this occurred between 1985 and 1998 in the lower half of the distribution. Cully (1999) notes that there appears to be an increasing polarisation in the Australian labour market between jobs that are high-skilled and paid, and those that are low-skilled and paid. This trend is also detected by Pappas (2001) who showed that differences in cognitive and interactive skills explain a good deal of the variation in earnings across occupations for both years and for males and females. He also demonstrated a strong rise in the return to cognitive skill, a measure derived from the US Dictionary of Occupational Titles (DOT), for male and female employees for the 1989-1994 period.

Saunders (2000) reports that the trend towards increasing inequality in Australia continued throughout the 1990s. For example, the difference between the earnings of full-time adult employees at the top of the earnings distribution (90th percentile) and those at the bottom (10th percentile) continued to rise. Between 1985 and 1998, 'the earnings of full-time adult employees at the lower end of the distribution (those at the 10th percentile) rose by more than those in the middle (i.e. the 90th/50th ratio increased by 6 per cent)' (Saunders, 2000, p. 145).

Borland et al. (2001) report that there was a strong widening of differentials between workers at the top and bottom of the distribution of earnings over the 1975-1999 period. Table 2.2 shows that for both males and females, earnings for workers with below-median earnings (10th/50th and 25th/50th ratios) have decreased relative to the earnings of

workers at the median point of the earnings distribution. Furthermore, what is striking about the numbers in Table 2.2 is that the ratio of the top to the middle ($90^{th}/50^{th}$) declined between 1980 and 1990 but increased substantially for males between 1990 and 1999. This also occurred for males at the $90^{th}/10^{th}$ ratio, where earnings inequality rose by 31.4 per cent between 1975 and 1999. Women experienced rises in earnings inequality of 17.8 per cent between 1975 and 1999 for the $90^{th}/10^{th}$ ratio. Earnings inequalities fell between 1990 and 1995, followed by a rise between 1995 and 1999. This pattern could also be seen at the $90^{th}/50^{th}$ ratio. What is clear from the studies discussed above is that earnings inequality increases appear to be of a long-term nature and are quite robust in terms of the type of measure used, the type of data utilised and the type of earnings variable employed.

Table 2.2 Earnings dispersion: weekly earnings of full-time employees in main job, 1975–1999

	P10/P50	*P25/P50*	*P75/P50*	*P90/P50*	*P90/P10*
Males					
1975	0.683	0.834	1.266	1.654	2.422
1980	0.625	0.816	1.316	1.714	2.742
1985	0.619	0.803	1.313	1.621	2.619
1990	0.593	0.777	1.309	1.616	2.725
1995	0.594	0.765	1.360	1.750	2.946
1999	0.590	0.765	1.401	1.878	3.183
Females					
1975	0.633	0.834	1.192	1.440	2.275
1980	0.604	0.802	1.225	1.538	2.546
1985	0.599	0.811	1.240	na	na
1990	0.604	0.804	1.281	1.604	2.656
1995	0.631	0.797	1.289	1.598	2.532
1999	0.620	0.793	1.323	1.661	2.679
2004					

Source: Table 1.1, Borland et al. (2001, p. 5); ABS 1975-1999, cat. no. 6310.0[7].

2.3 Empirical Analyses of Increasing Earnings Inequalities: The International and Australian Experience

The previous section summarised both the international and Australian evidence over the last three decades and found that earnings inequality was increasing in many

[7] New data is now available for 2002, 2003 and 2004. However, updating the data would require reviewing the trend analysis presented by Borland et al. (2001, p. 5).

countries. This section reports on the various forms of empirical techniques employed to study increasing earnings inequality. Section 2.4 discusses the most common explanations for its causes.

Empirical analyses of the causes of earnings inequality have concentrated in two areas. Explanations of wage inequality can be seen as changes in the wages received by different groups (between-group inequality) and wages received by employees within those groups (within-group inequality). The first area is concerned with a number of readily available characteristics of individuals such as age, gender, experience, ethnicity or years of education. It is useful to analyse the extent to which inequality is identifiable in characteristics between groups. These are also known in decompositional analysis methods as observed or 'observable' variables. In effect, what we are doing is understanding the characteristics of groups and how these affect earnings inequality. The second area is concerned with analysis of within-group inequality, which is hence due to factors other than those seen in these characteristics. Of course there is no absolute distinction between 'between-group' and 'within-group' as these vary according to the coverage of the groups being analysed. An example of this would be to look at changes in earnings inequality between males and females (between-group inequality) and then further disaggregate these groups to see if there are variations in earnings between men and women who possess other attributes (e.g. years of education, experience and skill levels). The relative importance of each group is in fact a simple function of disaggregation. If we continue to disaggregate the data to create more groups, then the relative importance of within-group inequality (unobservable characteristics) must increase, as this happens to be an arithmetic certainty.

2.3.1 Analyses of between-group earnings trends: the international and Australian experience

Explanations of between-group inequality are usually concerned with changing earnings differentials among groups of workers defined by education levels, gender, race, immigration, industry and age. Each of these factors is discussed below, with reference to findings in the international and Australian literature.

Educational level or attainment

The analysis of educational attainment stems from standard human capital theory. This states that, ceteris paribus, investment in human capital should eventually lead to higher wages in the form of a return to the human capital created. In other words, an employee with more years of education or training is more likely to earn a higher wage rate than their counterpart who does not possess the same years of education or training. At a time of increasing wage inequality, many economists have investigated changes to the returns to education. Machin (1996) in reviewing the experiences of Canada, Japan, Sweden, the UK, and the US reported that in the 1970s all these countries experienced a fall in the education premium, as a result of an increase in the supply of educated labour. In the 1980s, the picture changed considerably as the supply of educated workers 'continued to rise but, contrary to neoclassical price-theoretic responses, this went hand-in-hand with rising returns to education' or increases in wages to individuals who possessed higher educational qualifications (Machin, 1996, p. 53). For example, the percentage of men having a degree rose from 8 to 11 per cent and the percentage of men with no qualifications fell from 46 to 32 per cent in the UK. What appears to explain this increase in the returns to education in the UK and the US is that the demand for educated workers must have been increasing faster than its corresponding supply.

Studies in the US conducted by Topel (1997) and Levy and Murnane (1992) report that returns to a college education trended downwards until 1979, as college enrolments expanded sharply. The share of college graduates slowed in the 1980s, and this led to rising returns to education in the US. Topel (1997) reports a decline in the return to educated workers in the 1970s. This was driven by a strong and rapid expansion of the supply of educated workers which outstripped the demand, leading to a decline in the wage rate. Returns to college education stopped falling and began to rise in the 1980s, as the demand for educated workers had risen at a much faster rate than its corresponding supply. Sweden showed a similar pattern of flat or falling returns to university education during the 1970s, followed by rising returns during the 1980s, and this was also the case in many other developed economies (Topel, 1997, p. 66). This picture appears to have continued well into the 1990s. Card and Lemieux (2001) show that the college-high school wage gap continued to increase for young US men, and that little change was seen in the wage gap for older men. A similar trend could be found in

the UK and Canada, where the college-high school wage gap increased for young men relative to older men (Card and Lemieux, 2001, p. 739).

The link between wages outcomes and educational attainment has also been subject to close scrutiny in Australia. Borland (1996b) examined the education structure of earnings. His main findings were that overall earnings differentials between groups narrowed between the late 1960s and early 1980s. However, these remained steady or widened slightly between the early and late 1980s. For male workers with a degree, relative annual earnings declined from 1968-1969 until 1985-1986, but increased slightly between 1989 and 1990. Female workers with a degree experienced relative declines between 1973 and 1974 and 1978 and 1979. Preceding this period, relative earnings remained stable. In short, Borland's study indicates that Australia has not seen a strong trend in returns to education, as has been the US experience.

More recent work on the returns to education in Australia has adopted a different approach. Borland (2002) studies the impact of the introduction of the Higher Education Contribution Scheme (HECS).[8] His estimates of the rate of return from the post-HECS period are lower than those found in studies undertaken in the pre-HECS period. He concludes that the difference is due to the introduction of HECS.

Methods of analysis that look at the increases in the relative demand for college educated male and female workers can provide further insights into the reasons for increasing earning inequality both overseas and in Australia. These methods have been used in a number of studies that point to the fact that the relative demand for skilled workers has been consistently increasing over the last three decades.

Increased demand for educated workers has been widely seen as impacting negatively on the relative position of less skilled workers (Johnson, 1997; Murphy and Welch, 1993; Blackburn et al., 1990). Johnson (1997) arrives at the conclusion that the relative demand function for educated workers experienced rightward shifts during the 1980s and this 'holds for every method of aggregating different types of labour in a production function context' (p. 43). Murphy and Welch (1993) take the argument further, finding

[8] The introduction of HECS is likely to affect the supply rather than the demand of educated workers. If HECS fees imposed by government are too high, these may deter people from undertaking further study and they may choose to join the labour force sooner as less skilled workers.

that the demand for skilled or educated workers increased over the 1940-1990 period. Their estimates imply that the demand for men in the bottom wage decile fell by between 30 and 50 per cent, while the demand for men in the top decile rose by between 50 and 70 per cent. Katz and Murphy (1992) find that women's earnings in the 1963 to 1987 period increased by 9 per cent relative to those of men. Their earnings increased relative to men in almost all experience-education areas in the 1980s. The narrowing of the gender gap in wages began earlier for college graduates than for high school graduates, and the increase in the male/female wage ratio was much more substantial in the 1980s for high school graduates (Katz and Murphy, 1992, p. 41). Overall, the authors conclude:

> residual weekly wage inequality for both men and women (as measured by the 90-10 log wage differential) were [sic] stable during the 1960s and then increased by almost 30 per cent from the late 1960s to 1987. The increase in residual inequality has been quite steady since the early 1970s, while the growth in overall inequality accelerated in the 1980s. … male/female wage differentials narrowed substantially from 1979 to 1987. (Katz and Murphy, 1992, p. 46)

They explain the narrowing of the male/female wage differential for high school workers as a result of a decline in demand for high paying production jobs in the manufacturing sector, which were commonly held by high school educated males. Levy and Murnane (1992), on the other hand, highlight the magnitude of the impact of a changing economy. For example, in 1979, 38 per cent of 25-34 year old high school graduates were employed in the relatively high paying manufacturing sector. This had declined to 29 per cent in 1987. In contrast to this, the low paying wholesale and retail trade sector experienced an increase from 18 to 23 per cent of total employment of male high school graduates aged between 25 and 34 years. The authors believe that the shift in employment may have been due to either a decline or a stagnation of job opportunities in the manufacturing sector, forcing these workers to search for employment opportunities in other sectors where wages were lower and where they may have faced competition from women (Levy and Murnane, 1992, p. 1361). Haskel (1996), in a study into the decline of employment in UK manufacturing, found that changes in skill in employment were significant. He assembled a new data set to analyse the fall in unskilled employment. In this study he used data on relative skills, rather than the manual/non-manual distinction commonly used in UK studies. Haskel finds that between 1981 and 1989 the ratio of skilled to unskilled employment grew by

4.4 per cent and the numbers of non-manual workers rose by 6.7 per cent, indicating a positive shift in demand for more skilled labour.

Gender

A common feature of the last 25 years for most developed economies has been the increase in the participation of women in the labour market. This has been the experience of most OECD countries, including the US, the UK, Canada and Australia. The male/female wage differential remained almost constant during the 1970s despite the increase in the average work experience of women. Over the last 30 years, in the US, the UK and other European advanced economies, the gender pay gap has narrowed considerably as women have entered traditionally male occupations. The entry of highly educated women into the labour force in the late 1970s, which continued right through to the 1990s, continues to contribute to the fall in earnings inequality between men and women (Levy and Murnane, 1992). Nevertheless, it is important to recognise that the narrowing of the wage gap is likely to be a function of how large it was at the beginning.

Topel (1997, p. 67) argues that there is some evidence that the rising labour supply of women may have been an important contributor to an increase in male inequality. However, he states that the findings are only suggestive and that further research is required. More recent research concludes that the narrowing in the US gender pay gap decelerated in the 1990s. The reasons for the slowdown in this convergence are attributed to gender specific factors, but these are not explicitly stated, and further research is required (Blau and Kahn, 2000, p. 98).

Weinberger (1998, pp. 79-81) analysed the performance of college graduate women of different ethnic backgrounds in the US labour market. She found that women of all ethnic backgrounds faced a 10 to 15 per cent relative wage disadvantage against white males. White college graduate women experienced a 9 per cent disadvantage. Hispanic college graduate women faced a 6 per cent gap relative to white men who graduated from the same college, while black women experienced the most disadvantage as they were more likely to attend colleges whose graduates were least valued by the labour market. Overall, black women's relative wage earning capacity was 16 per cent below that of their white male counterparts. Finally, Asian men and women tended to face the

same 10 to 15 per cent wage disadvantage as white women, black women and black men relative to white male graduates who attended the same institution or college.

Australia experienced steady increases in the overall labour force participation rate between 1966 and 1996 (Borland, 1997, p. 5). The interesting feature of this is that male participation rates declined, whereas for females they increased steadily. The main cause for a higher aggregate participation rate has been the increased influx of women entering the labour force:

> Supply-side factors which are likely to have been associated with increasing participation by married females and higher wage rates for females following the 1969 and 1972 Equal Pay Case decisions, higher levels of educational attainment of females, increased availability and lower cost of childcare services, changing attitudes to female labour market participation, a reduction in the average number of children per family, extra labour saving devices for undertaking household tasks and changes in access to unemployment benefits for married females. (Borland, 1997, p. 11)

Gregory (1993) documented changes to the gender composition of employment and found that women performed 'absolutely and relatively better than men in obtaining employment in the middle of the male pay distribution' (p. 67) between 1976 and 1990, when seven out of every ten non-managerial jobs went to women. For males, unemployment increased four-fold and the male full-time employment-population ratio declined by 25 per cent. In an earlier study Gregory (1991) highlighted the loss of jobs in the manufacturing sector, affecting mostly male blue-collar workers. Job creation has manifested itself in the services sector, where the demand has been predominantly for white-collar, female and well-educated labour. Gregory's study shows that most of the fall in full-time employment between 1968 and 1988 was concentrated on men, of which half was as a result of job losses and the other half as a result of decreased male participation in the labour market. Preston (1997) used the competitive wage model to analyse the differences in the human capital endowments of men and women to explain differences in wages by gender. Her study found that, in spite of recent gains, women were still paid on average 85 per cent of the male wage rate. More recent work by Preston (2000) found that the wage gap of males and females in the private and public sectors showed signs of convergence between 1981 and 1991.

In summary, the international evidence shows that the wage differential between males and females in most industrialised countries has shown signs of decline. The US, for

example, has shown declines in wage disparities during the 1980s, whereas for Australia the stronger signs were seen in the 1970s, with continuing signs of convergence since 1981 (Preston, 2000, p. 49).

Age and experience differentials

Another between-group effect considered in this literature review is age/experience-related wage differentials. According to Machin (1996, pp. 52-55) these widened in Canada, Japan, Sweden, the UK and the US during the 1980s. Katz and Murphy (1992, p. 46) provide further evidence of the widening gap between experience groups. Between 1963 and 1987 experience differentials grew substantially in the US; the most pronounced increase was educated males in the 1979-1987 period.

Three major trends have impacted on the supply of labour in Australia: a slowdown of growth in the working age population, the importance of immigration, and the ageing population. Since 1966, Australia has experienced a downward trend in the rate of growth in the working age population. The proportion of younger persons in the population has decreased from 1976 onwards, with corresponding increases in the proportions aged 25-34 and 35-44 years.

In regard to earnings differentials, Gregory (1993) finds that older, more experienced workers have increased their earnings relative to those who are younger and less experienced. Between 1976 and 1990 median real earnings fell 15 per cent for 20-24 year olds and 5 per cent for 35-44 year olds. Since 1976 all age groups lost between 11 and 22 per cent of their middle income jobs. What this means is that employment in the middle level occupations and at middle level earnings is not being created. For example:

> The loss of middle level jobs for the 20-24 year olds has been associated with a 14 percentage point increase in the proportion of low paid jobs in this age group and there has been little change to their small share of high paid jobs. A similar effect has occurred for 25-34 year olds … The process at work among prime age groups is different. For them the loss of middle jobs has been associated with a similar increase in low and high paid jobs … and the driving force is a widening of the earnings dispersion. (Gregory, 1993, p. 75)

These findings are echoed by McGuire (1994, p. 43) who found that mean earnings for workers aged under 25 declined by almost 12 per cent for males and 15 per cent for

females relative to older workers. He also found that real earnings among the young declined by between 5 and 11 per cent between 1976 and 1992. Earnings dispersion within age groups also rose. For men aged 35 to 44, the inter-quartile ratio (i.e. the ratio of earnings for full-time employees at the third quartile to earnings of full-time employees at the first quartile) increased from 158 per cent in 1975 to 167 per cent in 1992. For women of the same age group, the increase was from 137 to 166 per cent.

Over the last three decades, participation in the Australian labour market has increased steadily. Of interest is the decrease in the participation rate of males over the long run, whereas for single females the increase has been steady, and for married women the increase has been quite rapid. The main cause of the fall in the participation rate by males has been the decrease among those aged 60-64 between 1966 and 1986, and aged 45-54 and 55-59 between 1976 and 1986 (Borland, 1997, pp. 6-7).

Both the international and Australian evidence points to increasing dispersion of earnings between age cohorts. These changes were more pronounced during the 1980s, when both increases in age and experience differentials were recorded in the US. Borland and Kennedy (1998b) decompose the sources of changes in overall earnings inequality. For Australia, earnings inequality occurred mainly as a result of large increases in wage differentials between age groups. On these findings, a note of caution needs to be made. Since the late 1970s and 1980s, younger workers enter the workforce much later, due to staying at school longer. As a result, comparisons with the older cohorts who entered the labour market before the 1980s may not be appropriate as the earnings gap would be substantial.

Immigration

Changing patterns of immigration may also contribute to a supply-related explanation for the increase in earnings inequality. It can be argued that an increase in the supply of low-skilled labour will result in a decline in wages of low-skilled workers, leading to an increase in inequality. To estimate changes in the supply of labour as a result of increased immigration levels, the new arrival of immigrants has often been treated as an exogenous shift in the supply of labour curve. Changes in wages among native workers depend on the size of immigrant inflows as well as on the own-price elasticity of demand for immigrant labour and the cross-elasticity of demand for native labour

compared to immigrant labour, in other words, the substitution effects between immigrant and native labour (Topel, 1997, p. 62).

During the 1970s, the US labour force increased by 2 million as a result of immigration, while 20 million US-born Americans entered the labour force because of the 'baby boom' and the increased participation of women (Meinsenheimer, 1992). The size of these increases shows that migrants' impact on the distribution of wages is quite small.

A counter-argument is that immigrant populations show a tendency to congregate in particular geographic areas and among less skilled workers, particularly in the US. The size of these changes suggests that immigration may substantially affect local labour markets. Nevertheless, the weight of the empirical evidence is that immigration has not contributed much either to reducing wages for low-skilled US-born workers or to changes in overall wage inequality (Topel, 1997, p. 63).

For Australia, the majority of studies of the impact of earnings inequality have focused on how it affects migrants who are of non-English-speaking background (NESB) and those of English-speaking background (ESB). Preston (1997) catalogues a number of studies which show that ESB migrants enjoy similar or better wage levels than their Australian-born counterparts, while NESB migrants earn much lower wages. The differential is mainly attributed to a lack of English language proficiency and lack of knowledge of how the Australian labour market operates. Preston estimated coefficients on the two birthplace dummy variables and found that ESB migrants, as in other studies, performed successfully in the labour market and often earned higher wages than Australian-born workers. On the other hand, the wages of NESB workers were 10.7 per cent less than their ESB and Australian-born counterparts for 1991. A more recent study by Addison and Worswick (2002) concludes that recent migrants do not significantly affect the earnings of wages of Australian-born workers, indicating that immigration does not seem to increase earnings inequality in the Australian labour market.

There seems to be little international and Australian evidence that immigration causes earnings inequality. However, when we analyse cohorts and we compare the earnings between Australian-born workers and NESB and ESB migrants, variations are found. The work of Preston (1997) shows that mainly NESB migrants tend to earn less than

ESB migrants and Australian-born workers. Even where it may take place, the change in relative wages appears to be of very little significance.

Inter-occupational wage changes

An issue that has attracted much attention in Australia is the role of inter-occupational wage changes in explaining the rise in wage inequality. Gregory (1993) highlighted this by pointing out changes in the labour market since the 1970s. According to Gregory, these impacted on the labour market by depressing growth in average living standards and widening the dispersion of earnings, predominantly for male full-time employees. He also identified the 'disappearing middle'. This phenomenon relates to large job losses occurring at the middle of the earnings distribution, together with rapid employment growth in low and high earning occupations. Having allowed for population growth, Gregory estimated that one in every three jobs in the middle of the employment distribution had been lost. Belchamber (1996) challenged these findings, using a hypothetical example where the rising number of employees at higher income levels can produce a 'disappearing middle' effect, thus showing that the median wage is a 'shifting post' that moves in response to changes in both wage and employment patterns. Using the same data, Belchamber (1996, p. 291) discovers a 'vanishing bottom' or declines in wages and jobs at the bottom of the employment and wages distribution.

Norris and Mclean (1999) show trends in earnings inequality for non-managerial workers in terms of three types of occupational shares. They divide all employees into three earning bands: low paid (those earning less than 75 per cent of the median), middle-paid (those earning between 75 and 150 per cent of the median) and high paid (those earning more than 150 per cent of the median). Their results show that there has been growth in high paid and low

paid jobs at the expense of middle-paid jobs, confirming Gregory's disappearing middle. A study conducted by the Economic Planning and Advisory Commission (EPAC) (1996) for a slightly different period includes managerial employees in its calculations, and shows that between 1986 and 1995 there was hardly any change in the wages of high-skilled and high paid jobs relative to other jobs. Furthermore, most of the increase in employment occurred in high-skilled jobs. Keating (2003) finds similar

results. These can be classified into the following categories. The first is that earnings by major occupation have been fairly stable and the rates of pay classified by major occupational group of ASCO I and II have been broadly stable between 1976 and 1997 (ASCO I) and 1997 and 2002 (ASCO II). This finding is consistent with the work conducted by EPAC (1996). Secondly, there have been considerable changes in the distribution of jobs across major occupations. For example, professionals and associate professionals accounted for most of the jobs growth between 1989 and 2000, while full-time job losses were significant among tradespersons and elementary clerical, sales and service employees and labourers and related employees (Keating, 2003, p. 14). Keating argues that the main reason why full-time earnings across occupations have become more unequal, for both males and females, is the rapid growth in employment in higher income occupations: ' the widening dispersion of earnings is principally due to changes in the structure of labour demand in favour of more skilled jobs' (Keating 2003, p. 1). He also analyses shifts among major occupation groups on relative earnings, concluding that occupation employment shifts explain nearly half of the change in the P10-P50 inequality, but not much change in the P50/P90 inequality. This is significant especially as it has been argued by EPAC (1996) that earnings across occupations have been relatively stable.

Borland et al. (2001) conduct an analysis of inequality between 1990 and 2000, in terms of change in real earnings per employee and job type. They find that full-time real occupational earnings grew by 41.4 per cent for managers and administrators, while for labourers the increase was only 6.9 per cent, and for elementary clerical, sales and service workers it amounted to 4.2 per cent. For part-time workers over the same period, the change in real earnings was more variable across occupational categories. In terms of total earnings change by occupation (part-time and full-time employment), the differences were strong. For managers, the increase was of 41.5 per cent and was at least 15 per cent above the next three occupations (professionals, associate professionals and tradespersons). The authors argue that it is difficult to draw direct conclusions from the data, but their findings highlight the importance of changing job types as an explanation to increasing labour market inequality in Australia (Borland et al., 2001, p. 9).

Pappas (2001) uses an innovative approach in explaining earnings inequality that involves the estimation of cognitive, interactive and motor skills of Australian employees derived from occupation-based proxies obtained from the Dictionary of Occupational Titles (DOT) (US Department of Labor, 1991). The method involves estimating the return of these proxies of skills between 1989 and 1994, and uses these results to decompose the growth in earnings inequality between changes in the distribution of and return to skill and other factors. To explain the change in the distribution of occupational earnings, log occupational earnings are regressed on motor, cognitive and interactive skill variables between 1989 and 1994. Pappas' analysis shows that differences in cognitive and interactive skill explain a good deal of the variation in earnings across occupations for both years and for male and female employees. He also shows that the change in the distribution of and return to skill is responsible for increased earnings inequality in the top half of the male occupational earnings distribution. For females, the change in the distribution of and return to skill is responsible for increased inequality in the bottom half of the distribution.

Inter-industry and intra-industry wage differentials

This sub-section pays attention to changes in the dispersion of earnings for workers within the same industry sector and for those in different industry sectors. Table 2.3 shows the effect of changes in inter-industry (between-group) and intra-industry (within-group) earnings for ten OECD member countries.

Changes in inter-industry wage differentials appear to have been rather small during the 1980s in most OECD countries, including Australia. Column 5 shows that changes in the between-industry dispersion are quite small and are often working in the opposite sign to the change in overall dispersion. This is the experience, for example, of the Netherlands, Sweden and the UK. Changes to within-industry dispersion are shown in Column 6. Changes to the dispersion of earnings can generally be accounted for by changes within industries. Other researchers report similar findings to those reported above by the OECD (1993). Dickens and Katz (1987) find evidence that industry-specific differentials explain about 15 per cent of residual earnings variations in a cross-section of industries. Blackburn (1990) shows that workers have moved from industries which experience low residual variation in earned income (mostly manufacturing) to those which experience relatively high residual variation (mostly services).

Table 2.3 Contributions of changes in employment structure to changes in dispersion

Country	*Years*	*Change in industry weights*	*Change in ratio of mean earnings*	*Change between-industry dispersion*	*Change within-industry dispersion*	*Total change*
		(1)	(2)	(1)+(2)		
National databases						
Canada	1981-1990	0.8	-1.0	-0.2	25.4	25.2
France	1974-1980	1.7	4.3	6.0	65.6	71.6
France	1980-1987	2.8	-1.7	1.1	-21.1	-20.0
Japan	1979-1989	1.6	2.6	4.1	5.2	9.3
UK	1984-1991	-6.9	8.6	1.7	52.3	54.0
LIS database						
Australia	1981-1985	1.7	2.4	4.2	11.1	15.3
Netherlands	1983-1987	0.3	-2.2	-1.9	11.0	9.2
Sweden	1981-1987	-0.6	-1.4	-1.9	7.5	5.6
UK	1979-1986	0.1	-0.2	-0.1	37.5	37.4
US	1979-1986	1.7	1.1	2.8	28.1	31.0

Source: OECD (1993, p. 173), Table 5.8.

It is important to note the limitations of the data presented in Table 2.3. One of these is the fact that the time periods are different and quite short, particularly for Australia and the Netherlands. Another limitation is the fact that changes in industrial structure depend on the level of disaggregation. Unfortunately, the OECD did not seem to account for these and was unable to provide definitions of the level of industry disaggregation. As a result, changes in inter-industry (between-group) earnings dispersion need to be studied in terms of more accurate and explicit definitions of industry groups. Another major shortcoming of the study reported is that conclusions that industry disaggregation is either small or large cannot be made because they are misleading. To obtain a better picture, it is important to conduct studies similar to those of the OECD with more disaggregated data at the industry level, more accurate definitions of industry and over longer periods of time.

Wooden and Bora (1999) using data from the Australian Workplace Industrial Relations Survey (AWIRS) examined the importance of workplace characteristics for wage outcomes. This detailed data set allowed the investigators to identify the sources of wage differentials across different types of workplaces. They found that workplace specific effects were able to explain rises in the variation of individual log wages of

between 39 and 53 per cent, indicating that wage levels depend both on worker productivity and the performance of firms at which they work. The authors also demonstrated that workplace characteristics such as size, foreign ownership, whether firms were successful at exporting, the presence of unions and employee union activity, the gender composition of the workforce, and the incidence of shiftwork also impacted heavily on wage levels. The authors noted the use of cross-sectional data as a possible limitation to their study. They argued that workplace specific wage effects may be the result of unobserved skill differences amongst individuals and these should not be discounted in the final analysis.

This sub-section has discussed increases in earnings dispersion between groups of workers, defined in terms of education, age, gender, immigration and industry, both in Australia and overseas. The evidence shows that earnings differentials between these groups have displayed considerable variation. In terms of educational attainment, Australia showed little evidence to suggest that earnings inequality was caused by an increase in the demand for highly educated labour. This is well documented by Gregory (1993) who showed that the majority of employment creation occurred at the bottom of the distribution. This is in stark contrast to the US and UK experience, where there were large increases in relative earnings in terms of educational attainment throughout the 1980s and 1990s.

In terms of gender inequalities, the Australian and international evidence shows that the wage gap between males and females has tended to converge over the last two to three decades. As it relates to age cohorts, the evidence points to increasing dispersion of earnings and, in terms of years of experience, the picture is mixed. For Australia, Borland and Kennedy (1998b) noted large increases in earnings inequality in terms of age groups, but these were not reflected in terms of experience groups, whereas the international literature shows both age cohorts and experience groups met with increasing dispersion of earnings, particularly in the US. Finally, immigration and inter-industry groups showed that neither of these between groups contributed significantly to increases in earnings inequality in Australia or overseas. More accurate research in terms of inter-industry wage differentials is required, given the limitations of the data used in the studies discussed above.

2.3.2 Between and within-group inequality: empirical results for Australia and the US

The previous section discussed increases in earnings dispersion between groups of workers, defined in terms of a variety of observed factors. As stated above, the Australian and international evidence shows that earnings differentials between these groups have displayed considerable variation. This section provides further empirical evidence to show that the behaviour of wages and returns to education in Australia and the US are different.

The results reported are from a US study conducted by Juhn et al. (1993) and an Australian study conducted by Borland and Kennedy (1998b). In interpreting Table 2.4 it is important to note that both studies are for different time periods and use distinct data sets; however, both use the same decompositional methodology pioneered by Juhn et al. (1993). This approach decomposes sources of changes in earnings inequality between changes in the distribution of observed skills amongst employees in the workforce, changes in the return to observed skills, and changes in the distribution of earnings within groups of workers with the same observed skills.

Table 2.4 Sources of changes in earnings inequality – Juhn, Murphy and Pierce (JMP) decomposition, 90-10 percentile log earnings difference for the US and Australia

Country	*Components of change*			
	Total change	*Change in observed attributes*	*Change in return to observed attributes*	*Unobserved factors*
US – (Males), Hourly wages 1964-1988	0.373	0.035	0.128	0.208
Australia – (Males), Weekly earnings 1982 to 1994-1995	0.132	0.021	-0.021	0.132

Source: Borland (2000, p. 90).

These are often referred to as changes in unobserved factors (Borland and Kennedy, 1998b, p. 25). In both studies, the 'observed' attributes are educational attainment and years of experience. The importance of this table is that it provides an indication of what is happening comparatively between Australia and the US in terms of explanations of increasing earnings inequality. The reason Borland (2000) chooses to replicate these results is that

> Notwithstanding the significant caveats on cross-country data comparability … most commentators have concluded that one robust finding does emerge from earnings inequality such as is presented [in Table 2.4]. From the countries for which data are available, the United States … have had the largest increases in earnings inequality. This results appears to hold over any time period from the late 1970s onwards, for any inequality measure and for any earnings measure. (Borland, 2000, p. 17)

Similarly, as discussed in Section 2.2.4, the evidence is that, irrespective of the measures utilised, all trends show that inequality of earnings in Australia has been increasing since the 1970s.

What distinguishes the two countries is that in the US the return to education/experience or between-group accounts for 34 per cent of the increase in earnings inequality between 1964 and 1988.[9] Thus we can say that 34 per cent of the variation in earnings is explained by observed factors, namely, education and years of experience. The remaining 56 per cent must then be found in changes in within-group inequality or unobserved factors.

The Australian situation is quite distinct from that of the US, with all of the increase in earnings inequality being explained by unobserved factors. During the 1982 to 1994-1995 period, none of the increase is explained by changes in earnings differentials between education/experience groups. Two possibilities may explain these findings. The first is that for Australia it is a quantity effect or a change in observable attributes, but not a return to observable attributes. The second is that, given that the unobservable factors do not explain any of the variation which may be due to a data problem, this can only be rectified by conducting more studies, using data that can actually capture the unobserved factors. Given these findings, the following questions arise:

- What explains increasing earnings inequality in Australia?
- Are there any other forces contributing to increasing earnings inequality in Australia?
- What dimensions of inequality are being experienced in the Australian economy that are distinctly different to those in other parts of the world?

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[9] This figure is obtained by working out the percentage of the change in return to the observed attribute (0.128) with respect to the total change (0.373).

2.4 Causes of Increasing Earnings Inequality

In labour economics, explanations for the causes of the rise in earnings inequality have centred on the consensus that technical change has favoured more skilled workers, substitutes the operations that many of the less skilled workers perform and worsens inequality. These have been shaped by the experience of the last three to four decades in which the introduction of new technologies (such as the personal computer and the internet) into the majority of workplaces of developed nations have favoured the more skilled (e.g. Acemoglu, 2002; Autor, Katz and Krueger, 1998; Krueger, 1993). These authors maintain that the use of new technologies has led to increasing demand for high-skilled workers relative to low-skilled workers. The premise or theoretical framework underpinning this model is that inequality and returns to skills are determined by demand and supply forces (Acemoglu, 2002, p. 10).

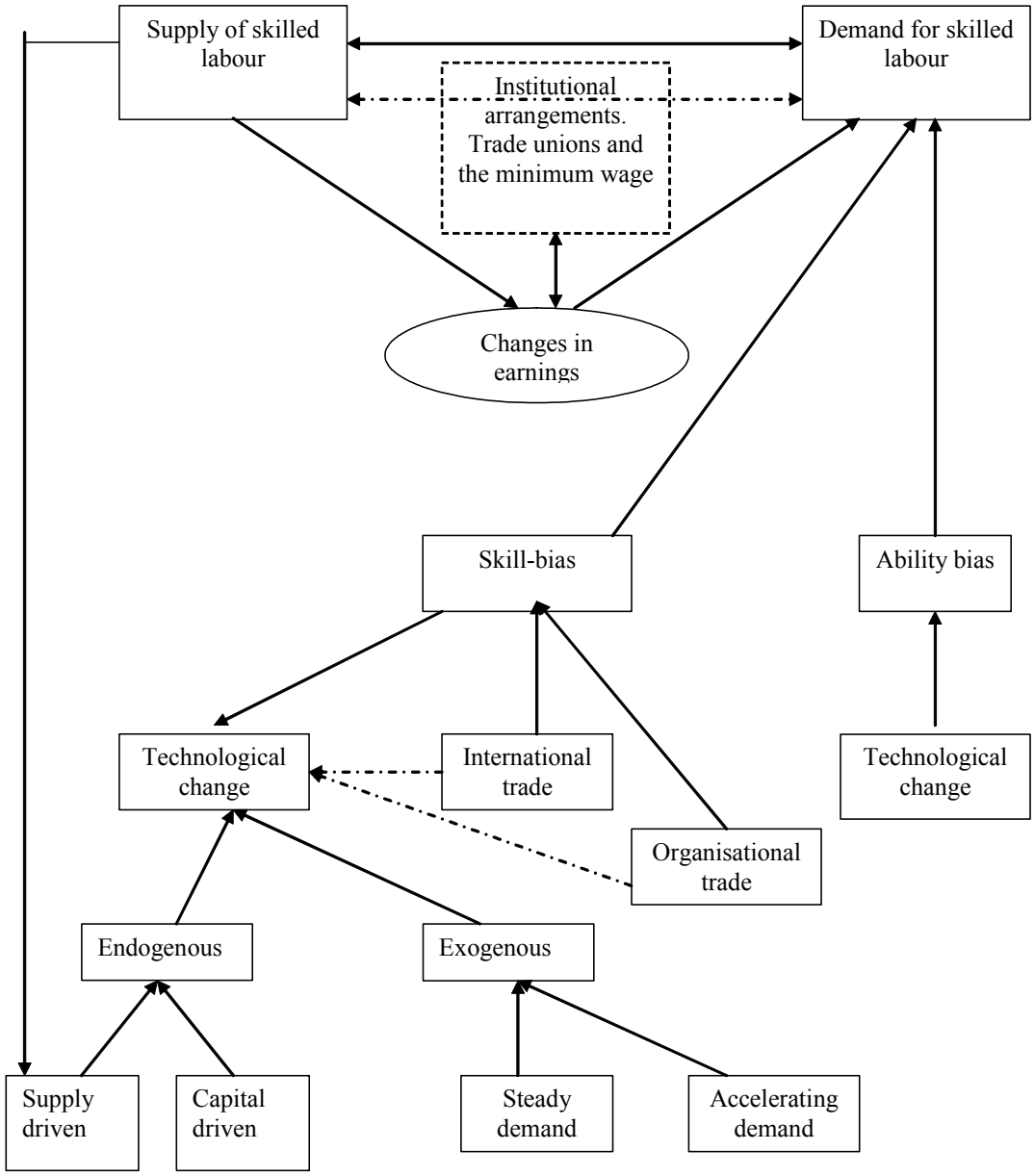
As indicated at the beginning of this chapter, the demand and supply for skilled labour in the Australian context is affected by the inter-relationships of various labour market and economic factors. These relationships are shown in Figure 2.1 and build on the work conducted by Acemoglu (2002).

The model seeks to explain changes in earnings inequality resulting out of the changes in the demand and supply for labour and the way in which these are impacted upon by labour market institutions. In Figure 2.1, labour market institutional arrangements (e.g. minimum wage legislation, trade unions and employment awards) are placed between the demand and supply for skills because they operate as mediating factors, affecting the interaction between demand and supply forces. This is graphically depicted by a broken line passing through the 'institutional arrangements' box linking both interactions between demand and supply for labour. Labour market institutions have the power to condition the market by placing a variety of constraints on its operations. For these reasons, changes in earnings are determined by changes in the demand and supply for labour, as well as by the way in which institutional factors impact the demand and supply for labour. At the centre of this model is the concept of skill-bias or upskilling. This refers to an overall increase in the skill requirement of jobs and is determined by the demand for skilled labour. It suggests that the demand for labour has become more skill intensive and that there has been a shift of demand towards skilled workers relative

to unskilled workers. In other words, if skill-bias is present in the labour market, then it follows that job creation has tended to favour the more skilled and this has been accompanied by a relative rise in the wages of the high-skilled relative to the less skilled.

Ability bias, a new proposition developed by Galor and Moav (2000), is placed next to skill-bias to reflect its closeness in definition. This concept is an extension of the work conducted by Bartel and Sicherman (1999) who found that the wage premium associated with changes in technology are mainly due to the matching of more able workers into industries characterised by higher rates of technological change (ability bias). Returns to education associated with technological change were the result of greater demand for innate ability or other unobserved characteristics of educated employees. Galor and Moav (2000) model the level of human capital of skilled and unskilled workers as being determined by their own ability as well as by technological changes. When human capital is technology specific, and technological progress erodes the skills of some workers (i.e. when new technologies are introduced), it is the more 'abled' workers who can learn to use them, and it is this level of learning capacity or ability bias which provides them with a wage premium over other 'less-abled' (though skilled) workers.

Figure 2.1 Model of factors that cause increasing workforce earnings inequality



Source: Author's design.

The model shows that skill-bias is influenced by technological change and other factors including international trade and organisational change as being linked to causes that give rise to earnings inequality. Figure 2.1 shows that international trade and organisational change may explain why the real wages of low-skilled workers have declined relative to more skilled workers over the last three decades. International trade can drive skill-bias in two ways. One is through standard trade theory (depicted by the dark unbroken arrows) which predicts that if an advanced economy (which possesses a

large supply of skilled workers) trades with a less developed economy (which possesses a large supply of unskilled workers), inequality rises in the advanced economy. This occurs because such trade raises the demand for skilled workers in the developed economy relative to the less skilled workers, generating inequality of earnings. Another way is that in the presence of endogenous technical change, increased international trade could affect the technologies developed and adopted by firms, and impact on skill-bias by raising the demand for skilled labour relative to unskilled workers.

The model also links technological change with the way in which it may have transformed how firms are organised and how they match employees to jobs. Changes in technology also influence the way in which firms organise their own operations and hierarchical structures (Snower, 1999). A different view holds that changes in technology may encourage firms to create types of jobs that suit high-skilled workers because these workers are more productive and profitable to the firm. For example, Cappelli and Wilk (1997) argue that firms that implement advanced computer technologies and pay higher wage rates screen their workers to ensure that they are highly skilled and able to use such technologies. Similar work conducted by Kremer and Maskin (1996) shows that high wage workers are more likely to be employed in high-tech firms, while less skilled and lower paid workers are more likely to be found in firms that use less sophisticated technologies. This suggests that the demand for skilled labour is more likely to be high in firms that employ new technologies, while firms that do not may favour less skilled workers.

Figure 2.1 also shows the links between skill-bias and technological change. Technological change can be either exogenous or endogenous. Exogenous technological change theory in labour economics can be seen as changes occurring from advances in technology such as the invention of the personal computer, the internet or microchips, or from the behaviour of investors who may be driven by a variety of non-profit motives (Acemoglu, 2002, p. 11). This theory maintains that exogenous technical change is mostly skill-biased and can exhibit two types of demand hypotheses. The first is known as the steady demand hypothesis, while the second is the accelerating demand hypothesis. The steady demand hypothesis argues that technological change occurs at a steady pace over time but the supply of skilled workers may not be growing at the same pace. So, if the demand for skill increases at a constant pace, changes in inequality may

be explained in terms of the rate at which the supply of labour increases relative to demand. If the supply of labour is able to match the demand for skills, then inequality is stable, as was the experience prior to the 1970s (Gottschalk, 1997; Sheehan, 2001). What this implies is that the rise in inequality seen in countries such as the US, the UK and Australia in the 1980s and 1990s is attributed to a decline in the growth in the supply of skilled labour relative to the growth in demand, and not to a major rise in the growth rate of technology. So, under conditions of exogenous technology, in order to avoid changes in the return to skill, the supply of skilled labour must grow at the same rate as the demand for skilled labour.

The accelerating demand hypothesis under exogenous technological conditions maintains that, during the 1970s and 1980s, developed economies such as the US, the UK and Australia experienced rising inequalities as a result of an acceleration in the skill-bias of technology driven by technological improvements that were closely related to the rise of the personal computer and the internet. This suggests that both skills and new technologies are complementary and not substitutes as was the case during the industrial revolution, when 'new technologies of the early nineteenth century were skill replacing (unskill-biased) because the technological frontier then only enabled the invention of skill-replacing techniques' (Acemoglu, 2002, p.11). It can also be said that, under accelerating demand conditions, human capital can be regarded as a factor of production. The faster the increase in technology that favours human capital, the more rapid will be the acceleration in the demand for skills, and this will generate increasing returns to skills.

An alternative way of seeing exogenous technology is to view technical change as being endogenous. This theory maintains that new technologies respond to incentives that give rise to higher profits to the firm. So if firms expect increases in profitability, they will adopt new technologies that are skill-biased and that generate higher returns. This suggests that new technologies should be skill-biased as the supply of skill increases and therefore it can be said to be skill driven. Thus, according to the diagram, endogenous technology is both supply (supply of labour) and capital (technology) driven.

> According to this reasoning, the development of skill biased technologies will be more profitable when they have a larger market size – i.e., when there are more

> skilled workers. Therefore, the equilibrium degree of skill-bias could be an increasing function of the relative supply of skilled workers. An increase in the supply of skills can lead to an acceleration in the demand for skills. (Acemoglu, 2002, p. 37)

As discussed in Section 2.2, the extent of earnings inequality both in Australia and overseas does not pose many controversies. The majority of economists in industrialised nations agree that such inequality has been increasing since the early 1970s against a background of massive global economic and technological change. What is at issue are the causes that have given rise to this polarisation, including in Australia.

The following section presents three of the most common explanations found in the literature.

2.4.1 The role of international trade

The impact of international trade on earnings inequality is strongly debated among economists. The debate falls roughly into two main schools of thought. The first maintains that globalisation, characterised by the integration of markets for goods, factors and technology, has widened the gap between the wages of more skilled and less skilled workers in industrialised nations. An explanation for the fall in wages of the least skilled is a result of a rise in imports from the South to the North (e.g. Wood, 1994, 1997; Saeger, 1997; Rowthorn and Ramaswamy, 1998). Other economists maintain that globalisation, both in terms of increased trade as well as increased capital mobility and foreign direct investment, has had a small impact on the divergence of earnings in industrialised economies (e.g. Slaughter and Swagel, 1997; Krugman, 1995).

As stated earlier, there has been a trend in labour markets in the advanced economies towards a continuing shift in the relative demand for labour from less skilled to more skilled. It has also been asserted that there is a link between increased globalisation and the declining relative wages of less skilled workers in advanced economies. To establish this link, Borjas, Freeman and Katz (1991) use input-output tables and data on US trade flows. They conclude that, from 1980 to 1985, trade accounted for almost 15 per cent of the total increase in income inequality, but that this effect diminished in later years. Wood (1994) calculates the extent of the decline in demand for labour in manufacturing industries for the US and other countries by examining them over two

decades and links it to import competition from the South. He uses a factor content methodology and finds that trade was responsible for about 20 per cent of the decline, with workers most affected being the least skilled. His findings point to an inverse correlation across developed countries between rising import penetration ratios and falling shares of manufacturing in employment, which 'is hard to interpret in any other way than the former causing the latter' (Wood, 1998, p. 1468). Saeger (1997) extends this analysis, which combines time-series and cross-country dimensions into a panel, and controls for other influences. Saeger's estimation is that 25 to 30 per cent of the fall in manufacturing employment is related to trade with the South. This occurs when the time dummies are included in the regression; when these dummies are excluded, the impact jumps to 50 per cent. Rowthorn and Ramaswamy (1998) apply a similar technique and conclude that trade with the South accounted for to 20 per cent of the fall in employment in North economies.

The alternative view is that, despite the links established by the authors above, the evidence appears to be pointing to other factors as the main cause for the rise in earnings inequalities in advanced economies, and international trade does not appear to be the main cause. Slaughter and Swagel (1997) question an important assumption made by Wood (1994) which is used to arrive at the estimate that 20 per cent of earnings inequality is derived from the North-South trade. Wood's argument is that advanced economies do not produce the same goods as those imported from developing countries, which suggests that the input-output tables for the advanced economies understate the amount of less skilled labour embodied in net trade flows and as a result understate the effect of trade on labour supply and thus on wages. They argue that:

> To compensate, he uses input-output tables for developing countries to calculate the factors embodied in imports, an approach which yields effects of trade on the labour supply of unskilled workers ten times larger than Borjas, Freeman and Katz. However, this assumption is rather questionable, since it is likely that differences in factor prices between advanced and developing countries are in fact connected to different factor usages, so that it is not appropriate to assume identical production techniques across countries … The lack of an analytical framework underlying the factor content studies means that the 'correct' methodology by which to calculate the quantity of labour displaced by imports is unclear. (Slaughter and Swagel, 1997, p. 15)

Gregory and Machin (1998) state that numerous studies of the impact of trade on employment and wages have found the effects to be quite small. Another factor has

been put forward as the main culprit for the fall in wages for the unskilled, namely SBTC. Gregory and Machin use a methodology that tackles the measurement of technological change directly. This allows for a quantitative comparison of the relative impacts of trade and technological change on the skill structure of employment. They apply this to UK data for three broad categories, namely, low, intermediate and high-skill. The groupings are constructed from detailed occupational classification, where occupations are ranked on the basis of education, skills and experience required for competent performance in their respective jobs for the 1979-1990 period. The authors find that the growth in employment was less than 3.5 per cent. High-skilled employment grew by 29 per cent, there was almost no change at the intermediate level of skill, and the low-skilled workers experienced a 15 per cent job loss. These findings are consistent with other studies using different methodologies (e.g. Borjas, Freeman and Katz, 1991; Sachs and Shatz, 1994).

It is clear that the impact of international trade on earnings inequality requires further study due to the inconclusive nature of many of the results. A criticism levelled by Sachs and Shatz (1994) in this area is that many of the studies do seem to underestimate the role of international trade in earnings inequality.

The impact of trade and protection on the labour markets has also come under scrutiny by labour economists in Australia. A number of commentators, particularly those in the mainstream media, have suggested that the increase in earnings inequality may be due to the increasing internationalisation of the economy. McGuire (1994) argues that, as trade and investment flows between developed and developing countries have increased, less skilled workers are forced to compete with workers in less developed countries who earn considerably lower wages. This creates a shift in job creation in low-skilled to semi-skilled jobs from developed economies to developing ones. Those who have kept their jobs in the developed economies have had to accept lower relative wages in order to do so (McGuire, 1994, p. 44). The evidence for this is hard to find. Borland and Foo (1996) present descriptive information on the composition of employment in the manufacturing industry in Australia and undertake an analysis of the sources of changes. They conclude that international trade may have had an impact:

> Although the evidence presented does not provide support for an effect of international trade on the composition of employment, it is possible that such an

> effect may have operated. First, even in the absence of a relationship between within-sector changes in the share of non-production workers and exposure to international trade, it is possible that such a relationship exists at plant level … international trade may have affected the composition of employment by outsourcing manufacturing industry tasks … it should be noted that the data series for numbers of production and non-production workers cease in 1987, and that it is since that time that the most significant changes in exposure to international trade have occurred. (Borland and Foo, 1996, p. 459)

Gaston (1998) investigated how imports, exports and trade barriers have affected employment outcomes for the Australian manufacturing industry. He concludes that reductions in protection rates had a minor effect on sectoral-level employment. It is only in the final part of the sample (1988-1992) that such reductions appear to explain a significant proportion of changes in employment. These changes only seem to account for about 2 percentage points of the annual employment reduction of 9.6 per cent in clothing and manufacturing.

As in the international experience, the picture that describes changes in employment levels and reductions in earnings for Australia as a result of international trade is mixed and inconclusive and requires further investigation. There is heated debate over the methodology used to measure the impact of international trade on relative wages, but the impact of international trade has contributed modestly to the rise in earnings inequality both in Australia and the US. In the US, it seems that the opening up of the economy has contributed mostly to the rise in earnings inequality (between 10 and 20 per cent is the estimate of the studies cited). The impact of international trade on earnings inequality can best be summarised in the words of Freeman (1995, p. 30): 'trade matters, but it is neither all that matters nor the primary cause of observed changes'.

2.4.2 Institutional change in Australia and overseas[10]

As has been argued in previous sections of this literature review, the labour markets of many economies have experienced fundamental changes, including in their institutions. In Australia, New Zealand and the UK these were characterised by the decentralisation of collective bargaining structures that began in the early 1980s (Wooden and Sloan, 1998). A common feature of these countries was that, in relative terms, they had

[10] This section draws heavily on the work conducted by Wooden and Sloan (1998).

reasonable levels of union participation in their workforce, and trade unions played an important role in negotiating wages outcomes for their members, as well as in national policy matters. The UK began the process of transforming industrial relations after the election of the Thatcher Conservative government in 1979. The government's strategy was to introduce a variety of laws which transformed the industrial landscape. The salient features of this process were the decentralisation of pay determination, the growth of plant and individual bargaining, and the decline in industrial action by unions and their membership (Wooden and Sloan, 1998, p. 197). The changes in New Zealand were far more dramatic, beginning with the Employment Contracts Act in 1991. This had the effect of accelerating the process of change with the abolition of the award system, and trade unions losing a large number of industrial and legal rights (Wooden and Sloan, 1998, p. 198). Changes to the industrial relations system in Australia did not occur with the same severity and speed. According to Campbell and Brosnan (1999) there was gradual but fundamental process of labour market deregulation, characterised by 'slow combustion rather than Big Bang [the New Zealand experience], and it continues to splutter and send out sparks' (p. 354). However, the changes have been of a fundamental nature, particularly in the way in which labour relations have been altered.

What were the main changes to the industrial relations landscape in Australia?

Wooden (2001d) summarises five salient features of the major changes that have occurred in the Australian industrial relations system over the last 20 years. The first relates to the spread of enterprise bargaining. The distinctive feature of the system was compulsory conciliation and arbitration, characterised by independent quasi-judicial industrial tribunals that had the power to stipulate legally binding awards that were required to be arbitrated or certified by these tribunals (Campbell and Brosnan, 1999, p. 354). This situation has changed considerably whereby most of the bargaining occurs at the enterprise level and the majority of the awards provide a starting point from which wages and other employment conditions are negotiated (Wooden, 2001d, p. 244). A second significant feature concerns the role that trade unions now have in the bargaining process of wage determination and employment conditions. Before 1993, the majority of industrial agreements would have required union participation. Today, New South Wales is the only jurisdiction where provisions for non-union agreements do not exist.

A third significant change has been the introduction of legislation (*Workplace Relations Act*, 1996) that gives employers the flexibility to use individually negotiated employment agreements that can either supplement and/or replace existing awards. Changes to the role of industrial tribunals have also been a significant aspect of labour market deregulation, much of which has been designed to diminish their significance and power. Clearly this is a reflection of the Commonwealth government's (both Labor and Liberal with the introduction of the *Industrial Relations Reform Act,* 1993 and *Workplace Relations Act,* 1996) push towards enterprise-bargaining structures with the end result of ensuring that employers and employees negotiate workplace arrangements without intervention by unions or other third parties. Furthermore, the role of the Australian Industrial Relations Commission (AIRC) in the arbitration of disputes has been reduced considerably, in the sense that it no longer has the power to impose arbitrated awards, and has been confined to disputes that relate to matters of awards and where the operation of essential services is in jeopardy (Wooden, 2001d, p. 247). Finally, the changing nature of industrial relations has impacted significantly on union membership. Since the 1970s the proportion of employees who are members of a trade union has fallen by 19 percentage points (Hawke and Wooden, 1998, p. 76). Whether this is entirely due to changes in industrial relations is difficult to ascertain. It is possible to argue that much of the decline in union participation has been due to changes in the composition of employment that favoured industries that would employ a traditionally non-unionised workforce, rather than changes to the industrial relations system:

> the most important changes … being the shifts in the industrial structure of employment, the relative decline in public sector employment and the relative growth of casual employment. Our best guess is that the net effect of structural change was to reduce the overall unionization between 1982 and 1996 by somewhere between 40 and 45 per cent. (Hawke and Wooden, 1998, p. 79)

More recent data suggests that the proportion of employees who are members of a union stands at 22.7 percent (ABS, 2004, cat. No. 6310.0).

In summary, the Australian experience centres around the fact that enterprise bargaining is in the process of replacing arbitration as the dominant industrial relations paradigm, with employers and employees now expected to negotiate their working conditions and

productivity. However, it is important to note that currently less than 2 percent of employees are covered by them (ABS, 2004, cat. no. 6306.0).

Institutional change and earnings inequality

In Section 2.2.4 it was shown that earnings inequality has been increasing in Australia over the last 30 years. A number of researchers have attempted to draw a link with deregulation of the labour market (e.g. Campbell and Burgess, 2001a; Campbell and Brosnan, 1999). A problem with this contention is that it is difficult to attribute the majority of the blame on changes to wage bargaining structures,[11] given that increasing earnings inequality between the most highly paid and the least paid began to emerge in the mid-1970s, and hence, according to Wooden (2001d), has occurred under both highly centralised and decentralised bargaining structures. As is pointed out by Norris and Mclean (1999), earnings inequality may have been caused by changes in the dispersion of wages paid to some occupations or by employment growth occurring in different parts of the earnings distribution. It also seems plausible that wage relativities between groups (who possess the same observed traits, i.e. educational attainment and years of experience) do not appear to have changed. Thus, as Borland (1999) suggests, the evidence points to increasing earnings inequality within those groups. As a result, the widening gap between the highly paid and the low paid in the earnings distribution may be driven by changes to the composition in the demand for labour. To summarise, in Wooden's words:

> Low-paid workers are no worse off, it is just that there are more workers filling better-paid jobs, which in turn is shifting the midpoint of the earnings distribution to the right. (2001d, p. 253)

2.4.3 Increasing returns to skill or SBTC hypothesis

This hypothesis is based on the notion that new technologies are complementary to new skills, so there exists a skill-bias related to technological change. A number of studies have looked at this phenomenon. Katz and Murphy (1992) use a simple demand and supply framework to analyse changes in the US wage structure between 1963 and 1987,

[11] It can be argued, however, that market deregulation has perhaps exacerbated an already increasing problem of earnings inequality in Australia, particularly for those who are in precarious employment. See for example Campbell and Brosnan (1999, pp. 361, 385).

using Current Population Survey (CPS) data. The authors found that changes in wage inequality arose out of the following three dimensions. Firstly, the wages of the more educated rose sharply, with the more pronounced gains being experienced by college graduates. Secondly, for those with relatively low levels of education, the wages of more experienced workers increased relative to the wages of younger, less experienced workers. Finally, earnings inequality rose sharply within narrowly defined demographic and skilled groups. To estimate the within-group impact on inequality, the authors plot the differences in log wage residuals of those at the 90^{th} and at the 10^{th} percentiles of the distribution for men and women. Within-group (residual) wage inequality expanded dramatically for both men and women between 1963 and 1987, increasing by almost 30 per cent. The authors also find that male/female wage differentials narrowed substantially from 1979 to 1987 and conclude that shifts in relative labour demand are occurring within detailed industry sectors, which are likely to reflect skill-biased technological change.

Juhn et al. (1993) find a similar result and interpret the increase in wage inequality over the last 20 years as increased returns to components of skill other than years of education and years of employment (within-group inequality). The authors view this as a trend towards increasing returns to skills (Juhn et al., 1993, p. 423). They conclude that the trend towards greater wage inequality in the US is due mainly to increases in the premia of both observed (education and experience) and unobserved dimensions of skills. The likely causes of this phenomenon, argue the authors, are biased rates of technological progress and changes attributed to the process of globalisation, although these are not clearly specified.

Berman, Bound and Griliches (1994) investigate the shift in demand from unskilled towards skilled workers in the US manufacturing sector during the 1980s. The bulk of their research relies on data drawn from the Annual Survey of Manufactures (ASM). They find that almost 30 per cent of skill upgrading was accounted for by the shift to white-collar or non-production labour. Furthermore, the authors showed a stronger trend towards skill upgrading favouring white-collar workers rather than blue-collar workers. They also find that most of the shifts occurred within (as opposed to between) manufacturing industries and were not related to imports or government defence expenditures. Furthermore, skill upgrading was seen to be positively correlated with

investment in computers and R&D expenditures, which provides evidence, the authors argue, in support of the SBTC hypothesis.

Berman, Bound and Machin (1998) claim that SBTC was a persistent feature in most OECD economies. They found that substitution towards skilled labour within industries occurred in all the ten developed countries that they studied. Furthermore, they found that the same manufacturing industries that substituted towards skilled labour in the US during the 1980s also did so in all the other economies studied.

Kremer and Maskin (1996) provide further evidence of the increase in inequality between high-skill and low-skill workers. The authors argue that over the last fifteen years it has become common for workers who possess high-skill levels to work in firms that do not employ workers with low-skills. At the same time, firms that employ low-skill workers are less likely to employ high-skill workers. They argue that recent economic activity has shifted from firms such as General Motors or Ford which employed a mix of high and low-skill workers, to firms whose workforces are more homogenous which specialise in employing either high-skill workers (e.g. Microsoft) or low-skill workers (e.g. McDonald's). To explain this phenomenon the authors create a model in which workers of different skill levels are imperfect substitutes. Using data from the US, UK and France they find that both within-plant and between-plant variances of wages have risen, reflecting the trends in rising inequality reported in the US, UK and other OECD nations. When looking at the UK data, the authors report increases in segregation by worker classification, among clerical workers and among all non-manual workers. Overall, they argue that their model is able to explain both increases in inequality and segregation of workers by skill. More recent work by Autor, Katz and Krueger (1998) supports the notion that the increase in the return to the college premium during the 1980s was fashioned by SBTC. To support this, they show that the supply of skill grew faster between 1970 and 1995 than 30 years earlier (1940-1970). For the first period, the supply of skill grew by 2.4 per cent per annum, while for the latter period it grew by 3.0 per cent. This contrasted with an increase in the return to the college premium of 0.4 per cent per annum between 1970 and 1995, compared with a decline of 0.1 per cent. The authors believe that this acceleration in the rate of increase in demand for more skilled workers is entirely accounted for by an increase in within-industry changes in skill, rather than the common between-industry employment

shifts. They also believe that the rapid introduction of computer technology may explain as much as 30 to 50 per cent of the increase in the rate of growth of the relative demand for more skilled workers since the 1970s. This finding is consistent with Krueger's (1993) study of the impact of the introduction of computers in the workplace on the wage structure. This analysis focused on whether employees who use computers on the job have a higher wage rate than those who do not, as a result of applying their computer skills. Krueger used three microdata sets from the 1984 and 1989 October Current Population Surveys (CPS) in the US. The estimates suggest that employees who directly use a computer earn a 10 to 15 per cent higher wage rate than those who do not. More recently, Acemoglu (2002) argues that the behaviour of wages and returns to schooling indicate that technical change has been skill-biased during the past 60 years and that it favours more skilled workers, replaces tasks done by less skilled people, and increases inequality:

> This view is shaped largely by the experience of the past several decades, which witnessed both major changes in technology, including the rapid spread of computers in workplaces and in our lives. In the United States for example, the college premium – the wages of college graduates relative to the wages of high school graduates – increased by over 25 per cent between 1979 and 1995. Overall earnings inequality also increased sharply. In 1971, a worker at the 90th percentile of the wage distribution earned 266 per cent more than a worker at the 10th percentile. By 1995 this number had rise to 366 per cent. (Acemoglu, 2002, p. 2)

A number of studies have been conducted to explore the SBTC hypothesis in Australia. Borland and Kennedy (1998b) utilise the Juhn-Murphy-Pierce (JMP) (1993) decomposition method to analyse changes in the distribution of observed skills of employees in the workforce, changes in the return to observed skills, and changes in the distribution of earnings within groups of workers with the same observed skills. The authors find that, both for males and females, the changes in the dispersion of earnings within groups of employees with the same educational attainment and years of experience have been overwhelmingly the main factor causing increases in earnings inequality. Changes in the distribution of education and experience have had little effect on earnings dispersion, whereas changes in the relative earnings of employees by education and experience have tended to reduce earnings dispersion (Borland and Kennedy, 1998b, p. 26).

Miller and Mulvey (1997) conduct a similar study to that of Krueger (1993) for Australia and examine whether computer usage at work provides a wage premium. They use data from the 1993 Survey of Training and Education which show that 52 per cent of males and 60 per cent of females had at some time utilised a computer at work. They find that computer usage is associated with around 13 per cent higher earnings for males, and 16 per cent higher earnings for females, than for those who do not use a computer at work. Strikingly, they find that computer skills appear to be a better human capital investment than completion of high school (Miller and Mulvey, 1997, p. 112).

Borland et al. (1997) conduct a similar study but introduce detailed controls for occupation into the earnings regression. Estimation of their basic specification of an earnings regression reveals a return to investment in computer knowledge of 18 per cent. However, inclusion of detailed controls for occupation, and other proxies for worker and job attributes, yields a return to skill that is less than 10 per cent. When the researchers disaggregate population groups, they find that returns to skill generally increase with years of service and age, and that a mixed pattern of significant and insignificant effect exists within occupations and education groups. Furthermore, earnings regressions estimated using detailed information on computer knowledge reveal that earnings are significantly related to number and level of computing skills.

Some questions about SBTC findings

Krueger's (1993) influential paper found that workers who used a computer at work earned a premium of between 15 and 20 per cent above those who did not do so. Many economists have interpreted these findings as evidence that much of the increase in earnings inequality between skilled and less skilled workers in the US and other parts of the world is due to the role played by technological change. Similar conclusions have been made by a number of Australian researchers. Examples of these include the work of Miller and Mulvey (1997) and Borland et al. (1997) who found that the workers who used computers experienced a wage premium of around 10 to 16 per cent.

Research by DiNardo and Pischke (1997) questions whether the large measured wage differentials for on-the-job computer use are in fact returns to computer skills. In their research they replicate Krueger's work and measure large differentials for use of calculators, telephones, pens or pencils, or for those who work while sitting down.

They find wage differentials of 9 to 14 per cent associated with white-collar tools (pens, pencils, calculators etc.) and sitting on the job. The authors conclude that these findings cast doubt on the interpretation of the computer usage wage differential as reflecting true returns to skill (DiNardo and Pischke, 1997, p. 291). One main reason for this was the lack of availability of panel data sets. More recent work casts further doubt on Krueger's findings and those of others who reached similar conclusions. Haisken-DeNew and Schmidt (1999) extend the results of DiNardo and Pischke (1997) by using panel data, which makes it possible to control for individual effects such as skill or ability (unobserved factors). When they control for these, they find that there are no computer usage wage differentials. A different way of looking at the issue of SBTC has been proposed by Borghans and ter Weel (2003) who find that differences in computer skills between workers are unlikely to explain why those who use computers earn more than those who do not. They conclude that returns to computer skills are more likely to occur when the computer is used for complex work that requires skills that go beyond 'the normal use' of computers. Yet another view is that proposed by Doms et al. (1997) who use cross-sectional data to show that firms that adopt a large number of new technologies employ more educated workers, managers and professionals, and as a result pay higher wages than firms that do not adopt new technologies.

In summary, the studies mentioned above show that there are good reasons to be sceptical about the wage effects of computer usage. In fact, they indicate that the effects may simply be picking up other unobservable characteristics that are strongly correlated to computer usage. On the other hand, the study by Doms et al. (1997) suggests that firms that employ high-skilled workers do so because they are the first to adopt new technologies. What these results indicate is that in order to measure the effects of skill on earnings inequality, it is important to use measures that are more accurate and are able to capture the appropriate 'skill'.

2.5 Inequality of Households: Another Dimension of Inequality

Another form of inequality arising out of the economic changes seen in Australia and overseas is increasing inequality amongst households. This has profound social and economic consequences and its impact has been closely monitored in numerous studies. Saunders (1993) studied the impact of the earnings of wives on the degree of income

inequality among families. He found that although earnings inequality increased between 1981 and 1982 and 1989 and 1990, such earnings did not add to increasing inequality of households. The author concluded that the earnings of wives may have been a moderating factor and, had they not entered the labour force, earnings inequality may have been even higher.

More recent work has concentrated on the polarisation of working families into high and low income and the way in which the composition of households has changed over the last two decades. Across many OECD nations, including Australia, an upward trend towards jobless households has been recorded (OECD, 1998a). For example, Miller (1997) showed that unemployment had become more concentrated in certain family types, couple families with young dependents and NESB immigrants being particularly affected. Furthermore, he recorded an increasing incidence of families which contained more than one unemployed member.

Harding and Richardson (1998) showed evidence of changes in the distribution across individuals and households that demonstrated a rise in household income inequality. Their work profiled low-wage workers who were described as reflecting 'the diversity of the Australian working population' (p. 25) because they could be found throughout the distribution of equivalent disposable income. Broadly speaking, these were full-time employed, with little formal education, often married and more likely than not female, of whom nearly 30 per cent had dependent children. Twenty-five per cent of people in the low income distribution were young men but not students who lived at home, often with their parents, and had a higher chance of being members of a low income family. Low-wage workers were strongly represented in the lower deciles of the household income distribution, and this pattern had not changed since the mid-1980s. Later work by Harding and Richardson (1999) showed that hours worked heavily influenced where in the distribution of income a family would be placed. They argued that full-time work even at low wages is more likely to add enough to family income to place a family in the upper deciles than part-time employment at low wages, indicating the importance of the number of hours worked. Their analysis also pointed out that families with an unemployed member were more likely to be disadvantaged than those with a low wage member. Families of unemployed workers were more likely to be found in the bottom 25th percentile of the weekly earnings distribution, while those

that have members who earn low wages end up moving above the median of the annual income distribution (1999, pp. 42-3).

The implications are many and varied, but one salient feature for Australia is the fact that individual employment/non-employment and household conditions have changed considerably over the last fifteen years. Using a variety of ABS data sources, Dawkins et al. (2002) show that measures of joblessness based on individuals have been falling, but measures of unemployment that are household based show a significant increase. Joblessness has become concentrated in particular households, most of which are headed by either a female or someone who is young or about to retire, and these households appear to be in economic and social distress as a result of the lack of earned incomes. Another finding is that couples increasingly appear to be congregating according to similar educational background and earnings. Similar findings are illustrated by Burbidge and Sheehan (2001) who show that many Australian families are polarising into work-rich and work-poor. The authors show that the total number of households with dependent children increased by 9 per cent between 1981 and 2000, but the number of these families with two jobs rose by 48 per cent. Families without any jobs or with only a single part-time job rose by 77 per cent. Burbidge and Sheehan also show that families with dependent children are polarising in terms of hours worked. For example, between 1986 and 1996 there was an increase of 42 per cent in couples with less than 30 hours work per week, and a virtual doubling of the number of couples working 90 hours per week or more (p. 137). Polarisation is also shown in terms of skill and educational attainment across work-rich and work-poor households. Households with no post-school qualifications had reductions in their total working hours, while qualified households have experienced increases in the number of hours worked (Sheehan and Burbidge, p. 140). Gregory (1999) provides further evidence of polarisation of families in terms of children. Between 1979 and 1998, 18 per cent of dependent children lived in a family in which no parent was employed, whereas 20 years earlier the proportion was just 11 per cent. For the same period, 45.1 per cent of dependent children lived in families where both adults worked, but 20 years earlier this proportion was 35.7 per cent.

2.6 The Transatlantic Consensus

This literature review has discussed the extent and causes of earnings inequality both in Australia and overseas. It revealed that the increase in this is not uniform across industrialised nations either in extent or timing. Trends in the distribution of earnings between advanced economies experienced strong variation, in particular during the 1990s. English-speaking nations experienced the greatest increases in earnings inequalities, while European countries appear to have had smaller increases. The prevailing view amongst economists regarding the increase in earnings inequality has been labelled the Transatlantic Consensus. Atkinson, who coined the term in 1999, argues that this notion:

> provides a unified explanation as to how a single cause has a differential impact on the United States and mainland Europe. It also captures the fact that this view has been widely influential in the policy-making of international institutions on both sides of the Atlantic, such as the IMF and the OECD. (1999, p. 2)

The Transatlantic Consensus links rising inequalities of labour market outcomes to the massive changes in economic activities that have taken place around the world. This explanation relates the increases in earnings inequalities and high levels of unemployment due to a shift in demand towards highly skilled workers and away from, unskilled workers, and is thus centred on the concept of skill. The implication of this is that where labour markets are sufficiently flexible, this shift in relative demand leads to increased earnings differentials and hence to a rise in earnings inequality. On the other hand, where labour markets are not flexible enough to generate changes in earnings differentials, the change in relative demand may lead to two outcomes. The first is a decrease in labour market access or an increase in unemployment. The second is 'the perceived decline in the quality of some jobs … interpreted as a process of deskilling' (Sheehan, 2001, p. 45). This is the experience of European nations such as France, Germany and a number of Scandinavian countries (Atkinson, 1999).

The SBTC hypothesis is seen as the prevailing explanation of rising earnings inequality in the US and Europe. Recent work lends further support to the view that technological change leads to a rapid growth in the demand for skilled labour relative to unskilled labour (see for example, Acemoglu 2002; Autor, Katz and Krueger, 1998). The Transatlantic Consensus suggests that rising earnings or income inequality is the

inevitable result of shift in demand away from unskilled workers. The way in which the Transatlantic Consensus operates is as follows: a shift in relative demand to skilled from unskilled workers leads to increased wages dispersion, because the wage premium favours those workers who are employed in skilled occupations or sectors. As the wages for workers in the unskilled labour sectors decline relative to those in the skilled sectors, the overall inequality of earnings increases. The explanation in the US is increased inequality of earnings in full-time work, resulting from less regulated labour markets than other countries across the Atlantic. In continental Europe (particularly France), effective minimum wage protection leads to higher unemployment rather than decreasing wages for the less skilled workers. But what is the situation in Australia, where diversity of employment creation (e.g. full-time and part-time permanent and casual employment) is particularly unique relative to other parts of the world (e.g. the US and continental Europe)?.

As discussed in this literature review, Australia has since the mid-1970s seen increasing inequality of earnings. Furthermore, as is explained in detail in the following chapter, there has been a massive expansion in casual and part-time employment. If employers regard these as a way of making substantial savings to their wages bill to obtain quality adjusted hours, particularly for less skilled workers, then it can be argued that such growth is partly a response to SBTC. Thus, this thesis sets to take the analysis of increasing earnings inequality in Australia beyond the limitations found in the literature. The specific aims are to explore in detail the following questions:

- Has Australia experienced upskilling in the demand for labour or skill-bias in the different types of employment creation, and are certain job types becoming more skilled than others?

- Is skill-bias a key factor in increased earnings inequality of full-time earnings?

- Has the shift in job type creation in Australia implied an increase in earnings inequality, and has this been a response to skill-bias in the demand for labour?

2.7 Conclusion

This literature review has discussed the extent and causes of increasing earnings inequality both in Australia and overseas for full-time earnings. Both the Australian and international literature reveal that this is more pronounced in English-speaking countries, including Australia, than in many European countries. Furthermore, the experience within this group of English-speaking nations has not been alike. For example, the US experience indicates that increasing inequalities were strong in the 1980s, but tended to stabilise throughout the 1990s. The UK, on the other hand, experienced considerable rises in inequality, increasing at a slower rate in the 1990s as compared with the sharp increases of the 1980s. Australia, on the other hand, has shown consistent rises in earnings inequality since the mid-1970s. These seem to be of a long-term nature and are quite robust in the type of measure used, the kind of data utilised and the type of earnings variable.

In terms of explanations for the increase in inequality in full-time earnings, the literature reveals that generally, for the US, about one-third of the increase can be explained by widening earning differentials between groups of workers with different levels of education and experience. The Australian experience is different. Australian studies, as summarised by Table 2.4, show that none of the increase can be explained by between groups in full-time earnings. In terms of within-group inequality, US studies show that as much as 50 per cent of the increase in earnings inequality can be explained by inequalities amongst workers who possess the same covariates (e.g. age, education, gender and experience). For Australia, as shown in Table 2.4, the increase in inequality in full-time earnings is entirely explained by within-group or unobserved factors. This finding raises a number of critical questions. Firstly, what explains the increase in earnings inequality, given that between-group inequality is unable to do so. Secondly, what unobserved factors are interacting or promoting the increase in earnings inequality in Australia? Are there other forces contributing to this? What dimensions of inequality are being experienced in the Australian economy that are distinct from those in other parts of the world?

The literature review examined three causes for the increases in earnings inequality, namely, increasing returns to skill, international trade and institutional factors. In terms

of the SBTC hypothesis, or increasing returns to skill, the literature finds that, in the US, a large portion of the increase is explained by the hypothesis. Other economists suggest that increases in earnings inequality are most likely due to an acceleration of skill-bias:

> The behaviour of wages and returns to schooling in the United States indicates that technical change has been skill biased during the past sixty years, and probably for most of the twentieth century. 2. Though more controversial, the evidence also points to an acceleration in skill bias during the past few decades (Acemoglu, 2002, p. 64).

The role of international trade provided little explanation for increasing earnings inequality for both Australia and overseas, although some studies seem to suggest that increasing trade tends to widen the wages between more skilled and less skilled workers in industrialised countries. As far as institutional factors are concerned, the evidence for the rise in increasing earnings inequality cannot be fully attributed to changes to the wage bargaining structure in Australia. This is particularly so because earnings inequality in Australia began to emerge in the mid-1970s and continued to increase under both highly centralised and less centralised forms of bargaining structures (Wooden, 2001d).

In summary, there has been considerable emphasis in both the Australian and international literature on increasing relative demand for skill, and the implied increasing return to skill, as the main causal factor, although several transition mechanisms for the increasing demand for skill (such as SBTC, the role of institutional factors and international trade with developing countries) have been suggested. The Australian literature, which has concentrated on increasing inequality within full-time earnings, has followed the international literature in emphasising the role of skill as a critical factor. This approach to increasing labour market inequality in Australia – rising inequality in full-time earnings due to increasing returns to skill – has at least, two related limitations. First, it relies heavily on an imprecise and unclear concept of skill. A second limitation is that it is one-dimensional in nature, in that it focuses only on the distribution of earnings in full-time work, while neglecting other forms of inequality. The implications of these issues are discussed in more detail in the following chapter.

Chapter 3
The Question of Measuring Skill and Labour Market Issues

3.1 Introduction

In the previous chapter, I discussed the extent and causes of earnings inequality both in Australia and overseas. The Australian literature has in the main followed the methodology adopted in international studies, and exhibits two related limitations. The first is that it relies on a single and poorly defined concept of skill, which underpins most of the analyses. It is implicitly assumed that the skills of workers in different jobs can be ranked in one dimension, from high-skilled to low-skilled, using skill measures implicit in standard occupational classifications or proxies such as educational attainment. But many different characteristics and competencies are involved in a worker being highly skilled in a given job. What counts as skill varies greatly across the workforce, and in many cases appears to change markedly over time. Thus the continuing relevance of this concept of skill is far from clear, particularly at a time when central to the discussion of the SBTC hypothesis is the notion of skill and how it should be measured. The second limitation is that the approach is too restrictive and one-dimensional, as it only focuses on the increased dispersion of the earnings of full-time employees, thus neglecting other potentially relevant factors, such as changes in the distribution of different types of work.

In this chapter, I discuss some of the most common problems that arise in defining and measuring skill (Section 3.2) before I proceed in Section 3.3 to discuss changes to the labour market in Australia and the rise of different types of employment. Section 3.4 presents a hypothesis explaining the current behaviour of the labour market and Section 3.5 provides a conclusion to the chapter.

3.2 Approaches to Measuring Skill in Labour Economics

At a time when the labour markets of most industrialised countries are experiencing rapid change, and increasing inequality of earnings has become a central issue of investigation, many economists have treated the concept of skill as given, without carefully considering its meaning, and the different approaches used to measure skill. But what is skill, especially in the current context? Do economists know enough about what skill is to use it as an explanatory variable in empirical work or as an important feature of policy development? Do they know enough about the proxies of skill to know what they actually capture in econometric analysis? In labour economics, the concept of skill has been difficult to define and measure directly in the economy. Certainly the proxies for skill used in most econometric work leave much to be desired. Many studies proxy skill by educational attainment, but it is clear that the two notions are very different. People in some specialised occupations may be highly skilled but without high educational levels. The aggregate occupational classifications of official statistics (managers, professionals, tradesmen etc.) have only modest relevance to changing trends. Many studies in manufacturing use the ratio of non-production to production personnel as a measure of skill, but replacing skilled tradesmen with salesmen or account clerks may reduce rather than increase the overall level of skill in a firm. Other studies proxy skill by earnings but, while this has some real advantages, it does little to throw light on the role of skill changes in the changing pattern of earnings, or to understand the changing nature of skill.

In their haste to set up a proxy measure, few studies stop to define what they mean by skill. One example of this is Colecchia and Papaconstantinou (1996) who conclude that in most OECD countries upskilling has occurred, but nowhere in their paper provide an explicit definition or discussion of the concept of skill. Many such examples abound, where studies of SBTC or skill-bias have been conducted without there being a considered explanation or discussion of what is meant by skill.

As an initial working definition, I take skills to be those generalisable attributes of individuals that confer advantage in the labour market. Thus they are a central form of human capital, and their existence needs to be demonstrated both as characteristics of individuals and as having the central feature of capital, namely, the potential to

provide a return. From this it follows that skills may change over time, as the nature of the economy and its requirements change, and are likely to be diverse, appearing in different forms in different sectors of the economy.

While needing further refinement, this definition does serve to highlight the fact that the nature of commercially relevant skills may be changing very rapidly. We are not yet well placed to understand those changes. Studies which, while often using a sophisticated theoretical and econometric framework, rely on a few simple proxies for skill may well give very misleading results. Tables 3.1 and 3.2 detail the different approaches used in the international and Australian literature.

Table 3.1 Recent studies of SBTC change and skill-bias outside of Australia

Author	*Year*	*Sector covered*	*Measure of skill*
Krueger	1993	Open	Computer usage
Berman, Bound and Griliches	1994	Manufacturing	Production/non-production workers
OECD	1996b	Manufacturing	Standard Classification of Occupations
Colecchia and Papaconstantinou	1996	Manufacturing	Standard Classification of Occupations
Kremer and Maschin	1996	Manufacturing	Production/non-production workers
DiNardo and Pischke	1997	Open	Calculators, pens, sitting down, etc.
Autor, Katz and Krueger	1998	Whole economy	Educational attainment
Berman, Bound and Machin	1998	Manufacturing	Production/non-production workers
Gregory and Machin	1998	Whole economy	Classification of Standard Occupations
Haskel and Slaughter	1998	Manufacturing	Production/non-production workers
Kahn and Lim	1998	Manufacturing	Production/non-production workers
Machin and Van Reenan	1998	Whole economy	Production/non-production workers; educational attainment
Murphy, Riddell and Romer	1998	Whole economy	Educational attainment
Bruinshoofd and ter Weel	1998	Whole economy	Educational attainment and occupation classification
Howell and Wolff	1992	Whole economy	DOT
Gittleman and Howell	1995	Whole economy	DOT
Wolff	1996	Whole economy	DOT
Pryor and Schaffer	2000	Whole economy	NALS and education

Source: Author's investigation.

A common proxy for computer skills is computer usage. Krueger (1993) examined the impact of computers on the US wage structure. Computer usage at work was defined as programming, word processing, e-mail and computer aided design. A similar approach was adopted in two Australian studies conducted by Miller and

Mulvey (1997) and Borland et al. (1997). The researchers concluded that workers using computers in the workplace were able to obtain a wage premium similar to that found by Krueger (1993).

As mentioned in Section 2.4.3, DiNardo and Pischke (1997) and Haisken-DeNew and Schmidt (1999), dispute these findings, arguing that computer usage is not a true indicator of returns to computer skill. Borghans and ter Weel (2003) provide further evidence that computer usage is not an adequate proxy for computer skills. They argue that measures related to computer usage do not accurately provide information about how well and how effectively a worker uses a computer. For example, drawing on the work conducted by Bell (1996), DiNardo and Pischke (1997) and Hamilton (1997) who employ computer usage as an indirect measure of computer ability or skill, Borghans and ter Weel question whether these measures of computer usage are actual measures of computer skill or ability in general. Moreover, they argue that these measures, broadly, fail to capture how well or effectively a worker conducts different complex activities using a computer. In their own study they use information that is used as a proxy for skill, which is directly related to the computer tasks that a worker is required to perform: 'information on the effectiveness of computer use from data analysed in this paper is directly related to computerised tasks a worker has to perform' (Borghans and ter Weel, 2003, p. 6). They conclude that skill differences between workers do not necessarily explain why users of computers earn a premium. Returns to computer skills are only detected when workers use a computer in an advanced manner. Moreover, they argue that the tasks required to operate the computer are not of central importance in terms of gaining employment.

> In most instances operating a computer is a routine job activity, which is not particularly the employer's motivation for hiring a worker and, as a result, the worker is not paid for the performance of these activities. (Borghans and ter Weel, 2003, p. 16)

Another approach found in the literature is the use of earnings as a proxy for skill, and to examine the changing structure of employment by earnings (Haskel and Slaughter, 1998; Berman et al., 1998). Haskel and Slaughter show that the sector bias of SBTC can help explain changing skill differentials. They found that these fell when SBTC was generally concentrated in unskilled labour-intensive sectors. A clear limitation of this approach is the extent to which changes in the earnings composition of

employment actually reflect changes in the skill composition of employment and changes in the reward for skill or other factors.

For studies of the manufacturing industry, the split between non-production and production workers has been widely used as a proxy for skill (e.g. Machin and Van Reenan, 1998; Kahn and Lim, 1998). The authors classify employees as production and non-production workers in relative terms, the former being skilled workers and the latter unskilled or less skilled workers. This dichotomy has also been described as either white-collar or blue-collar workers and is found in research by Kremer and Maskin (1996) and Berman, Bound and Griliches (1994).

Table 3.2 Measures of skill used in recent Australian studies

Author	*Year*	*Sector covered*	*Measure of skill*
Miller and Mulvey	1997		Computer usage
Borland et al.	1997		Computer usage
Borland	1996	Whole economy	Educational attainment
Maglen	1993	Whole economy	Educational attainment
Aungles et al.	1993	Whole economy	Standard Classification of Occupations
Cully	1999	Whole economy	Standard Classification of Occupations
Wooden	2000	Whole economy	Standard Classification of Occupations
Gregory	1995a	Whole economy	Educational attainment
Pappas	1998	Whole economy	DOT
Sheehan and Dunlop	1998	Whole economy	Standard Classification of Occupations

Source: Author's investigation.

This production/non-production dichotomy is also used by Haskel and Slaughter (1998). They use sector-level data on capital stocks, output, computer use, and employment and wages for both skilled and unskilled workers. Unfortunately, only manufacturing data were available and used in their study. This poses a major problem in that they draw conclusions about economy-wide effects based on the manufacturing sector, when changes in earnings that may have occurred in the services sector or other sectors of the economy are not necessarily able to be accounted for. Another criticism made of the production/non-production proxy of skill is that the distinction between the two is blurred and imprecise, suggesting a far too broad and arbitrary category. For example, skills embodied in occupations such as line-supervisor, product development and record keeping have been classified as

production workers, while jobs categorised as delivery, clerical, cafeteria and construction have been classified as non-production.

Most human capital is acquired through formal education at school and through formal and informal training programs conducted in workplaces. Education plays an important role in improving the labour market outcomes of men and women and in ethnic or racial groups (Borjas, 2000, p. 228). In a number of studies of earnings inequality it has been assumed that years of education are rewarded in the labour market by a wage premium. Murphy et al. (1998), for example, examine trends in relative wages in the US and Canada by using educational attainment measures such as primary and post-primary school completion and tertiary education attainment as proxies for skill. This approach has also been widely used in Australian studies (Maglen, 1993; Gregory, 1995a; Borland, 1996b). Borland (1996b) studied the evolution of earnings of workers with different levels of education between 1968 and 1969 and between 1989 and 1990, finding a relative increase in the demand for more highly educated workers.

The above approaches, however, have been the subject of criticism. Taking years of education and educational level as proxies for skill has been criticised for being rough measures of skill. This is mainly because secondary and post-secondary educational institutions differ in the level and content and, hence, the abilities they train students in, while degrees between universities can differ in terms of the skill levels attained by their graduates. As a result, it can be said that educational attainment, or years of education, is far too broad, disparate and hence an inadequate proxy for skill.

A similar approach to years of education and educational attainment can be found in a study by Dougherty (2000). He uses numeracy and literacy levels as a proxy for skill obtained from a US data set known as the National Longitudinal Survey of Youth (NLSY). Similarly, Pryor and Schaffer (2000) use both years of education and the National Adult Literacy Survey (NALS) data. A variation on this approach which is widely used in the literature combines both education and training measures (e.g. Bartel and Sicherman, 1998; Autor, Katz and Krueger, 1998). However, these proxies of skill used in combination tend to suffer from similar limitations to those found in educational attainment proxies for skill, which mirror years of education.

A more direct approach found in the literature and used to identify changes in skills is the Dictionary of Occupational Titles (DOT). Drawing on a detailed skill profile of highly specific occupation categories, it provides an empirically based analysis of the skills and abilities required by occupations at the micro-level with 21 task and skill descriptors for almost 12,000 occupational titles. In principle, such information allows for a more detailed analysis of the changing demands of the workplace, compared to some of the earlier approaches, such as those discussed above.

The use of the DOT approach in labour economics pioneered by Howell and Wolff (1992) has given rise to a number of studies using their technique. For example, they use the DOT to analyse technological changes in the economy and changes in the demand for skills in US industries. Gittleman and Howell (1995), using the US Current Population Survey and the DOT, undertook an analysis of the changes in the structure and quality of occupations for the 1974-1990 period. Wolff (1996) used skill indices derived from the DOT to show that cognitive and interactive skills in the workplace grew in the US, while motor skills experienced a decline. A more recent study using the DOT conducted by Autor et al. (2000) investigated an occupation's requirements for routine and non-routine cognitive and manual skills.

Adapting the DOT to Australian labour market conditions and using a similar approach to Wolff's (1996), Pappas (1998) found that inter-industry effects have been important in explaining changes in relative demands for cognitive, interactive and motor skills.

Another commonly used approach by economists, which is designed to provide a way of assessing skill, is reflected in the consideration given to the occupational structure of employment by analysing skill profiles in terms of the implicit skill content, and ranking them in broad occupational categories. This approach has been used by the OECD (1996b), as well as by Colecchia and Papaconstantinou (1996) and Dunlop and Sheehan (1998). In these studies, occupations were aggregated at different levels, making up a total of four 'skill' groups: white-collar high-skilled (WCHS), white-collar low-skilled (WCLS), blue-collar high-skilled (BCHS) and blue-collar low-skilled (BCLS) (OECD, 1996b, p. 82; Colecchia and Papaconstantinou, 1996, p. 8; Dunlop and Sheehan, 1998, p. 238). As in other approaches, this method is limited. The key shortcomings are that it operates at quite a high level of aggregation, the skill

structure is created on an a priori basis and the aggregated categories are framed in general terms.

In the Australian context, a number of studies have used the occupational data contained in the 1st and 2nd editions of the ASCO. In their analysis of occupational change Aungles et al. (1993) devise an index using ASCO 1st edition data to show upskilling of the workforce between 1971 and 1986. Similarly, Cully (1999) and Wooden (2000a) analyse upskilling of the labour force using ASCO 2nd edition to cluster occupations into five skill categories as recommended by the Australian Bureau of Statistics. The nine occupational categories of ASCO and five skill categories are detailed in Table 3.3.

Table 3.3 ASCO 2nd edition major groups and skill level

Major groups	*Skill level*	*Brief description*
1. Managers and administrators	I	Most occupations in major groups 1 and 2 have a skill level commensurate with a bachelor degree or higher qualification, or at least 5 years relevant experience.
2. Professionals	I	
3. Associate professionals	II	Most occupations in major group 3 have a skill level commensurate with an Australian Qualification Framework (AQF) diploma or advanced diploma, or at least 3 years relevant experience.
4. Tradespersons and related workers	III	Most occupations in major groups 4 and 5 have a skill level commensurate with an AQF Certificate III or IV, or at least 3 years relevant experience.
5. Advanced clerical and service workers	III	
6. Intermediate clerical, sales and service workers	IV	Most occupations in major groups 6 and 7 have a skill level commensurate with an AQF Certificate II, or at least 1 year relevant experience
7. Intermediate production and transport workers	IV	
8. Elementary clerical, sales and service workers	V	Most occupations in major groups 8 and 9 categories have a skill level commensurate with completion of compulsory secondary education or an AQF Certificate I.
9. Labourers and related workers	V	

Source: ABS (1997b, p. 9).

The occupational classification of ASCO is skill based and aims to cover all the occupations in the Australian workforce. In ASCO 2nd edition the definition of skill level of an occupation is defined 'as a function of the range and complexity of the set of tasks involved' and 'the greater the range and complexity of the set of tasks, the greater the level of the occupation' (ABS, 1997b, p. 5). In ASCO 2nd edition, skill

levels have been upgraded to include both formal education and/or training as well as previous experience required for entry to an occupation (ABS, 1997b, p. 5). When ASCO was upgraded from the 1st to the 2nd edition, it left the concept of skill unchanged but refined the criteria used to measure it. These criteria measure skill level in terms of formal education and/or training and previous experience usually required for entry to an occupation (ABS, 1997b, p. 5). Thus ASCO's skill measure is highly reliant on three factors: education, training and years of experience.

In broad terms, these approaches are limited, especially when the skill composition of the workforce is changing rapidly and, indeed, when the very meaning of 'skill' may be undergoing change, for example, as a result of technological advances or market (de)regulation policies.

As discussed above, the current measures of skill in labour economics contain numerous limitations and ambiguities. A major difficulty that emerges from the various studies lies in the lack of a clear and agreed definition of skill and in establishing what might constitute an accurate or adequate measure of skill. It can be argued that part of the reason for the current inadequacies in capturing skill in labour economics is that the concept is itself complex and ill defined, and its measures are, at best, limited to abstracted, observable features that may often represent effects.

Drawing on the discussion above, the present approaches may not generate clarity based on an agreed definition of the term 'skill' and what it encapsulates. The measures of skill in current studies may be capturing a particular dimension or a small cluster of dimensions of skill, on which they base broad conclusions. A further feature of the current lack of clarity or agreed definition of skill is reflected in the fact that economists are unsure whether skills are features of jobs or occupations or a property of the individual, being made up of various combinations of education, training, experience and competence (human capital). One example of the occupation based approach is found in the ASCO 2nd edition definition of skill level, namely:

> The skill level of an occupation is defined as a function of the range and complexity of the sets of tasks involved – the greater the range and complexity of the set of task, the greater the skill level of the occupation. (ABS, 1997b, p. 5)

The task of developing a clear and agreed definition of skill is also made more urgent as well as more complex by the changing nature of the modern economy, which makes it difficult to measure relevant skills uniformly over extended periods of time. Based on the discussion and analysis above, it is difficult to avoid the conclusion that economists are unlikely to succeed in assessing and identifying occupational skills without developing an agreed and scientifically based definition of skill.

It is for these reasons that I sought more robust and detailed definitions of skill that provide a more solid and scientifically valid basis for analysis of changes in the labour market and changes in earnings inequality in Australia. The development of the Occupational Information Network (O*NET) which was designed by the Department of Labor in the US allows for a more detailed data analysis.

The O*NET goes beyond the limitations of ASCO. One such limitation is found in the ASCO definition of skill, which is concerned about the range of tasks involved in a job, but does not in any way list, identify or assess the tasks that are required to perform it. The way that ASCO handles skill level is by using education, training and years of experience as an indicator of skill. This in effect is yet another proxy for skill. This heavy reliance on educational and training qualifications reinforces the problems highlighted earlier in this chapter, which suggested that using years of education as a proxy for skill is both too broad and inadequate.

An advantage of the O*NET over ASCO is that it is an extensive and comprehensive database that describes the attributes and characteristics of occupations and workers. Unlike ASCO, the O*NET provides detailed information and measures about the tasks involved in occupations. Such detailed information is not contained in ASCO. The information contained in the O*NET identifies, defines and describes the comprehensive elements of occupations and contains hundreds of information items on worker attributes and job requirements, capturing what people do in their day-to-day activities. The various elements, applications and relevance of the O*NET to this thesis are detailed in Chapters 4 to 6 and its application in the analysis of labour market change is presented in Chapters 7 and 8.

3.3 Labour Market Change: A Link to Skill-Bias?

As discussed at the beginning of the literature review, it is widely known that the Australian labour market has experienced enormous change over the last three decades. A major feature of this change has been the increasing diversity in the nature of work and the types of employment in which Australians are now engaged (VandenHeuvel and Wooden, 2000). For example, up until the 1970s, most Australians workers were in permanent full-time employment. During the early 1970s, just over one in ten worked in part-time employment – defined by the ABS as employment that involves less than 35 hours per week. By 2002 nearly one in three employees were employed on a part-time basis (ABS, Labour Force Survey, cat. no. 6203.0, 2002). Furthermore, in the early 1980s, alternative work arrangements began to flourish, especially casual employment.

Two major factors have contributed towards a trend that promotes labour market change, namely, demand and supply factors, and institutional forces. The desire of many workers to combine responsibilities and personal interests with participation in the labour market has impacted the supply side. Such examples are the entry of many married women into the labour market who are willing to combine home and family duties with employment arrangements such as casual and part-time work. Students have become strong participants in the labour market by studying and working at the same time. The opportunity for women to combine home and family responsibilities and for students to combine study and work can be seen as a positive outcome, in that it has improved both groups' social and economic wellbeing.

The increasing diversity of employment types in Australia has also been strongly influenced by demand factors. According to Dunlop (2002), many product markets have considerably changed as a result of globalisation and technological change.

> This has generated a necessary response by firms to find ways to reduce costs and compete more efficiently in often increasingly volatile and uncertain markets … Casual and part-time employment have provided opportunity for employers to do this. (Dunlop, 2002, p. 156)

As discussed in the literature review, government policy has also encouraged a move towards labour market flexibility, largely achieved, amongst other things, through the

spread of enterprise bargaining and a corresponding decline in compulsory conciliation and arbitration, a key feature of Australia's industrial relations landscape prior to the 1980s (Campbell and Brosnan, 1999).

These changes implemented by both Labor and Liberal governments over the past two decades continued the trend towards increasing diversity of job types, particularly the rise in part-time and casual employment (e.g. Campbell, 1996; Campbell and Burgess, 1997; VandenHeuvel and Wooden, 2000).

These employment arrangements (part-time and casual) have taken a more prominent share of total employment, accompanied by a decline in the creation of permanent full-time employment. The nature of these changes can be seen in Tables 3.4 and 3.5. Table 3.4, which is divided into two panels, distinguishes the changes to the labour market into four types of jobs: male and female, and full and part-time. The panel on the left shows the share of total employment for males and females, whereas the panel on the right shows the share of employment classified by gender.

Table 3.4 Full-time and part-time shares of employment for males and females, per cent, 1982-2002

Males as a share of total employment							*Males as a share of total male employment*					
Year	*1982*	*1986*	*1990*	*1994*	*1998*	*2002*	*1982*	*1986*	*1990*	*1994*	*1998*	*2002*
Full-time	59.1	56.4	53.5	50.8	49.3	47.4	93.7	93.3	91.7	89.3	87.5	85.3
Part-time	4.0	4.1	4.8	6.1	7.0	8.1	6.3	6.7	8.3	10.7	12.5	14.7
							100.0	100.0	100.0	100.0	100.0	100.0
Females as a share of total employment							*Females as a share of total female employment*					
Full-time	23.4	24.3	24.9	24.6	24.5	24.4	63.4	61.5	59.8	57.2	56.0	54.8
Part-time	13.5	15.2	16.8	18.5	19.2	20.1	36.6	38.5	40.2	42.8	44.0	45.2
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Source: ABS cat. no. 6202.0, various years.

For example in 1982, 59.1 per cent of all employees were men in full-time employment and only 4.0 per cent were men in part-time employment. Similarly, the numbers in the panel on the right hand side show that for 1982, 93.7 per cent of male employees were employed on a full-time basis, and only 6.3 per cent on a part-time basis.

As expected, the male participation rate has been consistently higher than that of females, but there is a pattern of convergence as evidenced by the large number of

female entrants into the labour market since the mid to late 1960s and the decline in male participation rates (Borland, 1997, p. 21). Between 1982 and 2002 the total share of full-time employment fell by 10.7 per cent, while the share of part-time employment grew to account for almost one-third of the total employed workforce (28.2 per cent). The share of male full-time employment declined by 11.7 per cent, while male part-time employment rose by 4.1 per cent (panel on the left).

The panel on the right of Table 3.4 provides further evidence of these changes. The share of total full-time employment for males declined by 8.4 per cent, while the share of male part-time employment more than doubled. Another striking feature is the continued growth in female part-time employment over the 1982-2002 period. Although women are still significantly over-represented in part-time employment, the share of part-time employment rose by 6.6 per cent, while the full-time employment share increased by just 1 per cent. In terms of the share of total employment, the convergence of full-time and part-time employment for women is quite evident. The share of total part-time employment rose from 36.6 to 45.2 per cent, while for full-time employment it declined by 8.6 per cent to 54.8 per cent.

Table 3.5 Employment by job type, 1989-2002

Job Type	*Employment ('000s)*		*Change in employment, 1989-2002*		
	1989	*2002*	*No. (000s)*	*Per cent (%)*	*Share (%)*
Permanent	5,184.5	5,766.6	582.1	11.2	38.0
Casual	1,210.6	2,160.3	949.7	78.4	62.0
Full-time, permanent	4,776.0	4,832.4	56.4	1.2	3.7
Full-time, casual	323.6	734.8	411.2	127.1	26.8
Total full-time	5,099.6	5,567.2	467.6	9.2	30.5
Part-time, permanent	408.5	934.2	525.7	128.7	34.3
Part-time, casual	887.0	1,425.5	538.5	60.7	35.2
Total part-time	1,295.5	2,359.7	1,064.2	82.1	69.5
Total	*6,395.1*	*7,926.9*	*1,531.9*	*24.0*	*100.0*

Source: ABS, cat no. 6310.0, 1989 and 2002; adapted from Borland et al. (2001, p. 11).

There has also been a strong growth in casual employment, accompanied by a decline in permanent full-time employment as seen in Table 3.5. It shows employment growth in terms of job types (permanent, casual, full-time and part-time employment) over a 13-year period.

Over the 1989-2002 period, total employment grew by over 1.5 million persons – an increase of 24.0 per cent. Two important features of the changes shown are the strong increase in casual and part-time employment and a corresponding small rise in permanent full-time employment. Both full-time and part-time employment grew over the period. However, the growth in part-time employment was almost 2.3 times greater than the growth in full-time employment.

Table 3.6 Change in employment, by occupation and job type, 1989-2002

Occupation category	*Permanent full-time*	*Casual full-time*	*Permanent part-time*	*Casual part-time*	*Total*
			No. ('000)		
Managers and professionals	547.2	145.3	188.6	104.4	985.5
Tradespersons and advanced sales and service workers	-272.5	50.4	41.9	30.2	-149.9
Other employees	-218.2	215.5	295.1	403.9	696.3
Total	*56.5*	*411.3*	*525.6*	*538.6*	*1,531.9*

Note: The 1989 employment data were concorded using the methodology explained in Chapter 5. *Sources:* ABS, cat. no. 6310.0, and unpublished data for 1989 and 2002 provided by the ABS; author's calculations.

Disaggregation of the changes in terms of job types shows that permanent full-time employment rose slightly (1.2 per cent) in spite of a strong increase in total full-time employment, indicating that job growth in full-time employment was mostly confined to casual employment (a massive 127.1 per cent). In contrast, permanent part-time employment accounted for 34.3 per cent of the total share of employment growth, while casual part-time employment accounted for 35.2 per cent. Changes in occupations in terms of employment type also reveal interesting trends. Following the methodology of Borland et al. (2001, p. 13), Table 3.6 breaks down these changes further into three occupational categories and four job types and shows that the most pronounced changes have occurred in high and low-skilled occupations.

Over the 12-year period, permanent full-time employment experienced strong declines in the lower skilled occupations, but showed strong gains in the higher skilled jobs, namely, managers and professionals. In contrast, employees in occupations other than permanent full-time work experienced considerable gains in other job types. For both tradespersons and advanced sales and service workers, and other employees in permanent full-time employment, a total of 490,700 jobs were lost. These same occupations experienced strong increases in both casual full-time

and part-time, and permanent part-time employment, contributing a total of 1.03 million jobs or 68 per cent of total employment growth.

The information detailed in tables 3.4 to 3.6 reveals that the nature of employment has changed considerably since the early 1980s. The picture that emerges demonstrates a twofold shift characterised by slow growth in permanent full-time employment and an increase in permanent part-time employment, but more particularly a shift towards casual full-time and part-time work.

In light of the enormous growth in casual employment it is important, in the context of this study, to consider its definition and nature. Casual employment has been defined differently by the Australian arbitration award system, in common law, and by the Australian Bureau of Statistics. The employment relationship which employees and employers enter into in Australia is governed by the award system. In the majority of awards, the term 'casual employment' is poorly defined. As pointed out by Owens (2001), the most significant attribute of a contract of employment for casual work is that the law sees each contract as separate (p. 120). Furthermore, there are two major features that highlight the difference between casual and permanent employment. The first is that each casual employment contract is treated as being unique in itself, and the second distinction is to be found in length of time provided in notices of termination. This can be found in the common law definition of casual work, which is summarised by Brooks (1985):

> Each engagement of a casual worker constitutes a separate contract of employment, and we can safely summarise the common law by saying that the only distinction of substance between the casual/part-time employee and the full-time/permanent employee lies in the period of notice required to properly terminate the contract. (p. 166)

Thus, according to the common law definition, casual employment contracts provide employees and employers with the flexibility of termination at short notice. In other words, whereas permanent employees enjoy a minimum period of notice of termination (at least one week), casual employees may not be given notice of termination, and may not always be required to be re-engaged once their contracts expire (Burgess and Campbell, 1998b, p. 36).

According to Dawkins and Norris (1990), another complexity can be found in the system of arbitral awards, wherein definitions of casual employment can vary

considerably both within an industry and between different industries. It is evident that the common law definition is unable to capture all the characteristics of casual employment within specific or individualised contracts. Because of this, many researchers regard casual employment as being a negative type, or a 'sub-standard' form of employment, emphasising the fact that the majority of these jobs are characterised by low pay, limited opportunities for career progression, lack of provision for training, low levels of union representation, reduction in employee influence over decision making in the workplace, increase in insecurity regarding the future of jobs, and diminished employee entitlements, such as lack of parental leave entitlements for long-term casuals (e.g. Burgess and Campbell, 1998a; ACIRRT, 1999; Watts, 2001; Campbell and Burgess, 2001a).

For all the inconsistencies in definition and shortcomings in effects for the employees concerned, casual, part-time and fixed term employment have a number of positive attributes. For example, an analysis of the Australian Workplace Industrial Relations Survey (AWIRS) which was conducted by Wooden (2001c) shows that casual and fixed term employment have both positive and negative traits. Both permanent part-time and casual employees reported satisfaction with their jobs. Casual and part-time employees also reported lower levels of stress compared with their permanent counterparts. Significantly, permanent part-time employees reported high levels of satisfaction, which can be attributed to a higher average hourly rate of pay. Interestingly perhaps, this group did not appear to be preoccupied about job insecurity. Wooden also found that workers on fixed term contracts were more likely to report having influence over decision making, experienced lower stress levels and believed that they received reasonable payment for their work. They often also believed that their employers were likely to provide them with training opportunities (Wooden, 2001c).

A different definition is provided by the ABS, which defines 'casual' employees as those who were entitled to neither paid holiday leave or paid sick leave, or both, in their main job'. In contrast, 'permanent employees' are defined as 'employees who were entitled to paid holiday leave or sick leave in their main job' (ABS cat. no. 6310.0, 2002). Using the ABS definition, 27.3 per cent (see Table 3.5) of employees in Australia were employed in their main job on a casual basis. Thus, the proportion

of employees who do not enjoy basic leave entitlements is relatively high. But as Wooden (2001b, p. 877) cautions, this figure should not readily be interpreted as a measure of the proportion of the workforce hired on a temporary basis. According to Wooden and Warren (2003), the ABS definition has a number of limitations. Firstly, like most surveys, it has reporting deficiencies. For example, respondents may confuse the actual receipt of entitlements with access to entitlements and may, as a result, make a reporting error. Secondly many respondents may not be able to report information about leave entitlements, in which case the ABS may code these answers as being negative, and may as a consequence inflate the incidence of casual employees. Thirdly, the ABS definition of an employee includes owner-managers. Many owner-managers who respond to the ABS survey may say that they do not provide themselves with either sick leave or paid annual leave entitlements, and may be overstating the number of casual employees (see also for example, Murtough and Waite (2000a) and Campbell and Burgess (2001a) for a more detailed discussion). Finally, the ABS survey categorises all employees as either casual or permanent without making provision for those who are on fixed term contracts. Most of these are entitled to paid sick and annual leave, and as a result they may be assigned to the criteria of permanent employment status in the survey (Campbell and Burgess, 2001a, p. 89). In spite of these limitations, the ABS survey is extremely valuable in the analysis of labour market change. It is historical in perspective, it allows researchers and policy makers to trace how the pattern of casual and permanent employment has changed over time, and it provides much information related to the incidence, characteristics and profile of the casual employment labour market.

3.3.1 Casual employees: a brief profile

The profile of casual employees is quite different compared with those employed on permanent or longer-term employment arrangements. Simpson et al. (1997) report that the proportion of employees in casual employment is higher for women than for men and the density of the casual employment workforce is much higher in the private sector. Much of this density was concentrated in service type industries, including and particularly high in the 'Wholesale and Retail Trade', 'Community Services' and 'Recreation and other Services'. Both the incidence and the rate of growth of casual employment were higher in the private sector, while industry

concentration of casual employment remained stable in the period between 1984 and 1993. Simpson et al. (1997) conducted a shift share analysis which showed that the growth in casual employment was explained by the increased use of casual employment within an industry, rather than the substantial growth of industries that employ high numbers of casual employees. Another important finding of this analysis was that the gender composition of the workforce was affected by the need for women to combine domestic duties with paid employment. Simpson et al. (1997) observed that an increase in the proportion of women in employment tended to coincide with an increase in the proportion of casual employment. Similarly, as already noted, the flexible nature of casual employment tended to satisfy the needs of students to supplement their income, particularly while pursuing full-time studies. Casual employment was also found to provide a form of income assistance for older workers as a supplement to their retirement incomes.

Using the Household, Income and Labour Dynamics in Australia (HILDA)[1] survey, Wooden and Warren (2003) provide detailed information on the characteristics of casual and fixed term contract employees and their jobs. An important feature of this study, as in the case of VandenHeuvel and Wooden (2000) and Waite and Will (2002), is that it distinguishes more sharply and clearly between casual, permanent and fixed term employees. Their analysis, which relies on self-reported data about employment contract type, finds similar characteristics to those reported by Simpson et al. (1997) above. Firstly, they report that unlike permanent or ongoing employees, casual employees are more likely to be women and young persons, engaged in full-time education, and completing post-school education or training. They also report a high incidence of casual part-time employment amongst married women, especially those with young children. Casual employees are also likely to be Australian-born, living in regional areas and to have recently experienced unemployment. Nearly 75 per cent on a part-time basis, compared to 16 per cent of permanent employees (Wooden and Warren, 2003, p. 10). Their average job tenure is much shorter than that of permanents, they are concentrated in low-skilled occupations and they tend to have relatively low earnings. In addition, casual employment is common amongst labour hire firms, and casual employees are unlikely to be members of a trade union. The type of organisations that hire casual employment are quite diverse, and are often

[1] Watson and Wooden (2002) provide a detailed description of this survey's methodology and content.

small private sector firms, typically engaged in the retail trade and in services such as restaurants and cafes.

3.3.2 Cost advantages of casual employment to employers

An important theme in our discussion of the behaviour of the Australian labour market is the way in which employers can minimise the cost of their wages bill. Dawkins and Norris (1990) provide an explanation of how firms do this by employing workers on casual contracts. Labour theory maintains that labour is a quasi-fixed factor of production and can be divided into variable and fixed costs. Variable costs are made up of the wage and on-costs, such as payroll tax, workers compensation premia, the superannuation guarantee levy and leave loadings. Quasi-fixed costs of labour include the cost of hiring new employees (e.g. advertising, screening), training and dismissal. With regard to casual employment, however, the situation is different in a number of significant ways, especially in the advantages that accrue to employers. One advantage is that casual employment, unlike permanent work, does not (most of the time) incur on-costs. Hence, according to neoclassical theory, it is likely that 'the demand for casual labour will rise if the costs of casual employment fall relative to permanent employment costs and the productivity of casual labour rises relatively' (Dickson, 1998, p. 8).

According to Campbell (2001), another clear advantage to employers is ease of dismissal of casual employees. Compared to permanent employees, they have minimal employment protection and lack entitlements to notice of termination, or severance pay, and do not have much protection when it comes to issues of unfair dismissal. Such issues often occur in two particular cases. The first is when a firm is forced to retrench large numbers of employees, thus reducing the large costs involved in dismissing permanent employees compared to those employed as casuals. The second occurs when an employee does not match the needs or expectations of the employer and can be dismissed with fewer legal complications and costs than if they were employed under permanent working conditions. A further cost advantage to employers is the ease with which they can match fluctuations of labour demand. This can be a significant cost reduction to a firm which is still required to pay full-time or part-time permanent workers during quiet periods. Thus, the clear advantage to a firm which has the flexibility of employing casual employees is that their wages do not

have to be paid during periods where the demand for labour is low. This is often the case in small, private sector firms whose business prospects may not be certain (Wooden and Warren, 2003, p. 12).

Campbell (2001) also identifies the administrative convenience of employing casual workers, as this often entails less need to keep track of entitlements. However, this cost advantage is often disputed by many employers who argue that casual employment arrangements create more administrative work than they save. Finally, another cost advantage to employers is that it offers them more control to manage their workforce. Such controls, according to Campbell, include opportunities for greater management flexibility over labour numbers, greater control over labour costs, and greater control over administrative obligations.

3.4 Labour Market Change: An Alternative Response to Skill-Bias?

The picture that emerges from this discussion in relation to the changes occurring in the Australian labour market is both dynamic and somewhat at variance with the Transatlantic Consensus view discussed in Chapter 2. The changes described in this section reveal that Australia may be experiencing a different scenario of the SBTC hypothesis. It is clear that if wages are inflexible downwards in the Australian labour market, but there exists a flexibility of job types (i.e. full-time and part-time permanent employment, and full-time and part-time casual employment, including fixed term employment), one way in which employers may reduce wage costs is by opting to employ workers on a part-time or casual basis. So, if wages are inflexible downwards (i.e. there exists a minimum wage protection scheme regulated by government) but the type of job creation is flexible in nature and this provides a lower cost alternative to employers, then this links to the SBTC hypothesis and job types. This may explain the rise and concentration in employment creation at the very top (e.g. as in the case of most skilled occupations or individuals) which is accompanied by increasing wages, whilst at the same time we see a decline in permanent full-time employment creation from the middle to the bottom of the employment distribution. This decline is then evidenced in a corresponding increase in part-time and casual

employment creation occurring from the middle to the bottom of these types of employment distributions.

3.5 Conclusion

This chapter has presented the complexity of the concept of skill and the limitations that arise out of measuring skill in labour economic research. It has also discussed changes to the labour market, particularly in terms of casual and part-time employment, and presented a hypothesis that describes the market's current behaviour. The implications of this hypothesis for the behaviour of the Australian labour market are examined in more detail in Chapter 11, while the next three chapters explain alternative measures of skill derived from the O*NET and Australian data used in this thesis.

Part B:
Assembling the Data

Chapter 4
The O*NET System

4.1 Introduction

The Occupational Information Network (O*NET) is an extensive and comprehensive database that describes the attributes and characteristics of occupations and workers. Its first version was launched in 1998 and the information detailed in this chapter refers to this version, also known as O*NET 98. The O*NET was designed to replace the DOT and is considered to be the most comprehensive standard source of occupational information in the US. It offers statistical information that can be applied to the Australian context to analyse labour market change.[1]

The aim of this chapter is to describe the O*NET and many of its components. The information that follows is mainly descriptive and draws heavily on the work conducted by Peterson et al. (1995, 1997, 1999) who were responsible for developing the O*NET. Information is also drawn from the O*NET 98 Viewer (US Department of Labor, 1998a) and the O*NET 98 training materials developed and distributed by the National Occupational Information Coordinating Committee (NOICC).

This chapter explains the origins of the O*NET and describes the occupational system developed by the US Department of Labor in terms of the Content Model (sections 4.2 to 4.4). The six domains that make up the Content Model are listed in section 4.5. The chapter ends with a conclusion.

[1] For example, Pappas (2001) used the DOT to analyse the causes of increasing earnings inequality in Australia, while Sheehan and Esposto (2001) used the O*NET to study the characteristics of Australian jobs.

4.2 Origins of the O*NET

The O*NET was developed by a consortium led by the Department of Labor in the US. It was built to replace the DOT, which was conceived in the 1930s and was last published in 1991. The DOT was developed in an industrial economy during a time that emphasised blue-collar occupations. It was updated periodically and proved very useful for more than six decades. Its usefulness, however, faded as economic changes shifted towards information and services away from heavy industries and other blue-collar work. Because of these changes, the need for more up to date occupational information that reflects modern jobs spurred the creation of the O*NET.

The O*NET, which was developed on the foundations of the DOT, was a response to a growing demand for an expanding public employment service and to was intended to assist, among other things, in job placement activities. It follows a different strategy from DOT, providing very detailed information on about 1,120 occupations rather than more limited information on over 12,000 occupations. The O*NET is continually updated to reflect the dynamic and ever-changing nature of employment. For example, the latest version is the O*NET 5.1.[2]

The occupational information in the O*NET is organised in a relational database which identifies, defines and describes the comprehensive elements of job performance. It contains hundreds of information items on job requirements, worker attributes and the content and context of work, capturing what people do in their day-to-day activities.

The origins of the O*NET go back to the 1993 report to the US Secretary of Labor's Advisory Panel on the DOT (APDOT). The report noted that the framework underlying the then current version of the DOT was not adequate for analysis and description of occupations. This was because the descriptions of occupations in the DOT were predominantly based on industries of an earlier era. These descriptors were deficient in dealing with the large shift towards services and the emerging information industries in

[2] The O*NET data used in this thesis is from the O*NET 98 version. The reason for this is that newer versions of O*NET have not upgraded all the data on the variables used here for analysis, which are contained in the first version of the O*NET 98.

the US economy. Furthermore, it was highlighted that the DOT did not meet the demands of the emerging labour force of the 21st century (Mumford and Peterson, 1999, p. 22). The APDOT report found the DOT inadequate in many areas, but particularly in that occupations were mainly described in terms of the tasks being performed. This focus on job tasks and the procedures used to obtain descriptive information for the DOT led to a number of problems.

Three main issues of concern were identified. Firstly, the DOT was based on analysts' descriptions of job tasks. The limitation here was that because descriptions are primarily based on occupation specific information, it makes it difficult to organise the information in such a way as to be able to make meaningful comparisons across occupations. Secondly, the DOT is fundamentally based on one kind of descriptive information, that is, the tasks which workers perform in their jobs. This was considered as inadequate because information related to work activities, such as interests, knowledge, abilities and skills needed in a given occupation, were not taken into account. Furthermore, information related to personal requirements to perform a job could not be obtained from information contained in the DOT. A final limitation of the DOT was that it is rather time-consuming and expensive to update descriptive information related to occupations without a commensurate benefit in its usefulness within a changing labour market.

The DOT's shortcomings indicated that it could not be used for rapid assessment of skills, abilities and other characteristics required by a job family or for showing how skill levels are changing or may be related, for example, across occupations. The changing nature of occupations expected in the 21st century gave the Department of Labor further evidence that the DOT was unable to meet the demands of a rapidly changing labour market and workplace and therefore needed replacement.

4.3 The O*NET: A Descriptive Occupational System

The O*NET was developed with the aim of becoming an information system consisting of a framework made up of a variety of components. Firstly, it possesses occupational information that allows jobs to be described in terms of more general descriptors that reflect the modern labour market. Secondly, the O*NET is closely linked to labour

market data which are updated continually. Although it was not originally intended for this purpose, an advantage of the O*NET is that the detailed data collected on worker characteristics and job requirements can be used to examine and analyse changes in the labour market. A further advantage is that it is updated every five years, whereas the DOT was updated five times in 60 years. Data are gathered on over 200 occupations each year, with the aim of totally upgrading the database every five years (O*NET Consortium, 2004). As distinct from the DOT, the O*NET contains cross-occupation descriptive information that includes the kind of work, conditions under which it is done, and the requirements imposed on the people doing the work. Finally, the O*NET takes into account the variety of applications of the information that is collected. All the occupations in the database are related to a common framework that describes job requirements and worker attributes, as well as the content and context of work using nearly 300 descriptors. All the information collected in the database is organised into a framework known as the Content Model.

4.4 The O*NET Content Model

The Content Model is the conceptual foundation of the O*NET. It was developed by Mumford and Peterson (1995b), using research on job and organisational analysis, and embodies a framework that reflects the character of occupations (i.e. using job-oriented descriptors) and people (i.e. using worker-oriented descriptors). The Content Model also allows occupational information to be applied across jobs, industry sectors (by using cross-occupational descriptors) and within occupations (using occupation-specific descriptors). Table 4.1 shows how the parts of the O*NET Content Model are categorised.

The Content Model classifies data into six domains that provide detailed information related to the attributes of occupations and to the characteristics required of people who actually do the job. It includes the specific domains and elements in the O*NET database that might be used to describe jobs. These components are based on psychological and job analysis research carried out by the O*NET consortium.

4.5 Domains of the Content Model

As mentioned above, the Content Model is organised into six major domains. Figure 4.1 summarises each of these domains and their corresponding components. The six domains are Worker Characteristics, Worker Requirements, Experience Requirements, Occupation Requirements, Occupation Characteristics and Occupation Specific Information. The organisation of the Content Model allows the user to concentrate on relevant information that details the attributes and characteristics of jobs and workers. Each of these domains is briefly described in Figure 4.1.

Table 4.1 Cross-classification of the O*NET occupational information

Type of application	*Job oriented descriptors*	*Worker oriented descriptors*
Cross-occupation descriptors	Generalised work activities (GWA)	Skills
	Work context	Knowledges
	Organisational context	Education
	Labour market information	Abilities
	Occupational outlook	Interests
	Wages	Work style
		Training
		Experience
		Licensing
Occupation specific descriptors	Tasks	Occupational skills
	Machines, tools and equipment	Occupational knowledges
	Labour market information	Training
	Occupational outlook	Experience
	Wages	Licensing

Source: Occupational Information Network, O*NET (2004).

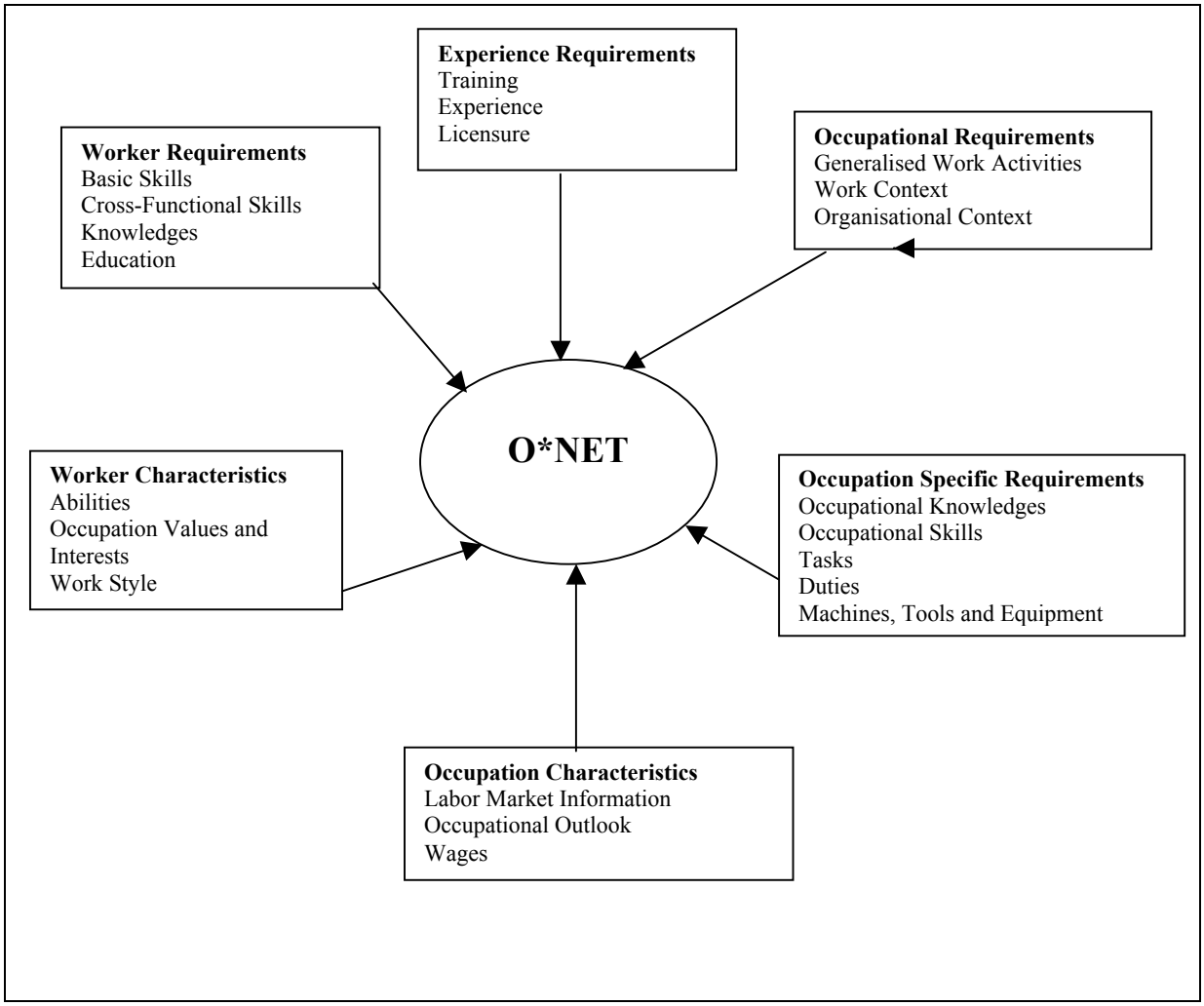
4.5.1 Worker characteristics

This domain specifies the enduring characteristics that are likely to influence both performance and the capacities to acquire the knowledge and skills necessary for effective work performance. The abilities, interests and work values associated with workers make up this domain. These are briefly explained below.

Abilities

Occupations are described in terms of the basic abilities required for successful task performance. Specialists in the field of industrial and organisational psychology developed the taxonomy of abilities. The O*NET defines abilities as the general traits of an individual that show a degree of stability over relatively long periods of time. Abilities are likely to affect the acquisition of skills and the competence to perform tasks. They cover a broad spectrum of performances that are often found in the world of work. There are 52 O*NET ability descriptors grouped into four categories: cognitive, psychomotor, physical and sensory.

Figure 4.1 Six domains of the O*NET Content Model



Source: Mumford and Peterson (1999, p. 25, Figure 3.2).

Work style

Occupations are described in terms of personality, particularly personality constructs that bear on an individual's work style. Work style data will be developed as a result of future survey data collection for the O*NET.

Occupational interests

The O*NET measures six types of occupational interests. It is a vocational interest assessment instrument that is either administered by vocational counsellors to individuals or can be self-administered. It is designed to provide career awareness and choice for individuals, and is aimed at assisting people to discover the type of work activities and occupations that they would like to pursue.

The O*NET defines interests based on the Holland Occupational Classification and reflects a model of personality types and work environments (US Department of Labor, 1998b). There are six interest categories used to describe the work environment of occupations: realistic, investigative, artistic, social, enterprising and conventional. This information is presented in the form of a classified index. In terms of practical applications, abbreviations are used to denote categories of information. The first letter is the most important. It shows the major category into which the occupation falls and conveys the most information about it. The second and third letters, in descending order of importance, provide supplementary information about the occupation by showing the categories that it next most resembles. No individual persons or occupations resemble a pure type.

Occupational values

The O*NET defines occupational values as characteristics of the work environment that are important to an individual performing a particular job. The variables used to obtain information in this area are based on the Minnesota Job Description Questionnaire (MJDQ). There are 21 O*NET values, grouped into the following categories: achievement, comfort, status, altruism, safety and autonomy. These are briefly defined below:

- Achievement is defined as the importance of an environment that encourages accomplishment;
- Comfort describes the importance of an environment that is comfortable and not stressful;
- Status describes the importance of an environment that provides recognition and prestige;
- Altruism illustrates the importance of an environment that fosters harmony and service to others;
- Safety relates to an environment that is predictable and stable;
- Autonomy relates to the importance of an environment that stimulates initiative.

4.5.2 Worker requirements

Worker requirements refer to a specific set of worker-related attributes that are used to describe people's jobs. They refer to developed attributes of the individual that contribute to performance and subsume a number of variables, which describe an individual. An example of this is knowledge that develops as a function of experience. In addition to knowledge and education, people's experiences provide them with a set of skills. Some, such as basic skills, can facilitate learning and the acquisition of knowledge in a number of contexts. Other skills, such as certain cross-functional skills, may be more closely tied to the type of work (Mumford and Peterson, 1995b, chap. 1, p. 1). Worker requirements include education, knowledge, basic skills and cross-functional skills. These elements are open to change through learning and experience.

Knowledge

The O*NET defines knowledge as a collection of discrete but related and original facts, information and principles about a certain domain. It is acquired through formal education and training or as a result of accumulated experience. Organisation into a

coherent structure is critical to the definition. Some knowledges[3] are more general than others in that they are important for successful performance in a greater variety of jobs. Others are more specific and apply to a narrower range of jobs, while still others are more occupation specific (Fleishman et al., 1995, chap. 4, p. 1). There are 33 different knowledge descriptors that are useful or required to perform effectively in an occupation. A description of each of these can be found in Appendix B.

Skills

Reflecting on the discussion in Chapter 3 on the deficiencies of what constitutes 'skill' as a concept, Mumford and Peterson (1995a) define skills as a set of general procedures that underlie the effective acquisition and application of knowledge in various domains of endeavour. The definition has three useful advantages. Firstly, skills are inherently tied to knowledge, practice and expertise. One cannot apply skills, or for that matter acquire them, without reference to some task or content domain. Secondly, skills can be seen as general procedures required to perform multiple tasks lying in some broad domain, such as problem solving or social interaction. Finally, skills are not necessarily stable attributes of the individual but are developed as a function of experience within a certain or single domain. There are 46 O*NET skill descriptors encompassing two broad categories. The first is called basic skills and has ten descriptors, and the second is called cross-functional skills and has 36 descriptors. A description of each of these can be found in Appendix A.

Education

Educational background represents a significant influence on the development of the general knowledges and skills and can be seen as another characteristic of individuals. In the O*NET, education reflects the prior educational experience required to perform a given job. It is made up of three components. The first is the level of education required to perform a particular job. The second refers to the instructional or occupation-specific/focused training program required to perform a particular job. The third component is concerned with the amount of education required to perform a given

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[3] Because the O*NET system has 33 knowledge descriptors, the plural version is used here, as described in the O*NET system.

job in 15 distinct subject areas. Subject areas cover most of the courses that occur in high school, junior college, college undergraduate degree programs, and other education and training programs. As yet, this component of the O*NET has not been fully developed.

4.5.3 Occupational requirements

This is made up of a comprehensive set of variables or detailed elements that describe what various occupations require. The most common procedure to describe occupational requirements is through definitions of the tasks performed in a given occupation. Hierarchical information is provided on generalised work activities, work context and organisational context.

Generalised work activities

The O*NET defines generalised work activities (GWAs) as an aggregation of similar job activities that underlie the accomplishment of major work functions. The GWA taxonomy is intended to provide a framework for evaluating the job activity requirements for all or the vast majority of occupations in the world of work. All tasks and duties of any occupation should be subsumed by one or more GWAs in the system. Because GWAs are general, they provide a plausible basis for describing work activities in a way that promotes cross-job comparisons.

The taxonomy is hierarchical. There are 42 descriptors that collapse into nine constructs and these further collapse into four constructs. The broadest constructs are: information input, mental processes, work output, and interacting with others. A description of each of these can be found in Appendix C.

Work context

These variables describe the conditions under which job activities must be carried out. They include physical conditions (e.g. temperature and noise) as well as social or psychological conditions (e.g. time pressure or dependence on colleagues) that might influence how people go about performing certain activities.

Organisational context

These are variables that might interact with the occupational environment and how people go about doing their work. For example, a flatter and more open organisational structure may require workers who possess a broader range of skills, placing a premium on problem-solving skills and an independent work style.

4.5.4 Experience requirements

This domain is related to previous activities and is explicitly linked to certain types of work. It includes information about the experience backgrounds in a particular occupation or group of occupations and involves preparation and licensure requirements. In this domain, data and information are provided about the professional or organisational certifications required for entry and advancement, preferred education or training, and required apprenticeships into professions or vocations.

4.5.5 Occupation specific requirements

This domain reflects variables or other Content Model elements in terms of selected or specific occupations. Occupation specific information in the O*NET Content Model is made up of skills, knowledge structures of occupations, tasks and duties, machines, tools and equipment required to perform a job satisfactorily. Labour market information defined by industry or occupation is also provided here. In this part of the Content Model, the O*NET includes a list of tasks which are unique to each occupation. Specialist occupational analysts developed statements for each task contained in the O*NET.

4.5.6 Occupation characteristics

The O*NET does not directly include variables in the domains of labour market information such as occupation outlook on wages, but it is designed so that connections can be made readily to databases that do contain those variables. It lists a set of variables that define and describe the general characteristics of occupations that may influence occupational requirements. Some of the most salient variables in these domains include current occupational employment, overall and by industry, completions

in professional, technical and other education programs, and occupation conditions, such as hours worked, location of employment and earnings.

4.6 Conclusion

This chapter provided a description of the O*NET system developed by the US Department of Labor. It presented a brief explanation of the origins of the system, the rationale for its development and a description of many of its components. The O*NET is a large and complex occupational information system. It contains a vast amount of information on about 1,120 occupations with detailed elements and descriptors of job requirements and performance. It is organised in a relational database and it has numerous applications. Three components of its data are used in the following chapters to analyse changes in the Australian labour market. These components are described in more detail in Chapter 6. The following chapter discusses the way in which Australian data are assembled and organised for analysis of changes in employment.

Chapter 5
Data and Measurement Issues

5.1 Introduction

This chapter deals with the various data sources used in Part B of the thesis. The main data are from three major sources. These are the Occupational Information Network, (O*NET), the Classification and Classified List of Occupations (CCLO), and the Australian Standard Classification of Occupations first (ASCO 1st edition) and second editions (ASCO 2nd edition). To create an occupational concordance between the CCLO and ASCO 1st edition, the CCLO/ASCO Link File (ABS cat. no. 2199.0) was used. The occupational concordance between ASCO 1st edition and ASCO 2nd edition was created using the Census of Population and Housing Link File between 1st and 2nd editions of ASCO (ABS cat. no. 1232.0.55.001). Employment data from the 1971, 1976, 1981, 1986, 1991, 1996 and 2001 censuses were used in this analysis. Information about how the concordances were done and how ASCO occupations were assigned to the O*NET is presented below.

5.2 Type of Data Used in the Analysis of Skill, Knowledge and Work Activity Intensity in Australian Occupations

To analyse changes in skill, knowledge and work activity intensity in Australian occupations, the indices developed had to be linked to data on Australian employment by occupation. To conduct this type of analysis, employment data were purchased from the ABS spanning seven censuses (1971, 1976, 1981, 1986, 1991, 1996 and 2001). The data were at the four-digit level for ASCO 1st edition for the 1986 and 1991 censuses. For the 1996 census, the occupational data are classified by ASCO 2nd edition. Data for the 1971, 1976 and 1981 censuses are coded under the CCLO. The data contain details of full-time and part-time employment for both males and females for over 340 occupations.

Unfortunately, but perhaps inevitably given the changing nature of the occupational structure, the number of occupations differs over the years and the occupational classification is different for different census years. This means that in order to compare employment by occupation over time in this thesis, concordances utilising ABS link files between CCLO, ASCO 1st edition and ASCO 2nd edition had to be performed.

5.3 The ASCO 1st Edition and the CCLO Concordance

Prior to 1986, Australian occupational data were coded using the CCLO. The CCLO was used to code occupation data for censuses between 1961 and 1981 inclusive. This classification was originally adapted from the International Standard Classification of Occupations (ISCO), issued in 1958. ISCO was considerably revised in 1968, and the changes made were carefully considered in revising the CCLO for use in the 1971 census. The structure of the CCLO was based primarily on the type of work being carried out (ABS, 1986b, p. 3).

To provide a basis for converting distributions of occupations coded to ASCO into distributions coded to CCLO, and vice-versa, a quantitative link file was developed by the ABS in the 1986 census by coding responses to the occupation questions for a sample of employed persons to both occupations (ASCO and CCLO). The sample was chosen by selecting every fourth collection district and every fifth dwelling within it. A total of 264,588 persons, or 4.06 per cent of the population, were sampled. From this work, the ABS produced a special CCLO/ASCO: Link File (cat. no. 2199.0) which is available on magnetic tape. This file was created for the purpose of allowing users to create their own empirically-derived link between occupation data produced in previous censuses and occupation data coded to ASCO in the 1986 census. It contains characteristics of persons which allow the generation of a matrix of cells in which the two occupation codes can be cross-classified by a number of other variables. The data items contained the following information:

- State of usual residence
- ASCO 1st edition code
- CCLO code

- Age
- Sex
- Status of worker
- Government or non-government worker
- Income
- Industry
- Level of qualification
- Field of qualification.

5.4 CCLO/ASCO Concordance Method

To create a concordance between the ASCO and CCLO, the first step required the creation of a link table similar to the ASCO 1st edition and ASCO 2nd edition. This involved a conversion of raw data into useable information, which required the creation of a link file that provided frequencies for each CCLO occupation linked to the ASCO 1st edition code. This table was created using the information provided in the CCLO/ASCO Link File (ABS, cat. no. 2199.0). An example of the data items contained in the link file produced by the ABS is shown in Table 5.1.

Table 5.1 Example of codes for CCLO/ASCO 1st edition link file

Description	*Code*	*Details*
State of residence	1	NSW
ASCO Code	2403	Primary School Teacher
CCLO Code	051	Graziers
Age	6	65+
Sex	1	Male
Worker status	2	Wage or salary earner
Govt or non-govt	2	Non-govt.
Income	1	$0-$9,000
Industry	2	Agriculture
Level of qualification	2	09
Field of qualification	2	18
State weight (rural or urban)	9	480212310

Source: ABS 1986c, Link File cat. no. 2199.0 and author's calculations.

To obtain the frequencies as organised in the ASCO 1st edition and ASCO 2nd edition link file, all the males who possessed the same codes for ASCO 1st edition and CCLO

were grouped. These were then multiplied by the state weight (either rural or urban) and were then aggregated.

The same procedure was conducted for females, where separate weights had to be created. Once this was completed, a final table of frequencies was created which contained the CCLO code, the ASCO 1st edition code, number of males, number of females and total. An example of this frequency is given in Table 5.2.

Once the link file was created, it was then aggregated in order to obtain proportions that were multiplied by the corresponding number of employed people in the 1971, 1976 and 1981 censuses. This operation provided the number of people in a CCLO occupation for these censuses in terms of the ASCO 1st edition occupation. Having concorded these sets of occupational values for the 1971, 1976 and 1981 values into the ASCO 1st edition, they were then concorded into the ASCO 2nd edition using the same procedure as was done with the 1986 and 1991 data. This is described below.

Table 5.2 Example of frequency table derived from the CCLO/ASCO 1st edition link file

CCLO	*Occupation CCLO*	*ASCO 1st edition*	*Occupation ASCO 1st edition*	*Male*	*Female*	*Total*
047	Executive Teachers	2905	Curriculum Development Officer	60	3	63
047	Executive Teachers	2403	Primary School Teacher	526	217	742
047	Executive Teachers	2405	Senior Teacher, Sec. School	20	60	80
048	Teachers with Tert. Quals.	2407	Resource Teacher	140	1567	1707
048	Teachers with Tert. Quals	2503	TAFE Teacher (Trades)	89	12	101
048	Teachers with Tert. Quals	2503	TAFE Teacher (General)	70	20	90
051	Other Ed. Inst. Teachers	2501	University Lecturer	35	19	54
051	Other Ed. Inst. Teachers	2503	TAFE Teacher (Trades)	196	156	352

Source: ABS 1986c, Link File cat. no. 2199.0.

5.5 Link between the 1st and 2nd Editions of ASCO

To facilitate the comparison of occupational data between the 1996 census and the 1986 and 1991 censuses, the ABS developed a link between the two editions of ASCO. Such a quantitative link is necessary because of significant structural differences between the two. According to the ABS (1998a, p. 1), the link file was developed by coding all occupation responses in the 1996 census to both the 1st and 2nd editions of ASCO. To

create the concordance, an electronic file (Census of Population and Housing: Link File between 1st and 2nd Editions of Australian Standard Classification of Occupations (ASCO), ABS cat. no. 1232.0.55.001) was developed by the ABS, which contains frequencies for each 1st edition occupation linked to a 2nd edition code. This was used to concord data for the 1986 and 1991 censuses to the ASCO 2nd edition. An example of this table for the whole of Australia is given below.[1]

Table 5.3 Example of link file for ASCO 1st and 2nd editions

1st Edition	*2nd Edition*	*Males*	*Females*	*Total*
1000-00	1000-00	51398	25754	77152
1000-00	1299-79	129	156	285
1000-00	2549-21	11	10	21
1000-00	3392-11	3252	1152	4404
1000-00	3399-79	28	43	71
1100-00	1100-00	135	35	170
1100-00	1111-00	0	0	0
1101-11	1111-11	676	189	865
1101-99	1111-11	475	410	885
1101-99	1111-79	42	19	61
1103-11	1111-79	15	0	15
1103-13	1111-13	422	54	476

Source: ABS, 1998b, Census of Population and Housing: Link File between 1st and 2nd Editions of Australian Standard Classification of Occupations (ASCO), cat. no. 1232.0.55.001.

These data are provided electronically in tables for each state and territory and for total Australia. For the purposes of establishing a concordance for the ASCO 1st edition and ASCO 2nd edition, the table for the total of Australia was utilised, given that the study looks at occupational changes for Australia as a whole. The link file is sorted by ASCO 1st edition codes because the ABS encourages users to change their old ASCO 1st edition data to the new ASCO 2nd edition classification.

From the sample Table 5.3 above, it can be seen that there are multiple ASCO 1st edition and ASCO 2nd edition codes. This is because the relationship between the two editions is not a simple one-to-one connection. There are numerous many-to-many relationships between the occupations in the two classifications. The incidence of multiple 2nd edition codes simply means that a given occupation may comprise parts of various 1st edition occupations and sometimes vice-versa. For example, ASCO 2nd

[1] ASCO 2nd edition has 986 occupations at the occupation group and 340 occupations at the unit group.

edition 1111-11 (Parliamentarian or Councillor) comprises all of ASCO 1st edition 1101-11 and part of ASCO 1st edition 1101-99.

In order to change the ASCO 1st edition coded data into the ASCO 2nd edition coded data, the link file was sorted into ASCO 1st edition codes. The link file was then aggregated to the next level of data available, in this case the four-digit level. The codes in the left column are ASCO 1st edition, while the codes in the second column are ASCO 2nd edition. The numbers in the next three columns are for males, females and persons. For example:

ASCO 1st edition	**ASCO 2nd edition**	**Males**	**Females**	**Persons**
1101-11	1111-11	676	189	865
1101-99	1111-11	475	410	885
1101-99	1111-79	42	19	61
becomes				
1101	**1111**	**1193**	**618**	**1811**

Once the link file was aggregated at the four-digit level, these numbers were changed into proportions or weights, as is shown in Table 5.4 below.

Table 5.4 Example of ASCO 1st edition and ASCO 2nd edition proportions

ASCO 1st edition	*ASCO 2nd edition*	*Males*	*Females*	*Total*	*Male weight*	*Female weight*	*Total weight*
1000	1000	51,398	25,754	77,152	0.937612	0.949806	0.941647
1000	1299	129	156	285	0.002353	0.005753	0.003478
1000	2549	11	10	21	0.000201	0.000369	0.000256
1000	3392	3,252	1,152	4,404	0.059324	0.042486	0.053751
1000	3399	28	43	71	0.000511	0.001586	0.000867
Total		*54,818*	*27,115*	*81,933*	*1.000000*	*1.000000*	*1.000000*

Source: ABS, 1998b, Census of Population and Housing: Link File between ASCO 1st and 2nd edition, cat. no. 1232.055.001; and author's calculations.

These numbers were then multiplied by the corresponding number of employed people in both the 1986 and 1991 censuses. This operation provided the number of people in an ASCO 1st edition occupation for the 1986 and 1991 censuses in terms of the ASCO 2nd edition occupation for either the 1991 or 1986 census. This operation completed the concordance between the 1986, 1991 and 1996 censuses.

5.6 Link between Australian Employment Data and the O*NET

To analyse changes in the GWA knowledge, and skill intensity of Australian occupations, Australian employment data were linked to the O*NET occupational data. This was done because, unfortunately, concordances between ASCO and the O*NET occupational codes do not exist. But even though in the US concordances are available between the O*NET and occupational employment data series, the number of occupations covered in the O*NET is greater than in the employment series. For example, by comparison with about 1,120 O*NET codes, the most detailed occupational employment data in the US are the Department of Labor's Occupational Structure data which cover 820 occupations. Thus, in this thesis, the 'most appropriate' O*NET code was assigned to a particular occupation in the employment data. More specifically, each Australian occupation was assigned an O*NET occupational code on an individual basis.

5.7 Occupational Assignment between the O*NET Code and ASCO 2nd Edition

In assigning the 'most appropriate' O*NET occupation code to an ASCO 2nd edition occupation code, it was assumed that there was a similarity in the description of US and Australian occupations, as the great bulk tend to have similar or close definitions and descriptions.[2]

The assignment of an O*NET occupation to an ASCO 2nd edition occupation was done by matching the occupation title from the O*NET to the ASCO 2nd edition, using the list of definitions and titles of occupations as described in both the ASCO (ABS cat. no. 1220) and the O*NET Dictionary of Occupational Titles (1998 edition). The assignment of occupations involved searching for an occupation title in the ASCO 2nd edition and then finding its corresponding title in the O*NET database. This was done for a total of 340 ASCO 2nd edition occupations. A number of examples of Australian occupations that had the same type of definition and description to the O*NET were

[2] This assumption has also been made by Pappas (2001) using the DOT and by Sheehan and Esposto (2001) using the O*NET.

assigned an O*NET code and job title. For example, Table 5.5 below shows how the majority of ASCO 2nd edition occupations were assigned an O*NET job code and title.

Table 5.5 Example of occupational assignment between ASCO 2nd edition and the O*NET

ASCO 2nd edition Code	*ASCO occupation*	*O*NET code*	*O*NET occupation*
1191	Building & Construction Managers	15017B	Construction Managers
1213	Human Resource Managers	13005A	Human Resource Managers
1221	Engineering Managers	13017A	Engineering Managers
2115	Medical Scientists	24311	Medical Scientists
2292	Librarians	31502A	Librarians

Source: Author's assignment.

When an 'exact assignment' was not found (i.e. the same occupational title and description), the following steps to obtain an occupation assignment were carried out:

1. When an ASCO 2nd edition job title did not exactly match an O*NET job title, a keyword search was conducted to discover the closest description of an O*NET occupation to its corresponding ASCO 2nd edition. This was further matched by closely studying the occupational descriptions of the ASCO 2nd edition and the O*NET description and matching the 'most alike occupational descriptions'.

2. When an occupational assignment could not be found using the above method, the work activity options in the O*NET 98 viewer were utilised to obtain a list of work activities. This was then matched to the ASCO 2nd edition unit group at the four-digit level, which lists skill level and tasks included in occupations. This assisted in matching O*NET descriptions to the closest ASCO 2nd edition.

3. In situations where an O*NET list of work activities could not be found, occupations were further narrowed by analysing the profile of occupations in the O*NET 98 viewer Version 1 and the O*NET Dictionary of Occupational Titles (1998). The O*NET's occupational profile provides a list of worker characteristics, worker requirements, experience requirements, occupational requirements, occupation-specific information and occupation characteristics. These were then compared to the skill level and tasks in the ASCO 2nd edition unit group.

Five per cent of occupations (17 in total) could not be matched following these methods. They were given the closest possible O*NET match by assigning to them a

generalist occupational code. A generalist occupational code is one that describes an occupation in a general sense. These occupations are detailed in Table 5.6.

The end result is three sets of data containing information on the GWA, knowledge, and skill intensity for about 1,120 O*NET occupations. Furthermore, we have GWA intensity, knowledge intensity, and skill intensity scores for over 340 Australian occupations for the census years 1971, 1976, 1981, 1986, 1991, 1996 and 2001, together with employment data (disaggregated by males and females, and by full-time and part-time work) for each year.

Table 5.6 Occupations assigned to a generalist occupational code

ASCO 2nd edition code	*ASCO occupation*	*O*NET code*	*O*NET occupation*
3493	Aboriginal and Torres Strait Islander health workers	21911A	Health officers
3990	Miscellaneous associate professionals	39999H	All other paraprofessionals
4214	Vehicle painters	89199	All other metal workers
4215	Vehicle body makers	85305B	Automotive body repairers
4216	Communications tradespersons	85599A	Communication equipment workers
4612	Shearers	79855	General farm workers
4613	Wool hide and skin classers	89599B	Fur garment workers
4911	Graphic pre-press tradespersons	34035C	Graphic designers
4944	Leather goods, canvas goods and sail makers	89511	Shoe and leather workers – precision
4980	Miscellaneous tradespersons	85132	Maintenance repairers, general utility
5995	Desktop publishing persons	25104	Computer support specialists
6143	Bank workers	53105	New accounts clerks (finance)
6399	Other intermediate service workers	69999E	All other service workers
7000	Intermediate production and transport workers	97117	Driver/sales workers
8115	Betting clerks	68014B	Games of chance attendants
8292	Ticket salespersons	68021	Ushers, lobby attendants and ticketers
8293	Street vendors and related workers	49026	Telemarketers, door-to-door sales workers, news and street vendors, and other related workers.

Source: Author's assignment.

5.8 Data Limitations

A number of limitations were found in the use of the O*NET and Australian census data. One limitation is that the O*NET data are about US occupations and not

Australian jobs. Although many Australian and US occupations are very similar in definitional terms and in terms of the tasks required to perform them effectively, conflicting issues about the content and tasks performed in each job may arise as a result of social and cultural differences between the two countries. These differences are very difficult to measure and quantify and thus their limitations are difficult to explain. Another possible limitation is the way the US data are collected. For example, it is not clear whether the sample used in the O*NET data are from particular states or the sample is a national one. As a result there could well be issues related to measurement errors in terms of the sample of occupations obtained. A further limitation is that the O*NET data are in their early stages of development and there may be a number of issues needing correction or clarification. Nevertheless, because of the richness of the data embodied in the O*NET, the assignment of O*NET to Australian occupations is a novel approach to be used in understanding changes to the Australian labour market.

Another limitation lies in the use of Australian census data which do not provide detailed information on employee entitlements, including either paid holiday leave or paid sick leave (or both) in their main job. Another limiting factor is that census data do not provide information on average earnings by occupation. To solve this problem, alternative data were used. These data and their corresponding analysis are described in Chapters 9 and 10. As a result, the analysis conducted in this part of the thesis is limited to changes in full-time and part-time male and female employment using the three O*NET measures described in the following chapter.

5.9 Conclusion

This chapter has detailed the type of data sets used in Part B of the thesis. It gave details of the concordance method between the CCLO, ASCO 1st and ASCO 2nd editions and explained how the occupational assignment between the O*NET system and the ASCO 2nd edition was conducted. It presented limitations of the database developed and provided solutions to overcoming these problems. The following chapter provides information about the three measures used to analyse changes to the job content of Australian occupations, how these were calculated, and their corresponding limitations.

Chapter 6
The O*NET Variables: A Different Approach to Understanding Labour Market Change

6.1 Introduction

As described in the previous chapter, a distinctive feature of the O*NET's Content Model is that it provides a detailed description of occupations in terms of cross-job descriptors. Furthermore, the O*NET contains data that can assist in measuring and comparing the content of occupations and how these have changed over time.

The discussion in Chapter 3 showed that many of the proxies of skill used in econometric work are not very effective and leave much to be desired. For example, numerous studies have used years of education or experience as a proxy for skill, but these two concepts are not necessarily the same thing. A number of studies of manufacturing have used the ratio of production to non-production employees as a measure of skill, but replacing skilled tradesmen with salesmen or general office staff may reduce rather than increase the overall level of skill in a firm. Other studies have used earnings as a proxy for skill. Although this has some advantages, it does little to throw light on the role of skill changes in the pattern of earnings, or to increase our understanding of the changing nature of skill. In summary, economies and labour markets in the industrialised world have experienced dramatic changes in the last three decades. As a result, the skill composition of many occupations may also be changing rapidly, and the measures and proxies for skill used to date may not provide us with enough insights to comprehend these changes.

In this chapter, I describe in more detail three O*NET indicators that can be used to investigate changes in the content of Australian occupations and how these may assist in providing us with a better understanding of labour market change. The three measures drawn are obtained from two domains of the O*NET Content Model, described in the previous chapter. Measures of skill and measures of knowledge are drawn from the Worker Requirements domain and measures of generalised work activities (GWA) are drawn from the Occupational Requirements domain. The description of these measures

discussed here is drawn from the work conducted by Peterson et al. (1995, 1997, 1999) who were responsible for developing the O*NET.

This chapter also presents the issues that relate to the use of the three O*NET measures which underpin the analysis of labour market change in this section of the thesis. Moreover, my intention is to elaborate on the methodology that has been used to analyse labour market change presented in the following chapters. I begin the next section by describing the similarities and differences of the two domains from which the three O*NET measures of skill, knowledge and GWA are obtained.

6.2 Worker Requirements and Occupational Requirements

Worker requirements in the O*NET Content Model refer to a set of developed attributes of the individual that have the capacity to influence performance across a range of occupations. These attributes are made up of a category of descriptors, which refer to work-related attributes that are acquired or developed through experience or education. In this domain of the O*NET Content Model, worker requirements have been identified as three sets of interrelated variables that are made up knowledges, skills and educational attainment. The interrelationship of these variables occurs because there is a high level of interdependence between them. This is particularly so for the concepts of skill and knowledge. For example, a particular individual cannot acquire a certain set of skills if a body of knowledge is not acquired through education and/or experience. Conversely, some skills such as basic skills (e.g. reading, writing and mathematics) are essential for the further acquisition of knowledge in a variety of work situations, e.g. the acquisition of knowledge in mathematics and science. Furthermore, the variables that measure skill and knowledge are highly correlated. Skill variables contained in 'content skills' are likely to be highly correlated with knowledge variables such as 'knowledge of mathematics and science'.

Worker requirements and characteristics are domains that concentrate on attributes possessed by individuals who perform a variety of tasks in different occupations. Occupational requirements, on the other hand, refer more specifically to a comprehensive set of variables or elements that describe what each occupation requires. In other words, this domain is occupationally centred as opposed to individually centred. It is made up of a set of three components, namely, GWA variables, work

context variables and organisational context variables. Occupational requirement variables are highly interrerelated and as a result correlated with worker characteristics variables. An example of this is with the work activity variable 'organising, planning and prioritising', which will be interdependent and highly correlated with knowledge, and skill variables such as 'administration and management' and 'negotiation'.

6.3 O*NET Descriptors Used for this Study

This section describes in more detail the three O*NET indicators used to investigate changes in the content of Australian occupations. The three indicators of skill, knowledge and GWAs form part of the domains of worker characteristics, worker requirements and occupational requirements described in the previous section. Each of the 46 descriptors of skill, 33 of knowledge, and 42 of GWAs are detailed in Appendices A, B, and C.

6.3.1 Skills

An important contribution of the skill definition of O*NET (Skill O*NET) is that it goes beyond the traditional means of capturing skills in terms of educational attainment, years of experience, occupational classification and the many other proxy measures discussed in Chapter 3.

The approach taken by O*NET to define skill is that of Mumford and Peterson (1995a). They define skill as a set of general procedures that underlie the effective acquisition and application of knowledge in different areas of endeavour (chap. 3, p. 4). The implication of this definition is threefold. Firstly, skills are innately linked to knowledge, learning, practice, education and experience. For example, a person cannot acquire or apply skills without learning, practising, being exposed to education, experiencing or by acquiring knowledge. Secondly, skills can be seen as general procedures that are necessary for the performance of multiple tasks. These tasks, however, must form part of a given domain of skills such as social skills, basic skills or problem solving skills. Finally, skills are not constant attributes of individuals that remain unchanged over time. These attributes can be acquired (sometimes they can be lost) and developed as a result of new learning, experience or newly acquired knowledge.

Given the above, Mumford and Peterson (1995a) argue that skills are not one-dimensional and require a variety of taxonomies. They divide the taxonomy of skill into two broad categories. The first is referred to as basic skills. These are defined as the developed capacities that facilitate learning or the attainment of new knowledge. Basic skills are subdivided into two further categories described as content and process skills. These are made up of six and four skill variables respectively, out of a total of 46 skills that comprise the complete O*NET skill taxonomy. Content skills can be broadly defined in terms of those capabilities that allow people to acquire information and convey it to others. They represent the structures required to work with and acquire other skills. This category includes skills such as reading, writing, listening, speaking, mathematics and science. These skills are also widely seen as fundamental in the provision of any sound educational system.

Process skills, on the other hand, are seen as those skills that facilitate the acquisition of content across domains. The ability to think critically is thus part and parcel of process skills. This skill is closely related to a second kind of general learning skill, referred to as active learning. Another process-oriented skill takes the form of learning strategy. This uses a variety of approaches when learning new things. Finally, monitoring represents an ongoing appraisal of the success of an individual's efforts because it assists them in assessing how well they are learning something or doing a particular task.

The second classification of skills is defined in the O*NET as the capacities that facilitate individuals to perform effectively in a variety of job settings. This skill definition is also known as cross-functional skills and in the O*NET Content Model is based on the notion of socio-technical systems theory. Within this theoretical construct:

> work is viewed as a process by which technology and people interact to transform raw materials into useful products. This transformation not only requires ongoing problem solving, it also suggests that in solving significant problems in the organization's transformation process, virtually all jobs will require individuals to work with people, technology, and a broader organizational system, using available systems to complete the work. (Mumford and Peterson, 1995a, chap. 3, p. 5)

Socio-technical theory is made up of five domains of cross-functional skills. Each of these is briefly explained below.

Problem solving skills

Problem solving is a common domain of work performance. A number of studies have shown that it is not simply a matter of expertise but depends on processes and procedures that people apply in the workplace. Mumford and Peterson (1995a) identified eight distinct processes that are present in problem solving. These are detailed in Appendix A, and can be summarised as being the developed capacities used by individuals to solve novel, ill-defined problems in complex, real-world settings.

Social skills

Social skills represent an essential component of performance in the workplace, especially where the dominant culture requires teamwork and customer service. In their review of taxonomies, Mumford et al. (1999) propose a six-variable taxonomy of social skills. These include variables that describe and measure social perceptiveness, coordination, persuasion, negotiation, instruction or teaching, and service provision. These social skills are described as being the developed capacities that individuals possess, and are used to work with people to achieve common goals and objectives.

Technical skills

Mumford and Peterson (1995a) present a 12-variable taxonomy of technical skills. These can be summarised as the developed capacities used to design, set up, operate and correct malfunctions involving application of machines or technological systems.

Systems skills

This set of skills is concerned with the effective performance of individuals in complex organisational systems requiring judgement and decision making. It is defined as the developed capacities of individuals used to understand, monitor and improve organisational systems, which involve the interaction of both the implementation of new technologies and people. It is made up of six variables that include measures of visioning, systems perception, identification of downstream consequences, judgement and decision making, and evaluation of systems.

Resource management skills

This taxonomy is defined as the developed capacities of individuals that can be applied to allocate resources in organisations in the most efficient and effective manner. It is

made up of four components: time management, management of financial resources, management of material resources, and management of personal resources.

6.3.2 Knowledges

The O*NET defines knowledge as a collection of discrete but related facts, information and principles about a particular area of work. Knowledge is acquired through formal education and/or training or can be built upon a collection of a variety of experiences. Knowledge is acquired incrementally and can be used to acquire further knowledge and to develop skills. It is closely related to skills because it can assist in the development of skills, while, at the same time, skills can aid the process of knowledge acquisition.

In the O*NET, knowledges form part of a structured taxonomy. For this taxonomy to be meaningful it needs to be organised in a coherent way. In the O*NET taxonomy, the 33 knowledges can be regarded as belonging to general categories. Some of these categories are general and are regarded as being essential elements in the successful performance of occupational tasks. Others are narrower and can only be applied to a fine range of occupational groups, while others can be seen as being occupation specific.

In identifying a taxonomy of knowledge indicators, Fleishman et al. (1995) developed a knowledge classification by analysing job descriptors and looking for tasks and behaviours that were representative of underlying knowledges in occupations. These underlying knowledges had to be general enough so that they could be transferable across different occupations. Lists of knowledge descriptors were created and these were further divided into categories or clusters of knowledges. Fleishman et al. (1995) arrived at a parsimonious set of 33 knowledges, which were grouped into ten knowledge areas, as described below.

Business and Management

This includes knowledge of principles and facts related to business administration and accounting, human and material resource management in organisations, sales and marketing, economics, and office information and organising systems. This area is made up of six knowledge indicators.

Manufacturing and Production

These are knowledge of principles and facts related to the production, processing, storage and distribution of manufactured and agricultural goods. This area is made up of two knowledge indicators.

Engineering and Technology

This area of knowledge is concerned with the knowledge and design, development and application of technology for specific purposes. It is made up of five knowledge indicators.

Mathematics and Science

This area of knowledge deals with the history, theories, methods and applications of the physical, biological, social, mathematical and geographical world relevant to different occupations. It is comprised of seven knowledge descriptors.

Health Services

Included here is knowledge of principles and facts regarding diagnosing, curing and preventing disease, and improving and preserving physical and mental health and wellbeing. This knowledge area comprises two knowledge indicators.

Education and Training

This area deals with knowledge of instructional methods and training techniques including curriculum design principles, learning theory, group or individual teaching techniques, design of individual development plans, and test design principles. It is made up of one knowledge indicator.

Arts and Humanities

Included here is knowledge of facts and principles related to the branches of learning concerned with human thought, language and the arts. This knowledge area consists of five knowledge indicators.

Law and Public Safety

This area of knowledge is concerned with the regulations and methods for maintaining people and property free from danger, injury or damage. It is also concerned with the

rules of public conduct established and enforced by legislation, and the political process establishing such rules. It consists of two knowledge indicators.

Communications

This knowledge area is concerned with the science and art of delivering information. It is made up of two knowledge indicators.

Transportation

This knowledge area focuses on the principles and methods for moving people or goods by air, rail, sea or road, including their relative costs, advantages and limitations. It consists of one knowledge indicator.

6.3.3 Generalised work activities (GWAs)

GWAs in the O*NET provide a taxonomic structure that can be used to describe the work that people do in their particular occupations. They describe the work activities that are needed or required for successful job performance. The distinction between GWA, knowledge and skills lies in the fact that our work activity measures are closely linked to the requirement of occupations, whereas knowledge and skill are measures that are closely related to requirements of individuals who perform a given job.

GWAs are useful in the O*NET system because they are closely linked to the knowledge and skill of individuals and can provide useful strategies when matching jobs to people. Furthermore, the data that describe and measure each of the 42 GWAs can be used to analyse changes in the labour market in terms of occupation specific requirements. This information can also be used to analyse changes in the composition of employment in terms of occupational requirements and can be compared to changes in the skill and knowledge composition of Australian occupations.

In the O*NET a GWA is defined as the aggregation of similar job attributes that brings about or promotes the accomplishment of major work functions and tasks. This broad definition provides a flexible framework of defining occupations and is consistent with the following criteria:

- broad in scope and applicable to a wide range of jobs;
- based on job analytic research;

- characteristic of the underlying structures of work requirements (Jeanneret et al., 1999, p. 106).

The taxonomic structure of the 42 GWA descriptors can be grouped or collapsed into four major constructs or areas, which can then be subdivided into nine areas of GWAs. The four broader areas are classified as information input, mental processes, work output, and interacting with others. These are detailed below with their corresponding structures.

Information Input

Information input refers to how and where information and data required to perform successfully in a specific job can be obtained or acquired. Two components make up this hierarchy: looking for and receiving job related information, and identifying or evaluating job-relevant information. The primary objective of the first construct is to identify the type of information that is required to perform a given job adequately. This construct is made up of two GWA descriptors. The objective of the second construct relates to the way in which information obtained in work settings can be interpreted to perform successfully in a given occupation. Three GWA descriptors make up this construct.

Mental Processes

Mental processes are concerned with the processing, planning, problem solving, decision making and innovating activities that are required to deal successfully with job-relevant information. This construct is made up of two sub-constructs or areas. The first sub-construct is concerned with dealing effectively with data processing and information in work related situations. It consists of four GWA descriptors. The second area of this construct is concerned with reasoning and decision making in work situations and is made up of six GWA descriptors.

Work Output

This construct is concerned with the following aspects of occupational requirements: the type of physical activities to be performed, the type of equipment and vehicles to be operated or controlled, and the complex and technical occupational activities that need to be accomplished in order to generate job outputs effectively. It is made up of two

areas: physical and manual work activities, and complex and technical activities. Four GWA descriptors make up the first area, while six descriptors make up the second.

Interacting with Others

This area of GWAs is concerned with the way in which people interact in work specific situations. It deals with the interactions between individuals in terms of supervisory activities and following or carrying out instructions while performing a given job or set of tasks. Three separate areas make up this construct. The first deals with communication and interaction issues that are relevant to workplace settings. This area consists of eight GWA descriptors. The second deals with the coordination, development, management and advisory activities required while performing a given job. It consists of six GWA descriptors. Finally, administering is concerned with the type of administrative, staffing, monitoring or controlling activities needed to perform effectively in a given occupation. Three GWA descriptors make up this construct.

6.3.4 An example of O*NET occupational data

The three O*NET measures described above contain a total of 121 variables which are assigned to a total of 340 Australian occupations in ASCO 2nd edition. Conceptualisation of how the data are organised in the O*NET and what they represent can be confusing without further explanation. To demonstrate how the O*NET data are organised for each of our measures, I provide an example using GWA information, together with average scores for skill and knowledge.[1]

The GWA taxonomic structure of the O*NET is hierarchically organised and is very detailed. Each descriptor defines a GWA, such as getting information to do the job, identifying objects, actions and events, judging quality of things, analysing data or information and thinking creatively. For a given occupation, each of these areas of GWAs is ranked on a scale of 0 to 100, for both its importance to the occupation and for the level in that area required in that occupation.

With a rank of zero in the importance scale, the descriptor of GWA shows that the work activity is of no consequence to that occupation, while at a ranking of 100, the descriptor is considered to be extremely important in performing that particular job. Thus the 'importance' indicator for a particular GWA refers to how important it is to the

[1] In the O*NET, information on skill and knowledge scores is organised in the same way as for GWAs.

performance of the job in question. Similarly, the 'level' indicator for a particular area of GWA refers to the degree or quality which that work activity requires in the occupation under investigation.

Table 6.1 Generalised Work Activity sources, importance and level, three occupations

	*Generalist Medical Practitioner O*NET 32102A ASCO 2311*		*Librarian O*NET 31502A ASCO 2292*		*Bricklayer O*NET 87302 ASCO 4414*	
Generalised work activities	*Importance*	*Level*	*Importance*	*Level*	*Importance*	*Level*
Monitor processes, materials, surroundings	100	89	42	29	67	26
Identifying objects, actions and events	95	83	58	43	63	29
Analysing data and information	95	89	63	43	54	26
Making decisions and solving problems	95	83	54	38	38	21
Getting information to do the job	95	91	79	60	71	31
Assisting and caring for others	95	91	67	38	8	12
Implementing ideas, programs, etc.	85	74	67	38	67	29
Documenting/recording information	85	57	79	48	4	10
Communicating with persons outside organisation.	80	71	92	62	8	14
Average GWA score	*56*	*48*	*53*	*41*	*29*	*18*
Average GWA cross-product score	*33*		*26*		*9*	
Average knowledge score	*29*	*27*	*26*	*25*	*8*	*5*
Average knowledge cross-product score	*15*		*13*		*3*	
Average skills score	*60*	*53*	*37*	*38*	*23*	*20*
Average skills cross-product score	*36*		*17*		*6*	

Source: US Department of Labor (1998a) and author's calculations.

Thus, in the example provided in Table 6.1, for the occupation 'generalist medical practitioner' the importance of the GWA descriptor 'monitor processes, materials, surroundings' is ranked 100, and the level of 'monitor processes, materials, surroundings' required is high, at 89. For 'librarian' the same GWA is not as important (score 42 in importance) and the quality required is even less demanding (score 29 in level). Their most important GWA relates to 'communicating with persons outside the organisation' (importance score 92, whilst its level has a score of 62).

6.4 Constructing Relevant Variables Using O*NET

Chapter 5 and previous sections of this chapter have discussed and shown that the O*NET contains valuable data and information that can assist in analysing changes in the content of Australian occupations. The approach taken in the chapters that follow in this part of the thesis is to analyse the pattern of employment change of Australian occupations using measures derived from the O*NET. The focus is to obtain a broader understanding of changes in the labour market in terms of the composition of worker requirements and occupational requirements using the O*NET measures of GWA knowledge, and skill.

One way of doing this is to analyse how the composition of GWA, knowledge, and skill of Australian occupations has changed between 1971 and 2001. To do this I use the O*NET system and Australian employment data. In using this approach, we can obtain a broader understanding of the following issues:

- How have the requirements of Australian occupations in terms of, GWA, knowledge and skill intensities changed over time?
- How has the composition of full-time and part-time employment for males and females changed over the period in terms of GWA, knowledge and skill?
- What can we say about changes in the GWA, knowledge and skill composition of Australian employment?

6.5 Type of Measures Used in Our Analysis

Three types of measures were used to analyse changes in the composition of Australian employment. The first is concerned with an analysis of the GWA, knowledge and skill intensity of job types. The second measure addresses whether, and to what extent, using our three O*NET measures, the content of jobs is increasing, in which part of the employment distribution these changes are occurring, and whether this increase is more prominent in male or female full-time or part-time employment. Our final measure is concerned with understanding how the worker requirement and occupational requirement of jobs has changed in Australia between 1971 and 2001. This analysis is conducted by examining changes in nine areas of worker activities, ten areas of knowledge, and seven areas of skill. Each of these measures is described below.

6.5.1 O*NET intensity measures of Australian occupations: measures and methods of analysis

To describe changes in the GWA, knowledge, and skill intensity of Australian occupations, a weighted average intensity index for each of our O*NET measures for Australian occupations was constructed using the cross-product of level and importance.[2] This measure takes account of changes in the knowledge, skill, and work activity intensity of Australian occupations over the 1971-2001 period.

The weighted average of work activity intensity measures the intensity of GWAs of occupations across the whole of the labour market and allows us to compare changes to the composition of GWAs in terms of job types. Hence, to say that on average GWAs in a given job type (e.g. female full-time employment) have increased is to say that on average the composition of employment in that given job type has changed for the reasons detailed below:

- there has been growth in occupations that require a higher level of GWAs;
- there has been a decline in the number of jobs that require lower levels of GWAs.

To illustrate the procedure used in developing this index for each of our four O*NET measures, an example using GWAs is provided below.

To create such a measure, using all 42 areas of work activity and numbers of employed persons in Australia, for 340 ASCO 2nd edition occupations, the work activity intensity (WA-ALL) score was calculated for occupations as follows:

- identify the work activity score for each descriptor, in each of the 340 occupations, by importance (0-100 scale);
- identify the work activity score for each descriptor, in each of the 340 occupations, by level (0-100 scale);
- calculate the average of the sums of the cross-products of the importance and level scores for each of the work activity areas in each of the 340 occupations;
- use the result, divided by 100, as a measure of the GWA intensity of an occupation;
- multiply the measure of the general work activity intensity in occupation j, by the employment level in occupation j, aggregate them and then divide this result by the total employment level.

[2] Table 6.1 shows an example of level and importance scores for three occupations.

Symbolically, the weighted average of work activity intensity index is given by the equation below:

$$WA_{ALL} = \frac{E_j \sum_{i=1}^{n} (I_{WA_i} . L_{WA_i}) / n}{\sum_{j=1}^{m} E_j} \qquad (6.1)$$

where

WA_{ALL} is the work activity intensity of Australian occupations; E_j is the number of people in occupation j (j = 1, 2, … , m = 340); I_{WA_i} is the importance of work activity i; L_{WA_i} is the level of work activity i (i = 1, 2, …, 42); and n is the number of GWA descriptors (n = 42).

Thus our intensity measure is a weighted average measure of GWA required in occupations as a whole or in a particular selection or type of occupations (e.g. female part-time employment). The above procedure was also conducted in creating our skill and knowledge intensity measures.

In trying to design our measure of intensity, an exploration of three alternative measures was carried out to arrive at our measure of intensity described in Equation 6.1. An example of how this measure is arrived at is illustrated using work activity measures. The first approach was to use the 'importance' score of the GWA. The second approach was to use the 'level' score of the GWA, whilst the third approach, which is the one used in this analysis, was to utilise the cross-product measure of both the 'importance' and 'level' of each GWA.

The results in Column 1 of Table 6.2 represent the GWA intensity of 'importance'. These are the weighted average of GWA intensity in terms of 'importance'. They are obtained using a variation of Equation 6.1, where the cross-product is dropped, and the weighted average of 'intensity' is calculated by itself using only our measures of work activity 'importance'. Similarly, the results reported in Column 2 of Table 6.2 represent the weighted average of work activity in terms of our 'level' measure and are calculated in the same way as the weighted average of 'importance' described above. Column 3 shows the weighted average of the cross-product of 'level' and 'importance' and is obtained using Equation 6.1.

The cross-product measure utilised has the advantage of encapsulating both how 'important' the requirement of a particular GWA was to a given occupation and to what extent the 'level' of a particular job was to the performance of a given GWA. Table 6.2 illustrates the issue by showing a comparison of the three GWA measures. While the average scores are different in magnitude, the three measures show similar trends; however, the cross-product measure accounts for both the 'level' and 'importance' of each without distorting the information contained in the average levels. Another important feature of the cross-product measure is that it provides us with a rating of activity for each occupation that includes both the 'level' and 'importance' score of work activity. This allows for comparability across occupations according to their corresponding work activity, accounting for both the level and importance of a given occupation. The process described above was also applied to our skill and knowledge measures.

Table 6.2 GWA scores for male full-time employees using level, importance and cross-product average scores

Year	*GWA level score*	*GWA importance score*	*GWA cross-product score*
1971	29.0	36.8	16.0
1976	29.3	37.0	16.2
1981	29.7	37.5	16.5
1986	30.5	38.3	17.1
1991	31.8	39.5	18.3
1996	32.1	39.8	18.5
2001	32.4	40.2	18.9

Source: Author's calculations.

6.5.2 Changes to the GWA, skill and knowledge intensity of job types in the Australian labour market

The issues addressed here are whether and to what extent the GWA, knowledge and skill content of jobs is increasing, in which part of the employment distribution these changes are occurring, and whether this increase is more prominent in male or female full-time or part-time employment types. In the exploration of these issues, a measure of the GWA, knowledge and skill intensity of occupations is constructed which takes account of each of the set of 33 knowledge descriptors, 46 skill descriptors, and 42 work activity descriptors.

The concept of the GWA, knowledge or skill intensity of Australian occupations entails the notion that an occupation is knowledge, skill or GWA intensive because it involves

the whole of the set of descriptors for each of our O*NET measures. To create such an measures for a given occupation, we calculate the GWA, knowledge and skill intensity scores separately, using all the O*NET indicators. To illustrate this, we calculate the GWA intensity score (WA_{ALL}) score for a given occupation as follows using GWA data:

- identify the work activity score for each indicator (I_{WA_i}), by importance (0-100 scale);
- identify the work activity score for each indicator (L_{WA_i}), by level (0-100 scale);
- calculate the average of the sums of the cross-products of the importance and level scores for each work activity descriptor, and use the result as a measure of the general work activity intensity of an occupation. This figure is divided by 100 to reduce the scale of the measure.

Symbolically, the above is determined by the equation below:

$$WA_{ALL} = \sum_{i=1}^{n} \frac{I_{WA_i} * L_{WA_i}}{n} \qquad \text{(n=42)} \qquad (6.2)$$

This measure (expressed in 6.2) of GWA intensity is the average of the cross-product of the 'level' and 'importance' required for the different work activities of an occupation. This provides a measure which assists us in comparing the relative GWA intensity of different occupations across different job types. This exact procedure is applied to each of our skill and knowledge measures.

Type of analysis

In terms of these knowledge, skill and work activity intensity issues, given the interest of inter-temporal questions, the following procedure is adopted. Australian occupations in 1971 are ranked by each of our four O*NET intensity measures, and divided into employment deciles in 1971 by GWA, knowledge and skill intensity. That is, the occupations accounting for the highest 10 per cent of employment in the GWA, knowledge and skill intensity ranking constitute the top decile, and so on until the occupations are divided into ten deciles. This is undertaken separately for males and for females, and for full-time and part-time employment. Once the deciles have been applied to 1971, the same decile divisions are applied to the data for the other seven corresponding census years for each O*NET measure. This is done to see how the decile composition of Australian occupations for male and female full-time and part-

time employment has changed over the 1971-2001 period. Then by comparing the properties of the 1971 knowledge, skill and GWA deciles in the seven census years, 1971, 1976, 1981, 1986, 1991, 1996 and 2001, an insight can be gained into changes in GWA, knowledge and skill intensity over the 30-year period. For this analysis, three forms of comparisons are made of these data, directed at these questions:

- What can we infer about changes in the knowledge, skill and GWA intensity of jobs between 1971 and 2001?
- How significant are the differences between narrow and broad knowledge, skill and GWA across occupations?
- What differences are observable between full-time and part-time jobs, and between males and females?

These three questions are answered by concentrating on the change in employment in a particular decile relative to the change in employment experienced by the whole employment population. By doing this, we can estimate the percentage change in employment with respect to the change in the total employment growth of the population. The relative decile employment change (RDEC) with respect to the change in total employment is calculated for knowledge, skill and GWA by using the following equation:

$$RDEC_i = \left(\frac{100 + D_i}{100 + N} - 1 \right) * 100 \qquad (6.3)$$

$$i = 1,2,3,\ldots,10$$

where D_i is the percentage change in employment in decile i for the 1971-2001 period and N is the change in the total employment population for the same years.

6.5.3 Changes in Australian occupations: worker requirements and occupational requirements

This part of the analysis investigates how the worker requirements and occupational requirements of Australian occupations have changed between 1971 and 2001 in terms of male, female, full-time and part-time employment. The analysis here is different to that described in 6.5.1, where the weighted average of each of the measures of GWA, knowledge and skill were used. Instead, the analysis focuses on particular areas of GWA, knowledge and skill and how these have changed over time for each job type.

Worker Requirements

Worker requirements are analysed in terms of ten areas of knowledge and seven areas of skill. The skill areas consist of content skills, process skills, social skills, complex and problem solving skills, technical skills, system skills, and resource management skills. The ten areas of knowledge are: business and management, manufacturing and production, engineering and technology, maths and science, health services, education and training, arts and humanities, law and public safety, communications and transport. The corresponding definitions for each of the skill and knowledge areas are detailed in Appendices A and B.

Occupational Requirements

Worker characteristic changes are analysed using nine areas of GWAs: looking for and receiving job-related information, identifying or evaluating job-related information, mental processes, information and data processing, reasoning and decision making, work output, performing physical and manual work activities, performing complex or technical work, interacting with others, communicating at work, and administration. These are defined in Appendix C.

Type of analysis

For the purpose of this analysis, attention is paid to each of the nine different areas of GWAs, seven areas of skill, and ten areas of knowledge as described above and detailed in Appendices A, B and C, over the 1971-2001 period for both male and female full-time and part-time occupations. From the O*NET data, a weighted average of GWA, knowledge and skill intensity for each area is obtained in order to see how each area of Australian occupations have changed over time.

Symbolically, the weighted average for each of the GWA, knowledge and skill areas under investigation is given by:

$$OA_j = \frac{\sum_{i=1}^{n} P_{ij} * E_i}{\sum_{i=1}^{n} E_i} \tag{6.4}$$

where

OA_j is the value of the weighted average of intensity area for GWA, knowledge or skill area *j*; P_{ij} is the average of all the cross-products of the level and importance for each of

the components of the GWA, knowledge or skill area j; and E_i is the number of persons working full-time or part-time in occupation i.

This index expressed in Equation 6.4 describes, for example, the knowledge or skill intensity requirement of job types. Hence, to say that the knowledge or skill intensity of a particular area (e.g. 'business and management knowledge' or 'technical skills' increased) is to say that the composition of employment for that area of knowledge or skill has increased because:

- there has been an increase in the number of occupations that require a higher level of knowledge or skill in the areas of 'business and management knowledge' or 'technical skills'; or
- there has been a decline in the number of occupations that do not require knowledge or skill in the area of 'business and management knowledge' or 'technical skills'; or
- there has been both an increase in the number of occupations that require 'business and management knowledge' or 'technical skills' with a corresponding decline in the number of occupations that do not require 'business and management knowledge' or 'technical skills' as an area of knowledge or skill.

Our weighted average measures obtained using Equation 6.4 capture each of the GWA, knowledge and skill areas separately. They are different to those obtained using Equation 6.1 because they concentrate on particular areas of GWA knowledge or skill. The weighted averages obtained using Equation 6.1 capture the weighted average of the 33 knowledge, 46 skill and 42 work activity measures.

6.6 A Further Limitation of the O*NET Data

Section 5.8 highlighted a number of limitations in the O*NET data. One of these is that the data on GWA, knowledge and skill come from data obtained through the analysis of US occupations and not Australian jobs. However, due to the cultural and occupational similarities between the US and Australia in terms of definitions, it was decided that the wealth of data and information contained in the O*NET could be used for the purpose of analysis of occupational change in Australia and was worth exploring.

Another main limitation is that the content of the informational data contained in each of the three measures of GWA, knowledge and skill is fixed in time. Thus, the

occupational measures of O*NET that we have are for the year 1998. For this reason, changes to the composition of occupations cannot be done over time in terms of our O*NET measures. The only way in which an analysis of the changing Australian composition of employment can be done in terms of knowledge, skill and GWA is through an assessment of occupational change at frequent time intervals. These intervals are the census years of 1971, 1976, 1981, 1986, 1991, 1996 and 2001. This type of analysis follows the same line of analysis of skill compositional change conducted in various labour economic studies. Two examples of these are the work of Cully (1999) and Wooden (2000a). Nevertheless, in spite of this data limitation, the analysis that follows in Part C of this thesis is about compositional changes in the labour market, in terms of our O*NET measures.

6.7 Conclusion

This chapter provided an extension of Chapter 4, which described the O*NET system and the Content Model. To study labour market change in Australia, it described in more detail two aspects of the Content Model, namely, worker requirements and occupational requirements. It also highlighted the similarities and differences of each of these Content Model domains.

Two measures of worker requirements, knowledge and skill, and one measure of occupational requirements, GWA, were analysed and described for the purpose of our occupational change analysis in terms of job types. The similarities and differences between the O*NET measures of GWA, knowledge and skill were also highlighted.

The chapter pointed out a major limitation of the O*NET data. This centres on the fact that our measures of GWA, knowledge and skill are fixed in time. As a result, the analysis that is pursued in the following chapters of this part of the thesis is similar to that of other labour economic research, which analysed changes in the skill composition in terms of occupational change at different time intervals.

The chapter also explained the measures used in the analysis of changes to the composition of Australian employment. The analysis of occupational change and its findings are detailed in the following chapters.

Part C:

The Changing Composition of Australian Employment

Chapter 7
The Work Activity Composition of Australian Employment

7.1 Introduction

A main issue of investigation in this thesis is whether in fact there has been skill-bias in the demand for labour in Australia, and what is the best measure of skill in addressing this issue. As discussed in Chapter 3, the concept is not well defined in economics and many of the proxies for skill leave much to be desired. A different approach used to obtain a broader understanding of skill-bias and perhaps a more direct measure of skill in the labour market is the application of the O*NET measures to look at changes in the occupational requirements and work requirements of different job types in the Australian labour market. An advantage of this approach is that although the occupational requirements in Australia, measured in terms of generalised work activities (GWA), do not provide a direct measure of 'skill', we can use this measure to obtain an understanding of the broad work activities required for these occupations.

One way of doing this is to analyse how the composition of GWA of Australian occupations has changed over the period between 1971 and 2001. This allows us to get a broader understanding of what lies behind changes in the composition of the Australian labour market and helps us to establish a more accurate relationship between generalised work activities and upskilling of the labour market. To do this I use the O*NET system and Australian employment data (see Chapters 5 and 6) to analyse these changes, and to provide answers to the following questions:

- How have the requirements of Australian occupations in terms of GWA intensities changed over time?
- How has full-time and part-time employment for males and females changed over the period in terms of GWA intensities?
- Do these changes of GWA intensities reflect a pattern of skill-bias in the demand for labour in different job types?

7.2 The Work Activity Intensity of Australian Job Types

This section considers the occupational requirements of Australian employment by analysing the overall 'work activity' intensity change of occupations. GWAs are assumed to lie outside the human capital domain, but are instead an occupational requirement which must be performed by the individual completing the set of tasks required by their occupation. To describe changes in the work activity intensity of Australian occupations, the weighted average of work activity intensity was used, using Equation 6.1. This index measures the requirements of specific Australian occupations in terms of work activity intensity, and provides an insight into how the pattern of job creation has changed for total employment, and for male and female full-time and part-time employment. An occupation is said to be more GWA intensive than another because the tasks required to be performed are more demanding or are more complex. For example, the work activities required to be performed by a surgeon in the course of an operation are considerably more work activity intensive than those performed by a nursing aide.

Table 7.1 reports the weighted average change in work activity intensity obtained by applying Equation 6.1. Overall, the work activity intensity of Australian occupations grew over the 30-year period, rising by a total of 17.3 per cent. This suggests that for the Australian labour market, the requirement of GWAs has become more demanding. In other words, it can be said that, overall, occupations that require higher levels of work activity or task performance have grown faster than those that require lower levels.

These trends can be observed when we look at the change in work activity for full-time employment. The growth in work activity intensity was much stronger for females than for males. The work activity intensity for male full-time employment grew by 18.2 per cent, while for females it more than doubled over the same period. Figure 7.1 shows that between 1971 and 1991 the work activity intensity of male and female employment increased at similar rates, but thereafter these diverged, indicating that between 1991 and 2001 the jobs created for females required higher levels of work activity intensity than for males. Another important feature of the changes in full-time employment is that in 1971 the work activity intensity of female full-time employment started from a

lower base than male full-time employment. By 1981, the GWA intensity of females was quite similar to that of males, but by 2001 it was considerably higher. This may imply that the GWA intensity in the mix of job growth for females in full-time employment was higher than that of males over the 30-year period.

Table 7.1 Work activity intensity scores and change in full-time and part-time employment for men and women, 1971-2001

Year	*Male full-time*	*Female full-time*	*Male part-time*	*Female part-time*	*All employees*
1971	16.0	14.6	16.6	14.9	15.6
1976	16.2	15.6	16.3	15.3	16.0
1981	16.5	16.4	15.8	16.1	16.4
1986	17.1	17.0	15.5	16.1	16.8
1991	18.3	18.5	15.2	16.2	17.7
1996	18.5	19.6	15.0	16.3	18.0
2001	18.9	20.3	15.2	16.5	18.3
Change (%) 1971-2001	*18.2*	*38.9*	*-8.1*	*11.1*	*17.3*

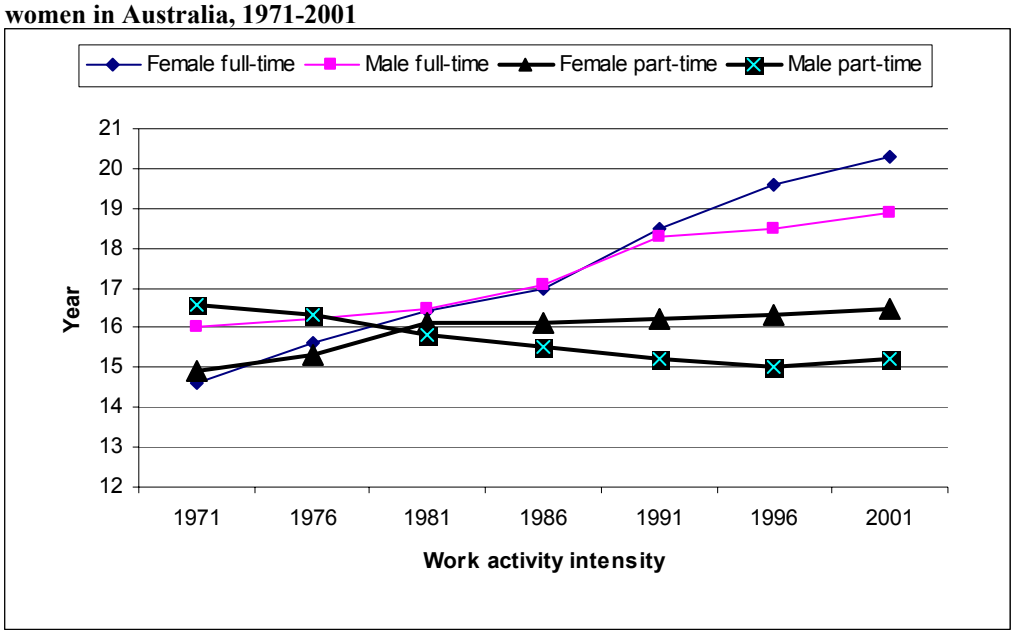
Source: Author's calculations.

By contrast, the work activity intensity for female part-time employment rose at a slower rate and by a smaller magnitude than for female full-time employment. For male part-time employment, the picture is quite different from that of male and female full-time employment and female part-time employment, as the work activity intensity fell. During this period, the decline in work activity intensity was steady for male part-time employment, indicating that the requirements of occupations in part-time employment have become less work activity intensive. An interesting feature of Figure 7.1 is that on average in 1976, GWAs for the four job types were relatively similar, but began to diverge considerably since then. These results show that on average over the 1971-2001 period, the GWA requirement for full-time employment creation increased faster than for part-time employment.

Female part-time employment experienced trends of increasing GWA intensity similar to those of male and female full-time employment. However, for male part-time employment, the situation is quite different, indicating both a decline in jobs that require high levels of GWAs and a rise in jobs with low levels of GWAs. What this suggests is that creation of full-time employment is occurring in occupations that need high levels of GWAs, whilst at the same time occupations that require low levels of GWAs are

either disappearing or not being created. This trend is also happening in part-time female employment, but not in male part-time employment. In terms of male part-time employment, jobs that require high levels of GWAs are disappearing and jobs that require low levels of GWAs are being created.

Figure 7.1 Total work activity intensity levels for full-time and part-time employment for men and women in Australia, 1971-2001



Source: Table 7.1.

This decline in work activity intensity of male part-time employment may indicate that the demand for labour favours occupations that require lower work activity intensity. Conversely, the increases in work activity intensity of full-time male and female employment, and female part-time work, show that the demand for labour favours occupations that require high levels of work activity intensity and this may translate into a bias towards occupations that require high levels of work activity intensity.

7.3 Changes to the Work Activity Intensity of Job Types in the Australian Labour Market

The previous section has shown that the GWA intensity in full-time jobs has grown steadily for men but faster for women. In part-time employment, women experienced similar trends to full-time jobs, but male part-time employment experienced a decline in GWA, indicating that changes to the requirement of jobs has not been uniform across occupations, and that it is apparent that there is a bias in demand towards full-time employment and female part-time employment.

This section investigates the extent to which the GWA content of jobs is increasing, where in the employment distribution these changes are occurring, and whether this increase is more prominent in male or female full-time or part-time employment types. In the exploration of these issues, a measure of the work activity intensity of occupations is constructed which takes into account the 42 work activity descriptors. The procedure of analysis adopted here is described in section 6.5.2 of Chapter 6, and the measures used are obtained using equations 6.2 and 6.3.

7.3.1 The work activity change of Australian full-time employment

Tables 7.2 to 7.5 show changes to the composition of the work activity intensity of full-time occupations in Australia. However, it is important to know what the numbers in the corresponding tables mean to understand the changes that occurred in the labour market. Tables 7.2 and 7.4 show the number of full-time employed men and women arranged in deciles from lowest to highest. The occupations in each decile were ranked from highest to lowest according to the GWA intensity of each of the 340 occupations.

Table 7.2 Number of male full-time employees in GWA intensity deciles

	Low intensity deciles							*High intensity deciles*		
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	322,437	319,389	317,542	317,272	351,233	296,647	295,921	323,570	314,528	313,229
1976	327,597	320,355	323,945	329,429	367,461	284,713	315,785	350,835	327,181	336,303
1981	295,131	307,787	308,102	321,234	371,553	281,806	327,068	358,320	347,346	344,648
1986	275,191	277,140	296,619	306,969	363,750	284,951	330,916	360,805	360,149	392,940
1991	238,017	250,822	261,336	304,615	338,710	264,359	303,223	352,791	330,401	506,677
1996	256,970	263,363	254,362	308,389	344,521	275,837	327,700	403,248	371,064	546,679
2001	279,552	267,174	252,846	282,593	343,537	272,009	348,365	420,878	366,518	612,244

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001; and Author's calculations.

To compare changes in full-time employment over time, the number of occupations was held constant according to the 1971 GWA intensity division of deciles. Tables 7.3 and 7.5 illustrate the decile percentage change for full-time male and female employment over the 1971-2001 period. The last row shows the employment growth in each decile relative to the total employment growth for the period and is calculated using Equation 6.3 in Chapter 6.

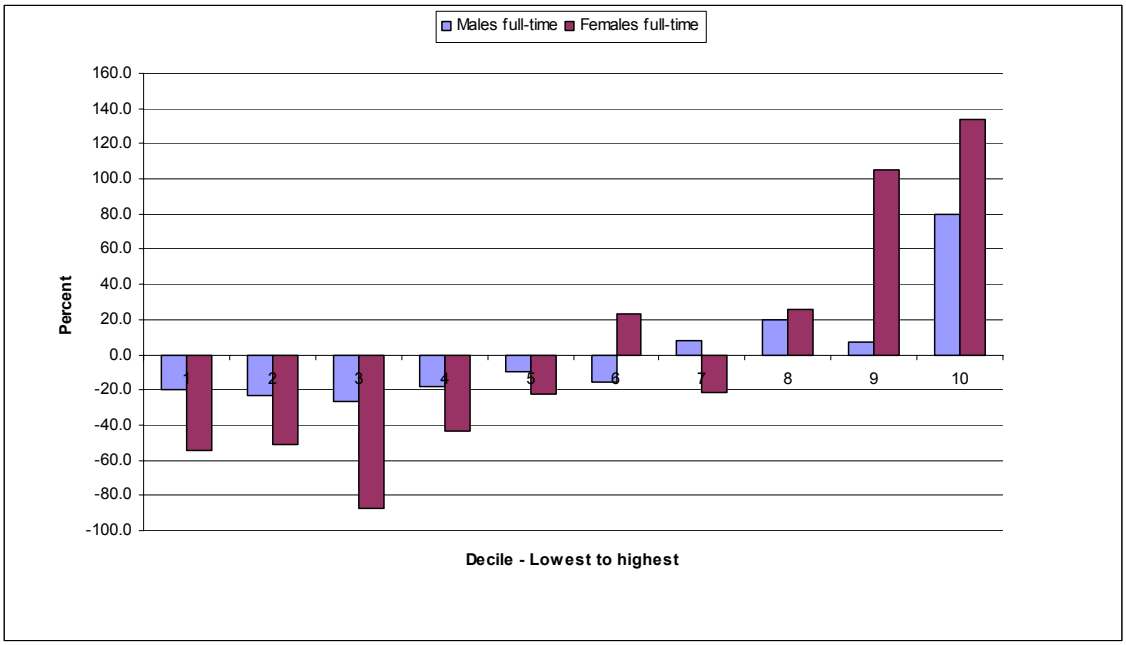
Table 7.3 Decile percentage change for male full-time employees, arranged by GWA intensity, per cent

	Low intensity deciles									*High intensity deciles*
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971-1976	1.6	0.3	2.0	3.8	4.6	-4.0	6.7	8.4	4.0	7.4
1976-1981	-9.9	-3.9	-4.9	-2.5	1.1	-1.0	3.6	2.1	6.2	2.5
1981-1986	-6.8	-10.0	-3.7	-4.4	-2.1	1.1	1.2	0.7	3.7	14.0
1986-1991	-13.5	-9.5	-11.9	-0.8	-6.9	-7.2	-8.4	-2.2	-8.3	28.9
1991-1996	8.0	5.0	-2.7	1.2	1.7	4.3	8.1	14.3	12.3	7.9
1996-2001	8.8	1.4	-0.6	-8.4	-0.3	-1.4	6.3	4.4	-1.2	12.0
1971-2001	-13.3	-16.3	-20.4	-10.9	-2.2	-8.3	17.7	30.1	16.5	95.5
Change relative to total employment growth (%)	*-20.2*	*-23.0*	*-26.7*	*-18.0*	*-10.0*	*-15.6*	*8.4*	*19.7*	*7.3*	*79.9*

Source: Author's calculations.

Figure 7.2 shows the compositional change of both male and female full-time employment. For both, the number of people working at the top of the work activity intensity of occupations rose significantly. For men, the number of occupations in the highest four deciles rose relative to the total employment growth as can be seen in Table 7.3. These increased by 8.4 and 79.9 per cent respectively. As we move down the work activity intensity distribution of male full-time employment, we can see that from decile six to the lowest work activity intensive decile, the work activity intensity of male full-time employment declined between 1971 and 2001. The most notable decrease was seen at the third lowest decile, with a relative fall of 26.7 per cent, 23.0 per cent at the second lowest decile and 20.2 per cent at the lowest decile, respectively. For women (Table 7.5) the picture was similar to that of men; however, the relative employment growth in work activity intensity was concentrated in the top three deciles. The top two deciles experienced strong increases. At the highest decile the relative increase for women was 134.0 per cent, 105.1 per cent at the second highest decile and 25.9 per cent at the third highest decile. Decile six rose by 23 per cent. Declines in work activity intensities occurred in all the other deciles. These declines ranged from 26.7 per cent to 10.0 per cent.

Figure 7.2 Change in full-time employment in each decile relative to total employment growth, arranged by GWA intensity, 1971-2001



Source: Tables 7.3 and 7.5.

Table 7.4 Number of female full-time employees arranged by GWA intensity deciles

	Low intensity deciles							*High intensity deciles*		
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	128,561	101,163	130,607	105,259	129,618	115,622	98,173	115,642	117,982	113,230
1976	120,141	95,870	125,931	109,492	83,037	188,812	56,198	196,989	165,028	145,486
1981	106,707	89,644	97,230	102,710	94,213	202,104	66,093	211,991	192,765	177,414
1986	97,643	89,255	86,188	103,605	114,114	210,926	83,749	233,315	232,501	209,663
1991	81,459	88,010	58,893	109,554	122,537	214,714	86,962	247,259	271,215	285,485
1996	85,444	85,595	31,593	110,290	164,469	207,338	102,820	241,746	349,604	354,413
2001	93,823	79,182	26,577	95,347	160,909	228,189	124,010	233,608	388,353	425,173

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* Author's calculations.

The increases in the work activity intensity of full-time employment probably indicate a process of increased relative demand for occupations that require higher levels of work activity intensity. The strong demand for male occupations requiring high levels of work activity were concentrated in the top decile, where the relative demand for these occupations rose by 80 per cent. For women, on the other hand, the relative demand for occupations with high levels of work activities was 105 and 134 per cent in the top two deciles. More than half of the growth in the work activity index for full-time males is attributed to the growth in employment in five occupations all in the top decile, namely

computing professionals, general managers, sales and marketing managers, project and program administrators and information technology managers. For women, there was a broader pattern of employment growth. Twenty-three per cent of the work activity increase for full-time females is attributed to the growth in employment of occupations all in the top decile of employment. Examples of this include: human resource professionals, business and organisation analysts, computing professionals, registered nurses, finance managers, production managers, and sales and marketing managers.

Table 7.5 Decile percentage change for female full-time employees, arranged by GWA intensity, per cent

	Low intensity deciles						*High intensity deciles*			
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971-1976	-6.5	-5.2	-3.6	4.0	-35.9	63.3	-42.8	70.3	39.9	28.5
1976-1981	-11.2	-6.5	-22.8	-6.2	13.5	7.0	17.6	7.6	16.8	21.9
1981-1986	-8.5	-0.4	-11.4	0.9	21.1	4.4	26.7	10.1	20.6	18.2
1986-1991	-16.6	-1.4	-31.7	5.7	7.4	1.8	3.8	6.0	16.7	36.2
1991-1996	4.9	-2.7	-46.4	0.7	34.2	-3.4	18.2	-2.2	28.9	24.1
1996-2001	9.8	-7.5	-15.9	-13.5	-2.2	10.1	20.6	-3.4	11.1	20.0
1971-2001	-27.0	-21.7	-79.7	-9.4	24.1	97.4	26.3	102.0	229.2	275.5
Change relative to total employment growth (%)	*-54.5*	*-51.2*	*-87.3*	*-43.6*	*-22.7*	*23.0*	*-21.3*	*25.9*	*105.1*	*134.0*

Source: Author's calculations.

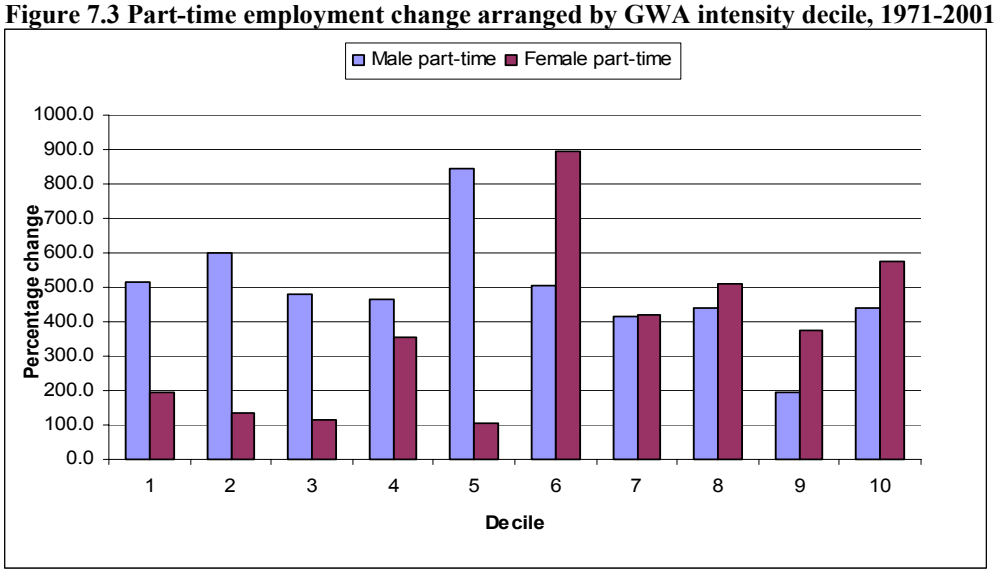
7.3.2 Changes in work activity intensity of part-time employment

We now take a look at changes in the work activity intensity of part-time employment. Figure 7.3 shows the growth in part-time employment for males and females over the 1971-2001 period. This figure details employment changes across deciles arranged from highest to lowest according to the generalised work activity intensity obtained using Equation 6.2. Male part-time employment experienced large increases in all deciles, with the most pronounced occurring in the lower half of the distribution. For women the largest rises occurred at the highest, third, fourth and fifth highest deciles. The pattern of employment growth changes when we take into consideration changes in employment deciles relative to changes in total employment growth. These changes are detailed in Tables 7.6[1] to 7.9. The relative percentage changes in part-time employment

[1] There are significant differences between the 1976 and 1981 census data reported for part-time employment for men and women. Over this period, part-time employment nearly trebled for men.

for males and females are obtained using Equation 6.3. These changes are detailed in Tables 7.7 and 7.9. What emerges is that the generalised work activity intensity for male part-time occupations declined in most of the employment distribution. The top four deciles for the male work activity distribution experienced declines of between 8.3 to 49.9 per cent.

Figure 7.3 Part-time employment change arranged by GWA intensity decile, 1971-2001



Source: Author's calculations.

Changes to the work activity intensity for women in part-time employment can be seen in Tables 7.8 and 7.9. The work activity intensity increased for the top half and declined for the bottom half of the employment distribution. The highest increases were at the sixth and top deciles. What is important to note is the decline in the work activity intensity at the lowest three deciles, which declined by between 37.1 and 54.3 per cent respectively. This is the opposite trend to that of men, which saw relative increases in two of the four lowest work activity intensity deciles.

According to the ABS, this is attributed to changes to the census survey. In 1981 people were required to tick boxes when answering questions about the total number of hours worked, whereas for the 1976 census, respondents were required to write an estimate of the number of hours worked. Thus, for the 1976 census, the coding for the number of hours worked was recorded according to what was written on the form. Another reason for the large difference in numbers is that the 1976 census only processed about 50 per cent of all the forms, and the total numbers of part-time persons recorded were estimated using population weights. According to the ABS, high sampling errors may have contributed to the large difference in numbers reported in the census between 1976 and 1981.

Table 7.6 Number of male part-time employees in GWA intensity deciles

	Low intensity deciles						*High intensity deciles*			
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	16,204	16,055	15,337	15,918	13,564	14,684	15,140	17,359	14,079	14,014
1976	16,133	15,345	16,661	15,653	13,684	14,376	14,835	20,072	11,577	12,401
1981	42,853	48,866	43,987	50,610	39,503	40,574	29,003	51,444	33,228	33,682
1986	53,313	59,843	49,302	52,993	40,487	53,063	32,597	61,205	32,051	34,211
1991	59,247	76,044	59,061	60,824	57,144	59,181	40,695	58,214	30,824	43,089
1996	77,491	99,335	76,886	85,504	94,722	71,745	58,912	81,564	31,715	56,156
2001	99,710	112,517	89,121	89,554	128,410	88,789	78,265	93,759	41,519	75,457

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* Author's calculations.

Table 7.7 Decile percentage change for male part-time employees, arranged by GWA intensity, per cent

	Low intensity deciles						*High intensity deciles*			
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971-1976	-0.4	-4.4	8.6	-1.7	0.9	-2.1	-2.0	15.6	-17.8	-11.5
1976-1981	165.6	218.5	164.0	223.3	188.7	182.2	95.5	156.3	187.0	171.6
1981-1986	24.4	22.5	12.1	4.7	2.5	30.8	12.4	19.0	-3.5	1.6
1986-1991	11.1	27.1	19.8	14.8	41.1	11.5	24.8	-4.9	-3.8	26.0
1991-1996	30.8	30.6	30.2	40.6	65.8	21.2	44.8	40.1	2.9	30.3
1996-2001	28.7	13.3	15.9	4.7	35.6	23.8	32.9	15.0	30.9	34.4
1971-2001	515.4	600.8	481.1	462.6	846.7	504.7	416.9	440.1	194.9	438.4
Change relative to total employment growth (%)	*4.5*	*19.0*	*-1.3*	*-4.5*	*60.8*	*2.7*	*-12.2*	*-8.3*	*-49.9*	*-8.6*

Source: Author's calculations.

The overall picture that emerges from the above analysis is that the intensity of work activity for part-time male workers has consistently declined at the top four deciles of the distribution, and increased in the middle (deciles 5 and 6) and bottom of the distribution (deciles 1 and 2).

Women experienced a similar pattern of change in the work activity intensity of part-time employment, where the demand for occupations requiring high levels of work activity intensity rose at the top but declined at the bottom of the distribution. For male part-time employment, the opposite trend is evident. The decline in demand for occupations requiring high levels of work activity intensity fell considerably at the top of the distribution but rose for occupations that require low levels.

Table 7.8 Number of female part-time employees arranged by GWA intensity deciles

	Low intensity deciles						*High intensity deciles*			
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	42,303	34,308	38,469	38,757	35,682	37,775	32,777	40,837	40,343	34,103
1976	50,057	46,056	51,392	55,125	14,194	85,163	36,685	76,506	61,548	50,461
1981	66,444	57,969	59,475	69,224	20,512	117,501	56,347	113,352	105,300	91,694
1986	82,315	68,178	72,656	91,147	25,980	157,720	83,542	144,254	120,810	123,461
1991	94,236	73,948	83,466	114,654	41,186	224,560	106,337	176,477	135,173	153,878
1996	110,604	75,495	82,790	170,729	60,736	304,127	135,404	216,062	165,455	187,274
2001	124,305	79,867	82,042	175,745	73,466	375,640	169,795	248,175	192,583	231,033

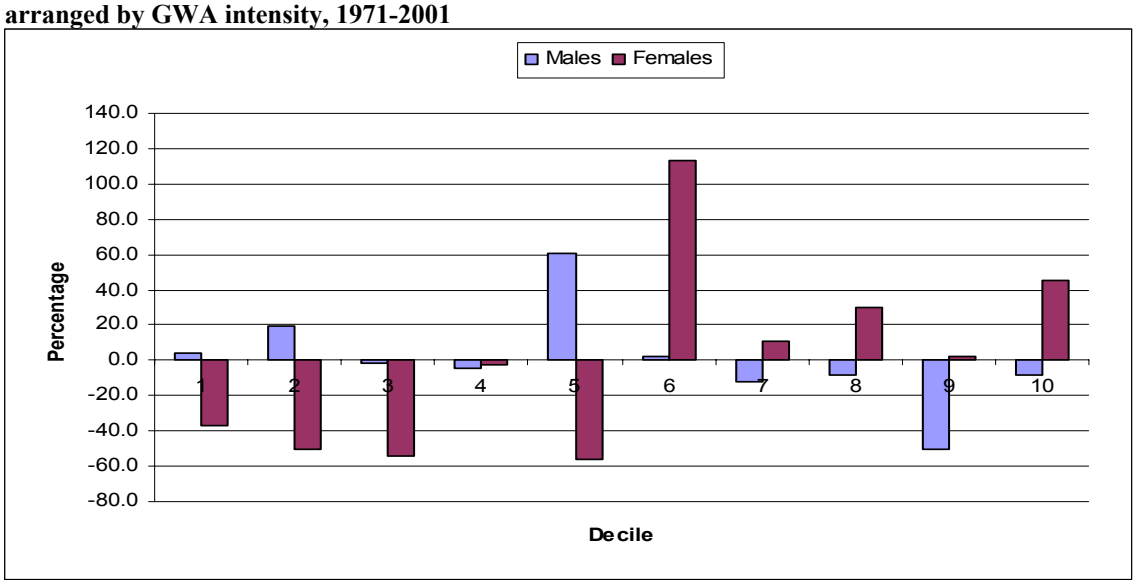
Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* Author's calculations.

Table 7.9 Decile percentage change for female part-time employment arranged by generalised work activity intensity, per cent

	Low intensity deciles									*High intensity deciles*
Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971-1976	18.3	34.2	33.6	42.2	-60.2	125.5	11.9	87.3	52.6	48.0
1976-1981	32.7	25.9	15.7	25.6	44.5	38.0	53.6	48.2	71.1	81.7
1981-1986	23.9	17.6	22.2	31.7	26.7	34.2	48.3	27.3	14.7	34.6
1986-1991	14.5	8.5	14.9	25.8	58.5	42.4	27.3	22.3	11.9	24.6
1991-1996	17.4	2.1	-0.8	48.9	47.5	35.4	27.3	22.4	22.4	21.7
1996-2001	12.4	5.8	-0.9	2.9	21.0	23.5	25.4	14.9	16.4	23.4
1971-2001	193.8	132.8	113.3	353.5	105.9	894.4	418.0	507.7	377.4	577.5
Change relative to total employment growth	*-37.1*	*-50.1*	*-54.3*	*-2.9*	*-55.9*	*113.0*	*10.9*	*30.2*	*2.2*	*45.1*

Source: Author's calculations.

Figure 7.4 Change in part-time employment in each decile relative to total employment growth, arranged by GWA intensity, 1971-2001

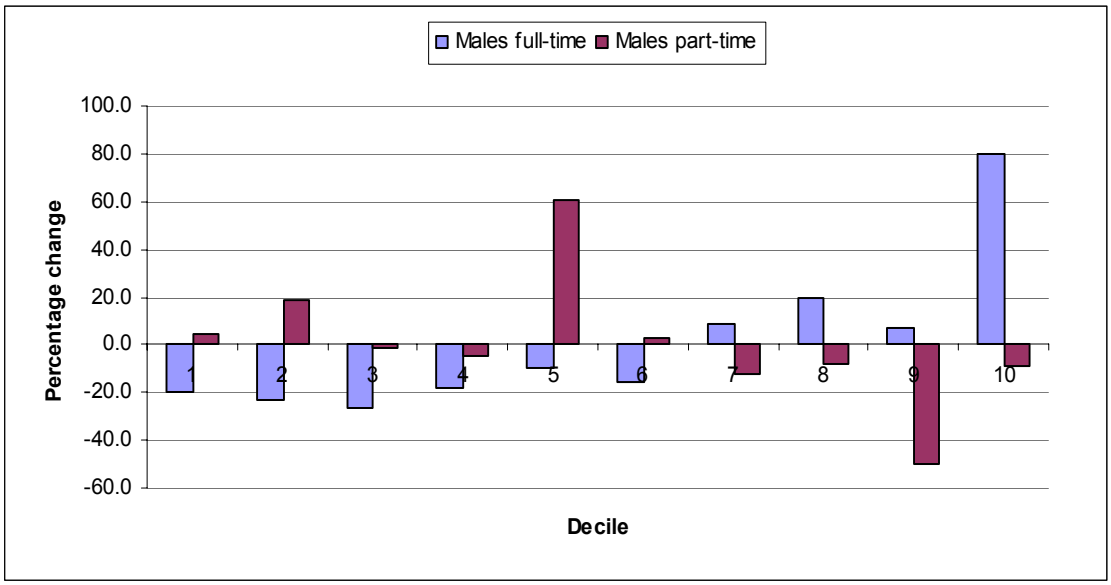


Source: Tables 7.7 and 7.9.

7.3.3 Work activity intensity trends for men and women in Australian employment

Figure 7.5 shows that for males, the work activity intensity of full-time employment increased in the top four deciles, while for part-time employment it declined. From the fourth highest decile downwards, the work activity intensity of full-time employment declined for each decile. In part-time male employment, increases in work activity intensity occurred in the middle and lower part of the distribution. Given the trends shown in Figure 7.5, one could easily assume that a process of job substitution is occurring between full-time and part-time work that requires high levels of work activity intensity and vice-versa. It is difficult to know, given our data, whether and how much these trends for male employment are a product of either job creation or job substitution of part-time jobs for full-time jobs or vice-versa.

Figure 7.5 Change in male full-time and part-time employment relative to total employment growth, arranged by GWA intensity, 1971-2001



Source: Tables 7.3 and 7.7.

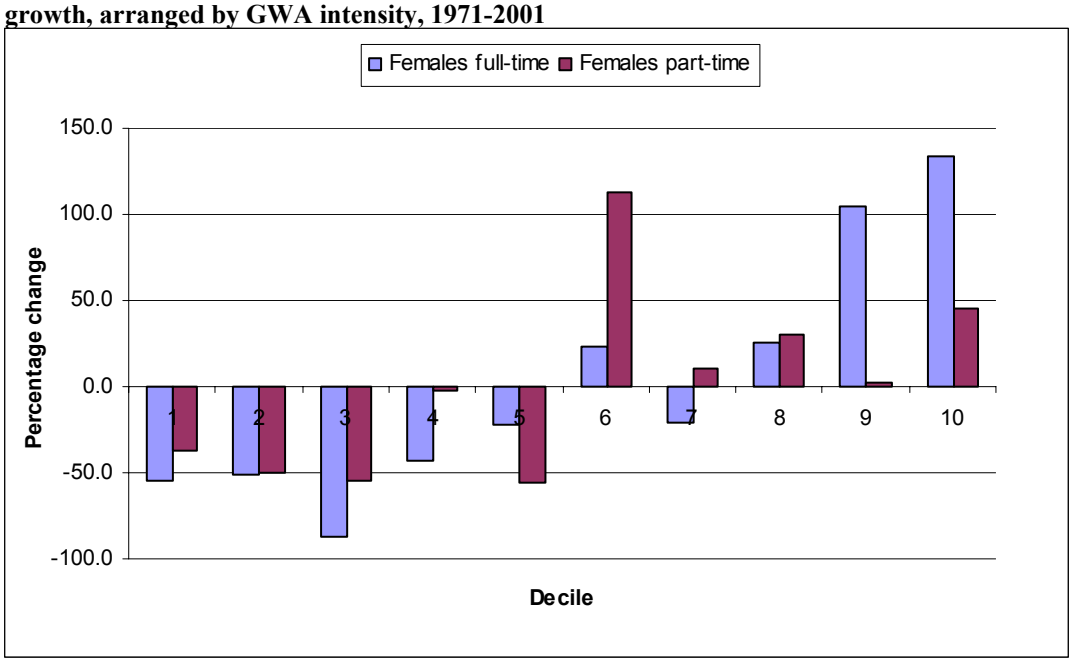
The trends shown in Figure 7.5 may suggest that this is the case, but one limitation of this work is that the cross-sectional data do not allow us to investigate this phenomenon. To obtain a clearer picture of job substitution of part-time work for full-time work or vice-versa would require the use of panel data that provide a time span long enough for

analysis. Unfortunately these data are not available for such a period[2] and the analysis cannot be performed.

The trends in employment growth for females are different to those of males. GWA intensity rose at the top four deciles for both full-time and part-time employment. The magnitude of these changes can be seen in Figure 7.6. For both full-time and part-time work the trends show that there were increases in the work activity intensity of jobs in the higher deciles, with a mix of falls and rises in the middle of the distribution and consistent falls from the middle to the bottom of the female employment distribution.

Hence, we can conclude that the changes in employment featured in Figures 7.5 and 7.6 show that there has been a bias in the demand for labour in full-time employment for men and women that require high levels of work activity intensity. This trend is also evident for female part-time employment but not for male part-time employment.

Figure 7.6 Change in female full-time and part-time employment relative to total employment growth, arranged by GWA intensity, 1971-2001



Source: Tables 7.5 and 7.9.

[2] One such data set is the Household, Income and Labour Dynamics in Australia (HILDA) survey. This survey could be a useful source of data for this kind of analysis, but the periods are still not of a long enough nature to conduct this research.

7.4 The Changing Work Activity Requirement of Australian Occupations

The themes emerging from the decile analysis of work activity intensities can be examined from a different perspective. To provide further insights about how these changes are impacting Australian occupations, an analysis of different types of work activity areas is carried out. The importance of this approach is that it provides insights as to how the composition of work activity requirements is changing in the Australian labour market for different job types. To understand how the occupational requirements have changed, nine different types of work activity areas over the 1971-2001 period are examined. These are taken from the O*NET's Content Model and are described in Table 7.10.

As explained in Section 6.3.3, the taxonomic structure of GWAs is hierarchically organised and is made up of 42 GWA descriptors which are organised into four high-order taxonomy categories. Each of these four taxonomies is divided into nine second-order factors. These nine second-order factors are used to analyse changes in the work activity requirements of Australian employment between 1971 and 2001, and are henceforth called areas of work activity.

GWA area requirements relate to the functions of work that Australian employees are required to perform in their respective occupations. In other words, GWA areas give us an indication of what Australian employees are required to do at work. These are detailed in Table 7.10.

7.4.1 Type of analysis

The analysis conducted in this section is described in Section 6.5.3. For the purpose of this investigation, attention is paid to the nine different areas of GWAs as described in Table 7.10 over the 1971-2001 period for both male and female full-time and part-time occupations. From the O*NET data, a weighted average of work activity intensity by work activity area is obtained in order to study how the work activity requirements of Australian occupations have changed over time. This is obtained using Equation 6.4.

Table 7.10 Taxonomic description of generalised work activities

Taxonomy	*Taxonomy description*	*Number of descriptors*
Area 1: Looking for/receiving job-related information. *Searching*	Getting information needed to do the job. It concentrates on how information is actually obtained in workplaces in order to perform a particular task.	2
Area 2: Identify or evaluate job-related information. *Evaluating*	Relates to how information is interpreted in order to perform a particular job.	3
Area 3: Information or data processing. *Processing*	Relates to how information is processed to perform a particular occupation or job task.	4
Area 4: Reasoning or decision-making. *Reasoning*	Refers to the type of decisions that are made and the types of problems that need to be solved in order to perform a particular job or job task successfully.	6
Area 5: Performing physical and manual work activities. *Physical Work*	Relates to the type of activities that require use of the body and hands to perform a job or job task successfully.	4
Area 6: Performing complex or technical work activities. *Complex/Technical*	Relates to controlling computer functions, providing documentation, detailed instructions or specifications and conducting or carrying out work procedures and activities in accord with the employees' own ideas or information.	6
Area 7: Communicating or interacting. *Interaction*	Refers to the type of interactions that occur with other people whilst performing a particular job or job task.	8
Area 8: Coordinating, developing, managing or advising. *Coordination*	This second-order factor relates to coordination, managerial or advisory activities which are done while performing a given occupation or job task.	6
Area 9: Administering *Administering.*	Refers to the type of administrative, staffing, monitoring or controlling activities that are done while performing a given job.	3

Source: Jeanneret et al. (1999).

7.4.2 Work activity requirement trends for full-time work in Australia

Tables 7.11 and 7.12 and Figure 7.7 detail changes to the nine work activity intensity areas of full-time male and female employment, respectively. The highest work activity intensity area for male and female full-time employment in terms of score is *searching*

(Column 8 of tables 7.11 and 7.12). This area of work is concerned with the use of information in work situations. It involves a variety of activities that require the use of information in terms of receiving it and distributing it to other colleagues or across different levels of the organisational structure, and to organisations that are outside of the immediate work environment. For men, looking for and receiving job related information increased by 13.3 per cent over the 30-year period, whereas for women, this work activity area increased by 33.0 per cent. The stronger rise for women in full-time employment may be due to their increasing involvement in occupations that require work activities that need observing, receiving and obtaining information, and monitoring and reviewing information from different sources.

The second highest score for men and women in full-time employment was processing data and information. This work activity is concerned with the way in which information and data are processed in order to perform a given job. The increasing importance of this work activity shows that Australian occupations are changing towards tasks that necessitate higher levels of information processing and analysis. A number of tasks are involved in this work area and include: processing information and data, and compiling, categorising, calculating, auditing and verifying different types of information. Making judgements about or assessing the value, importance or quality of things or people has also become an important work activity area. This area of work has also become significant because of the need to evaluate information and occupational tasks against a set of standards. For men, this area of work experienced the fifth highest increase, while for women this area experienced the fourth highest increase.

The third most important ranking for men was evaluating. For women, this work activity area ranked fifth. This area of work is concerned with how information is to be interpreted in order to perform a job or task successfully. Three key elements make up this area of work. The first is concerned with the identification of information received by making categorisations or estimates that are related to work situations. This may involve the recognition of similarities and differences, or sensing changes in events related to the work environment. The second area is concerned with the inspection and diagnosis of equipment. This may include activities such as estimating sizes, distances, or quantities, or determining time, costs, resources and materials needed to perform or

complete a given work activity. For men, this work activity area increased by 9.3 per cent, while for females the increase was 32.5 per cent.

Table 7.11 GWA area requirement scores and change for male full-time employment, 1971-2001

Male full-time	*1971*	*1976*	*1981*	*1986*	*1991*	*1996*	*2001*	*Change 1971-2001 (%)*
Area 1: Looking for/receiving job-related information.								
Searching	29.9	30.3	30.8	31.8	33.3	33.5	33.9	13.3
Area 2: Identify or evaluate job-related information.								
Evaluating	21.1	21.2	21.4	22.0	22.7	22.8	23.0	9.3
Area 3: Information or data processing.								
Processing	19.8	20.1	20.6	21.5	23.5	23.6	24.0	21.3
Area 4: Reasoning or decision-making.								
Reasoning	15.1	15.4	15.9	16.8	18.8	19.2	19.7	30.6
Area 5: Performing physical and manual work activities.								
Physical Work	22.5	22.1	21.7	21.1	20.1	19.7	19.2	-14.5
Area 6: Performing complex or technical work activities.								
Complex/Technical	11.2	11.4	11.7	12.0	12.6	12.8	12.9	14.8
Area 7: Communicating or interacting.								
Interaction	14.0	14.3	14.8	15.5	17.2	17.6	18.0	29.1
Area 8: Coordinating, developing, managing or advising.								
Coordination	10.1	10.3	10.6	11.4	13.3	13.7	14.2	41.5
Area 9: Administering.								
Administering	11.8	11.8	12.0	12.8	14.5	14.7	15.0	27.1

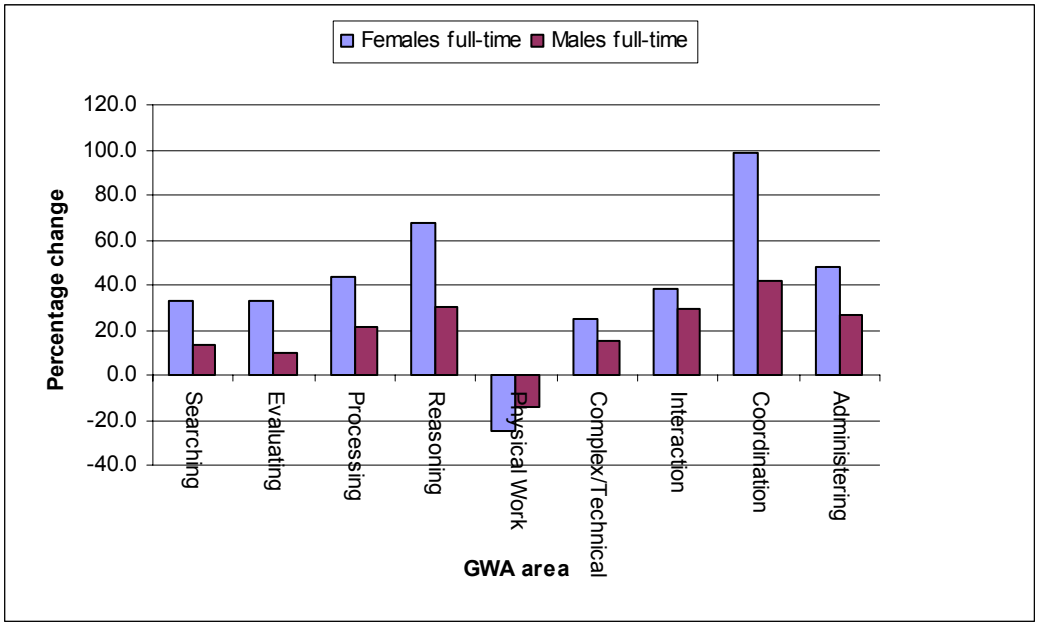
Source: Author's calculations.

Table 7.12 GWA area requirement scores and change for female full-time employment, 1971-2001

Female full-time	*1971*	*1976*	*1981*	*1986*	*1991*	*1996*	*2001*	*Change 1971-2001 (%)*
Area 1: Looking for/receiving job-related information.								
Searching	26.0	27.7	28.7	29.7	31.8	33.4	34.6	33.0
Area 2: Identify or evaluate job-related information.								
Evaluating	15.3	16.4	16.6	17.3	18.4	19.4	20.3	32.5
Area 3: Information or data processing.								
Processing	18.9	20.2	21.2	22.4	24.6	25.9	27.1	43.5
Area 4: Reasoning or decision-making.								
Reasoning	13.1	14.5	15.8	16.9	19.1	20.9	22.0	67.3
Area 5: Performing physical and manual work activities.								
Physical Work	16.8	16.5	15.8	14.9	13.9	13.2	12.6	-24.9
Area 6: Performing complex or technical work activities.								
Complex/Technical	9.5	10.0	10.3	10.6	11.2	11.6	11.8	24.5
Area 7: Communicating or interacting.								
Interaction	18.2	19.3	20.7	21.5	23.2	24.4	25.2	38.6
Area 8: Coordinating, developing, managing or advising.								
Coordination	8.3	9.6	10.5	11.4	13.6	15.4	16.5	98.9
Area 9: Administering.								
Administering.	12.9	14.2	14.5	15.5	17.1	18.5	19.2	48.3

Source: Author's calculations

Figure 7.7 Change in work activity area for full-time employment, 1971-2001



Source: Tables 7.11 and 7.12.

The fourth highest ranked work activity area for men and women was reasoning. For men and women, this work activity experienced the second largest increase of 30.6 per cent and 67.3 per cent, respectively. This area is concerned with mental processes that take place at work. It involves a variety of tasks that include: making decisions and solving problems, thinking creatively, updating and using job-related knowledge, developing objectives and strategies, scheduling work activities and organising, and planning and prioritising work activities. Combining, evaluating and reasoning with information and data are job tasks that have become increasingly common in workplaces. For example, men and women in full-time employment are increasingly experiencing work situations where they need to make decisions about the importance of information. Furthermore, they are required to choose or find the best solution to work related problems as they arise. Full-time employees are also experiencing work activities that involve the development of plans to accomplish work output, and to prioritise and organise their own work or the work of others.

The fifth most important area for work for males was physical activities. For females, this was ranked eighth. This work activity declined in full-time employment for both men and women between 1971 and 2002. For men the decline was 14.5 per cent, while for women the decline was 24.9 per cent. This area of work is concerned with the type

of physical activities performed, and the type of equipment and vehicles that need to be operated or controlled in work situations. The decline of this area of work indicates that physical work activities are losing importance in full-time employment. Physical activities that require moving one's whole body such as climbing, lifting, balancing and walking are in decline. For example, activities that require the use of the arms and the legs, such as moving and handling physical materials, have become less important in Australian jobs. Handling and moving objects, the use of either control mechanisms or direct physical activity to operate machines or processes have also become less important in full-time employment. These types of activities were quite common in manufacturing, and their decline can be attributed to a structural industrial shift from the manufacturing to the services sector. Another explanation for the loss of physical work in Australian workplaces is that more productive forms of technology have now replaced much of the physical and repetitive work carried out by people. These types of activities were often seen in production work.

The sixth most important work activity area in terms of ranking is interaction. For men this work activity experienced the third highest increase, while for women it was the fifth highest increase. This area of work activity is concerned with the way in which individuals interact in work situations. It consists of a variety of activities that involve the explanation of information to colleagues and how this information can be understood or used to support the work of colleagues or work teams. This area of work activity involves the provision of information to supervisors, fellow workers and subordinates, and it may involve the use of a variety of media. This information can be exchanged face-to-face, in staff meetings or seminars, in writing or via telephone, fax or e-mail. It also involves the development of constructive and cooperative working relationships with colleagues and with people outside the organisation. Australian full-time employees are increasingly required to work in environments where the establishment and maintenance of interpersonal relationships is important. This may involve assisting and caring for others, influencing others and resolving conflicts within the organisation, with other organisations and with the public at large.

The seventh most important area of work activity was administration. For men, the change over the 30-year period was the fourth largest (27.1 per cent) while for women it was the third largest (48.3 per cent). This can be attributed to changes in the structures

of organisations where administrative tasks within the organisation and across work groups and other organisations have become increasingly common. The activities that have become progressively more important in this area of work include: approving requests, handling paperwork, performing day-to-day administrative tasks, staffing administrative units, recruiting, interviewing, selecting, hiring and promoting staff, monitoring and controlling resources, and overseeing the spending of money.

Coordinating was ranked eighth in terms of area of work activity intensity. However, this area of work experienced the largest increase over the period for both male and female full-time employees. For men the increase was 41.5 per cent, while for women it was 98.9 per cent. The magnitude of the changes shows that this area of work has become a significant feature of full-time work. It is concerned with the type of managerial or advisory activities required to perform a particular set of tasks. Examples of this include the coordination of work and the activities of others. This work activity also involves teaching, guiding, directing and motivating subordinates, teams and work colleagues, and providing consultation and expert advice to management or other groups on technical or procedural issues.

Finally, the performance of technical and complex activities ranked last in terms of work activity intensity; however, its intensity level increased for both men and women by 14.8 and 24.5 per cent respectively. One reason for the increase in this area of work has been the introduction of computers. This activity may involve controlling computer functions, writing software, and communicating with others through the use of computers. Another component of this area of work activity is the implementation of ideas, programs and systems used to improve productivity at work. An example of this may involve the repair and maintenance of mechanical, electronic or computerised equipment.

7.4.3 Work activity trends for part-time employment

Inspection of Tables 7.13 and 7.14 and Figure 7.8 shows that the trends in areas of work activity intensity for part-time employment were quite different for males and females. This contrasts with the experience of full-time employment, where the work activity intensity was similar for both sexes.

For male part-time employment, all areas of work activity intensity declined, with the exception of physical work. The reasons for these changes are that the bulk of part-time employment creation requiring physical work appears to be concentrated in occupations carried out by men.

Table 7.13 GWA area requirement scores and change for male part-time employment, 1971-2001

Male part-time	*1971*	*1976*	*1981*	*1986*	*1991*	*1996*	*2001*	*Change 1971-2001 (%)*
Area 1: Looking for/receiving job-related information.								
Searching	29.9	29.2	28.8	28.4	27.4	26.6	26.8	- 10.3
Area 2: Identify or evaluate job-related information.								
Evaluating	20.1	19.1	19.3	18.7	18.3	17.9	18.0	-10.8
Area 3: Information or data processing.								
Processing	20.3	19.9	19.3	18.5	17.9	17.2	17.5	-13.8
Area 4: Reasoning or decision-making.								
Reasoning	16.5	16.1	15.3	14.4	13.9	13.3	13.6	-17.8
Area 5: Performing physical and manual work activities.								
Physical Work	21.2	20.6	21.4	22.4	22.5	22.3	21.7	2.4
Area 6: Performing complex or technical work activities.								
Complex/Technical	10.3	9.9	10.1	10.1	9.8	9.5	9.6	-6.1
Area 7: Communicating or interacting.								
Interaction	16.0	16.4	15.6	14.8	14.9	15.0	15.5	-3.2
Area 8: Coordinating, developing, managing or advising.								
Coordination	11.9	11.7	10.6	9.7	9.2	8.7	9.0	-24.6
Area 9: Administering.								
Administering	12.9	12.1	11.4	10.3	10.5	10.2	10.4	-19.3

Source: Author's calculations.

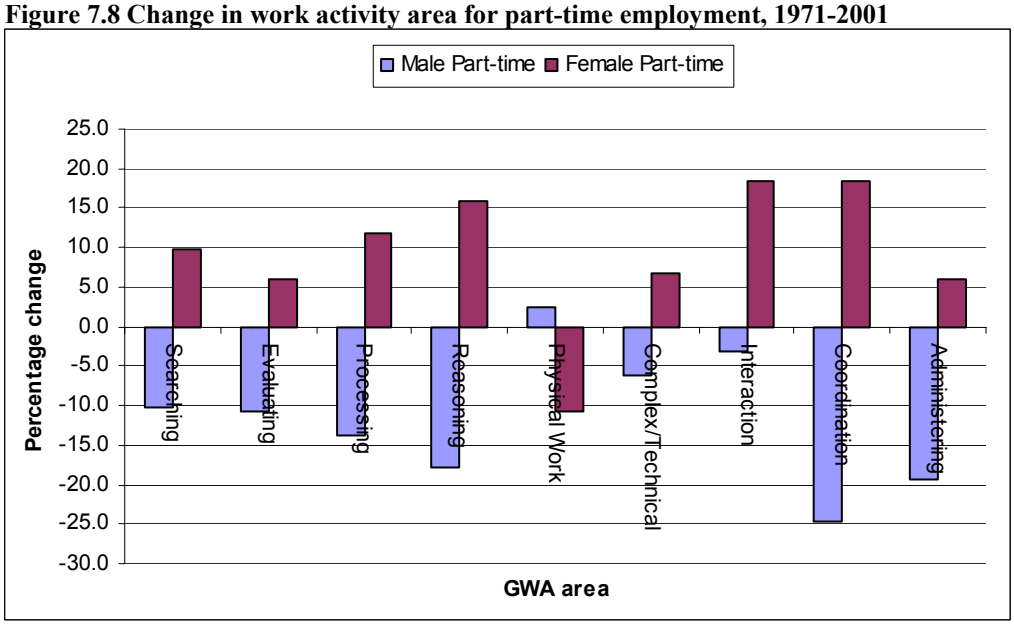
In contrast, female part-time employees experienced the same trends in work activity intensity as those seen in full-time work for men and women, indicating that work activity requirements for part-time employment for women are similar to those for full-time employment.

Table 7.14 GWA area requirement scores and change for female part-time employment, 1971-2001

Female part-time	*1971*	*1976*	*1981*	*1986*	*1991*	*1996*	*2001*	*Change 1971-2001 (%)*
Area 1: Looking for/receiving job-related information.								
Searching	25.6	26.4	27.7	27.7	27.7	27.5	28.1	9.8
Area 2: Identify or evaluate job-related information.								
Evaluating	15.6	15.9	16.0	15.9	16.1	16.1	16.5	5.9
Area 3: Information or data processing.								
Processing	18.3	18.9	20.0	19.9	19.9	19.9	20.4	11.9
Area 4: Reasoning or decision-making.								
Reasoning	13.2	13.7	15.2	14.9	14.9	14.9	15.2	15.8
Area 5: Performing physical and manual work activities.								
Physical Work	18.0	17.8	17.2	17.3	17.1	16.6	16.0	-10.8
Area 6: Performing complex or technical work activities.								
Complex/Technical	9.0	9.2	9.5	9.6	9.6	9.5	9.6	6.8
Area 7: Communicating or interacting.								
Interaction	19.1	19.7	21.0	21.3	21.7	22.1	22.6	18.3
Area 8: Coordinating, developing, managing or advising.								
Coordination	9.0	9.3	10.6	10.3	10.3	10.2	10.6	18.3
Area 9: Administering.								
Administering	13.0	13.5	13.6	13.3	13.6	13.6	13.8	6.0

Source: Author's calculations.

Figure 7.8 Change in work activity area for part-time employment, 1971-2001



Source: Author's calculations.

7.4.4 Interpreting changes in work activity areas

The analysis of changes to the work activity requirements of full-time and part-time employment provides an indication of what areas of work have been increasing in demand and which have not. Increased demand in male full-time employment has occurred in occupations with work activities that involve coordination, management of projects and work teams, and administration. Other areas of work activity that have increased in demand include interacting with colleagues and persons within and outside the workplace, as well as making decisions and solving problems. For female full-time employment, the demand trends in work activity areas have been the same as for men, but the increases have been one and a half to three times larger. The only area to experience a fall in demand in full-time work was physical work, indicating the decline in importance of manual and physical activities in Australian workplaces.

For part-time employment, women experienced the same demand trends as those seen in full-time employment, with declines in demand in occupations that require physical activities. Part-time employment for men, on the other hand, experienced declines in demand in all areas of work activity with the exception of physical work.

7.5 Conclusion

Our analysis of Australian job types in terms of generalised work activities showed different trends for full-time and part-time employment. In terms of changes to the overall work activity intensity, the aggregate employment-weighted index of work activity intensity increased for men and women in full-time employment, with the increase in the index for women being more than twice as much as that for men. In part-time employment, the index rose for women but declined for men. Changes to the index in full-time work have been driven by employment growth in occupations that require high levels of work activity intensity. The increase in the index for female part-time employment appears to be driven by growth in employment that requires relatively high levels of work activity intensity, as shown in Table 7.9. Conversely, in part-time employment for men, the decline in the index seems to be driven by increases in demand for occupations that require low levels of work activity intensity.

The decile analysis conducted in Section 7.3 also showed different trends for full-time and part-time employment for men and women. For male and female full-time employees, growth generally occurred in the top three deciles, but declined in most other deciles. The strong increase in work activity intensity in the top decile for male full-time employment and the top two deciles in female full-time employment probably indicates a process of increased relative demand for occupations that require high levels of work activity intensity. For example, a large portion of the growth in the top decile for men and the top two deciles for women can be attributed to growth in employment in 20 or so occupations, such as computing professionals, general managers, human resource professionals, registered nurses and program administrators.

Female part-time employment experienced a similar pattern of change in the work activity intensity of occupations as female full-time employment, where the demand for occupations requiring high levels of work activity intensity rose at the top but declined at the bottom of the distribution. Unlike female part-time work, male part-time employment experienced declines in the work activity intensity at the top of the distribution and increases at the bottom. This shows a decline in the demand for part-time occupations requiring high levels of work activity intensity and increases in demand for occupations that require low levels of work activity intensity.

In terms of our analysis of work activity areas, it was found that full-time employment experienced increases in all areas of work activity intensity, with the exception of physical work, which declined for both men and women. This trend was present in female part-time employment, but not for part-time employment for men. This type of employment saw increases in the area of physical work, with declines in all work activity areas. This analysis of changes to the work activity requirements of full-time and part-time jobs provides valuable information about what particular areas of work have been increasing in demand and which have not.

Chapter 8
The Skill and Knowledge Composition of Australian Employment

8.1 Introduction

Chapter 7 examined the occupational requirements of different job types in terms of GWAs. The analysis looked at changes in the composition of employment in Australian occupations for men and women in full-time and part-time employment in terms of generalised worker activities. It showed that the demand for labour increased in occupations that required high levels of worker activity intensity, particularly, in full-time employment for men and women, and for part-time female employees. Conversely, the demand for labour in these job types declined in occupations that required low levels of worker activity intensity. For male part-time employment, the results showed a decline in demand for occupations requiring high levels of GWAs and an increase in demand for occupations requiring low levels of GWAs.

This chapter expands on the analysis conducted in Chapter 7, by looking at the worker requirements of Australian occupations. As described in Chapter 6, the distinction between worker requirements and occupational requirements is that the former are concerned with attributes that are possessed or embodied by the individual, while the latter are concerned with a set of variables describing what each particular job requires. Worker requirements consist of three components: O*NET skill and knowledge indicators, and educational background. In the analysis that follows, the O*NET measures of skill and knowledge are applied to investigate changes to the composition of full-time and part-time employment for men and women by exploring the following questions:

- How have the worker requirements of Australian occupations in terms of knowledge and O*NET skill intensities changed between 1971 and 2001?
- What can be said about the changing knowledge and O*NET skill requirements of Australian occupations?

- Do changes in the skill and knowledge intensity of Australian occupations reflect a pattern of skill-bias in the demand for labour in job types?

8.2 Skill and Knowledge Variables in O*NET: Two Dimensions of Human Capital

In trying to understand the role that human capital plays in the transformation of the Australian labour market in terms of different job types, it is important to distinguish between the definitions of O*NET skill and knowledge. These two concepts are difficult to distinguish because they overlap and can be seen as interdependent. Costanza et al. (1999) define knowledge as a collection of discrete but related and original facts, information and principles about a certain field of work.

Knowledge is acquired through formal education or training, or accumulated through specific experience over a period of time. Skills, on the other hand, are more dependent on learning and represent the product of training and learning certain job tasks. Skills are a general set of procedures required to perform tasks such as problem solving or social interaction. In contrast, knowledge may be 'known', but this does not necessarily mean that through 'known' knowledge a set of tasks can be performed successfully. For example, a recently graduated medical doctor may possess a lot of knowledge on the anatomy of the heart, but this does not necessarily mean that they can perform open-heart surgery on a patient.

Skills, as defined by O*NET, are inherently tied to knowledge, practice and expertise, and are not necessarily stable attributes, but are qualities or characteristics of the individual that develop as a function of experience within a certain area of work. According to Mumford and Peterson (1995a), skills are situational and tend to improve with time, practice and learning. In contrast, knowledge does not have to be necessarily situational as it can be acquired in the abstract. For example, knowledge about changing a car tyre can be obtained by reading a car operational manual, but this does not mean that, after reading the manual, an individual is skilled in changing car tyres.

Skills and knowledge are dependent on each other, but knowledge is required so that skills can be applied in work situations. To acquire a certain skill, it is important to

have knowledge about a certain collection of related facts and information in a given field of work. For example, a surgeon who is skilled in open-heart surgery is required to have knowledge of the anatomy and functions of the heart, and to possess information about the techniques needed to diagnose and treat diseases that are related to the heart. In contrast, skill in open-heart surgery cannot be acquired without knowledge about open-heart surgery.

The above example shows that the concepts of skill and knowledge can be interdependent and overlapping. However, in order to facilitate the analysis of change in the skill and knowledge intensity composition of employment, these concepts are treated as separate and independent.

8.3 The Skill and Knowledge Intensity of Australian Occupations

This section considers the worker requirements of occupations by analysing the overall skill and knowledge intensity change of Australian occupations. The analysis is the same as that conducted for worker activities in Section 7.2. To describe changes in the skill and knowledge intensity of Australian occupations, separate employment indices of skill and knowledge intensity were created using Equation 6.1.

The indices measure the intensity of skill and knowledge in occupations across the whole of the labour market and allow us to compare changes to the composition of skill and knowledge in terms of job types. Hence, to say that on average the skill or knowledge intensity in a given job type (e.g. female part-time employment) has increased is to say that on average the composition of employment in that job type has changed because:

- there has been growth in occupations that require a higher level of skill or knowledge intensity;
- there has been a decline in the number of jobs that require lower levels of skill or knowledge intensity;
- there has been both an increase in occupations that require higher levels of skill or knowledge intensity and there has been a decline in occupations that require lower levels of knowledge or skill intensity.

We begin our analysis by looking at the changes to the intensity of skill and knowledge for full-time employment and then we proceed with the same analysis for part-time employment.

The results for full-time employment are reported in Table 8.1. Men start from a higher base than women, particularly in terms of skill intensity (14.3 and 10.7 per cent) and, to a lesser extent, knowledge intensity (7.1 and 6.8 per cent). By the end of the period, in skill intensities, women almost caught up with men, whereas in terms of knowledge intensity, occupations for women had overtaken those of men. This may indicate that the occupations created in employment for women are of higher knowledge intensity than for men.

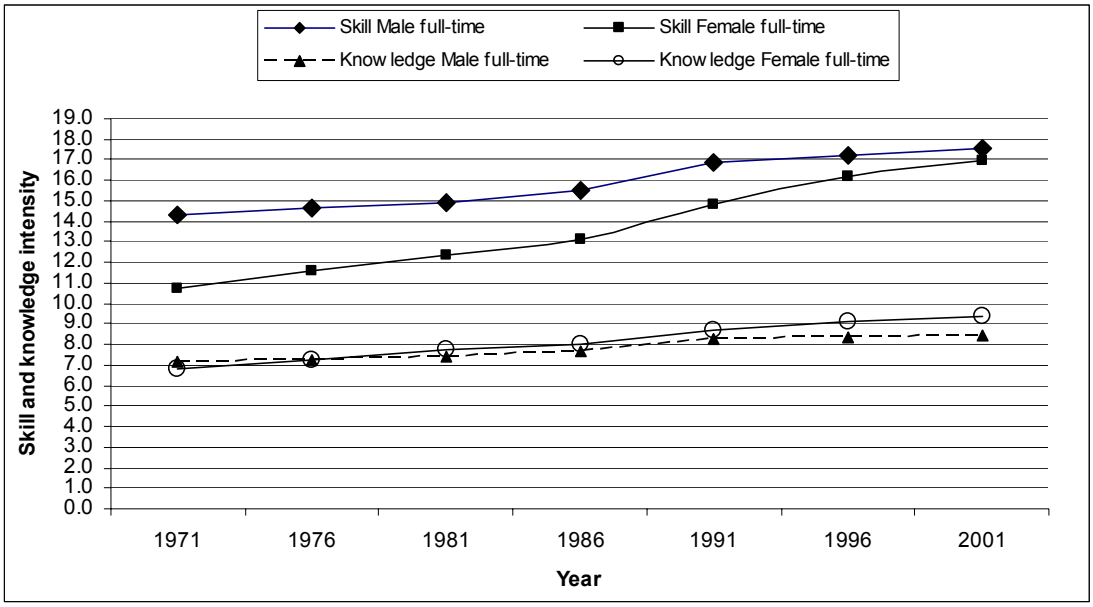
Table 8.1 Skill and knowledge intensity scores and change for total employment, and male and female full-time employment, 1971-2001

Year	*Skills*			*Knowledge*		
	Total employment	*Male full-time*	*Female full-time*	*Total employment*	*Male full-time*	*Female full-time*
1971	13.2	14.3	10.7	7.0	7.1	6.8
1976	13.5	14.6	11.6	7.2	7.3	7.2
1981	13.9	14.9	12.4	7.5	7.4	7.7
1986	14.2	15.5	13.1	7.7	7.7	8.0
1991	15.2	16.9	14.9	8.1	8.3	8.7
1996	15.5	17.2	16.2	8.2	8.3	9.1
2001	15.7	17.6	16.9	8.3	8.5	9.4
Change (%) 1971-2001	*19.3*	*22.6*	*58.2*	*18.0*	*18.6*	*36.9*

Source: Author's calculations.

Figure 8.1 shows that female skill intensity started from a lower base than men but grew at a much faster rate. The change in skill intensities was also of a larger magnitude than for knowledge. For women, the change in skill intensity was 2.5 times larger than for males, and 2 times larger in terms of knowledge intensity. These findings are similar to those found in the worker activity intensity analysis described in Section 7.2.

Figure 8.1 Total skill and knowledge intensity levels for full-time employment for men and women in, 1971-2001



Source: Table 8.1.

Table 8.2 Skill and knowledge intensity scores and change in part-time employment for men and women, 1971 and 2001

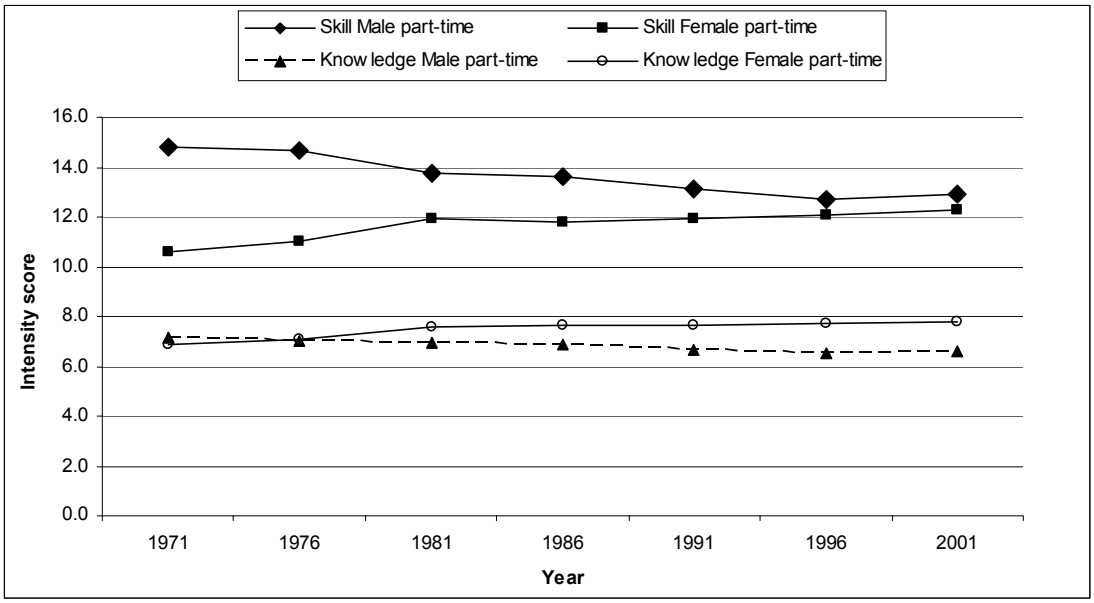
	Skills		*Knowledge*	
	Male part-time	*Female part-time*	*Male part-time*	*Female part-time*
1971	14.8	10.6	7.1	6.8
1976	14.6	11.0	7.0	7.1
1981	13.8	11.9	7.0	7.6
1986	13.6	11.8	6.8	7.7
1991	13.2	11.9	6.7	7.7
1996	12.7	12.1	6.5	7.7
2001	12.9	12.3	6.6	7.8
Change (%) 1971-2001	*-12.6*	*16.0*	*-8.0*	*13.6*

Source: Table .8.2

The trends for part-time employment were different to those for full-time employment. The main difference in the results of our analysis is that the skill and knowledge intensity in part-time employment for women increased (just as in the case of full-time occupations), whereas that for men declined (see Table 8.2). The skill intensity of female employment started from a lower base in 1971, and by 2001 had nearly caught up to that of males. Over this period, the skill intensity of female part-time employment grew by 16.0 per cent, whereas for men it declined by 12.6 per cent. The falling trends in skill intensity for men were consistent between 1971 and 1996,

but these were reversed between 1996 and 2001. Over this period the skill intensity of part-time male occupations grew by 1.6 per cent.

Figure 8.2 Total skill and knowledge intensity levels for part-time employment for men and women, 1971-2001



Source: Table 8.2.

The trends in the knowledge intensity for part-time occupations were similar to those of skills (Figure 8.2). The knowledge intensity of female part-time employment started from a lower base compared to male part-time employment, but by 1976 this had been overtaken by females. The increase in the knowledge intensity of female employment was 13.6 per cent, whereas the decline for males was 8.0 per cent. As with the case of skills, the falling trend in knowledge intensity was reversed between 1996 and 2001. Over this period the knowledge intensity of part-time employment for men grew by 1.5 per cent.

Overall, the increases in the indices of skill and knowledge intensity for full-time employment for men and women and for female part-time employees indicate that job growth in the Australian labour market is geared towards occupations that require high levels of skill and knowledge intensity. This may be interpreted as a process of skill-bias towards occupations that require high levels of skill and knowledge intensity. In contrast, the declines in skill and knowledge intensity for male part-time employment show that the demand for labour is declining in occupations that require lower levels of skill and knowledge intensity, indicating that male part-time employment may be experiencing a process of deskilling.

8.4 Changes to the Skill and Knowledge Intensity of Job Types in Australian Employment

The analysis continues the work conducted above by disaggregating changes occurring in male and female full-time and part-time occupations in terms of skill and knowledge intensity. This aims at understanding, just as with the GWA analysis, whether and to what extent the skill and knowledge intensity content of occupations is changing over time, in which part of the employment distribution these changes are occurring, whether they are more prominent in male or female full-time or part-time employment, and whether they reflect a pattern of skill and knowledge intensity bias in the demand for labour in different job types. In the exploration of these issues, a measure of the skill and knowledge intensity of occupations is constructed (in a similar way as GWA in Section 7.3) by taking into account the 46 skill and 33 knowledge descriptors. The procedure of analysis adopted here is that described in Section 6.5.2, and the measures used are obtained using Equations 6.2 and 6.3.

8.4.1 The skill and knowledge intensity of full-time employment

Tables 8.3 to 8.6 show the trends and changes in the composition of the skill and knowledge intensity of full-time employment in Australia. They show the number of full-time employed men and women arranged in deciles from highest to lowest for 1971 and 2001 and the percentage change in each decile for the census years starting from 1971 through to 2001. The occupations in each decile were ranked from highest to lowest according to the skill and knowledge intensity for each of the 340 Australian occupations. To allow for a comparison across time, the number of occupations was held constant according to the 1971 skill and knowledge intensity division of deciles. The last row shows the employment growth in each decile relative to the total employment growth and is calculated using Equation 6.3.

Close inspection of Tables 8.3 and 8.4 reveals the decile percentage change for the skill intensity of full-time male and female employees over the 1971-2001 period. For males, the strongest rises in skill were seen at the top three deciles which increased by 86.4, 33.0, and 13.1 per cent respectively. In comparison, the rise of skill intensity was stronger for women, where the top four deciles rose by 165.2, 83.2, 19.4 and 15.2 per cent.

Table 8.3 Number of male full-time employees and decile percentage change, arranged by skill intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	368,214	270,495	321,728	345,471	309,343	299,086	340,569	287,065	318,412	315,887
2001	306,548	209,096	305,849	299,023	242,960	264,419	367,434	352,119	459,515	638,753
Change (%)										
1971-1976	1.5	-2.0	-0.2	3.4	1.0	5.6	0.4	7.7	4.6	12.0
1976-1981	-5.1	-9.8	0.1	-2.5	-0.9	0.5	0.2	1.9	5.0	4.9
1981-1986	-9.7	-6.9	0.6	-4.5	-3.3	-3.0	-0.7	0.9	3.7	13.7
1986-1991	-11.6	-10.4	-4.7	-16.2	-12.3	-15.6	5.5	-6.3	0.9	26.9
1991-1996	7.0	-0.6	-3.3	3.1	-0.5	5.0	6.9	19.6	14.8	8.3
1996-2001	1.2	5.4	2.6	3.9	-7.0	-3.0	-4.2	-1.3	9.3	10.2
1971-2001	-16.7	-22.7	-4.9	-13.4	-21.5	-11.6	7.9	22.7	44.3	102.2
Change relative to total employment growth (%)										
	-23.3	*-28.7*	*-12.4*	*-20.2*	*-27.6*	*-18.5*	*-0.5*	*13.1*	*33.0*	*86.4*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

Table 8.4 Number of female full-time employees and decile percentage change, arranged by skill intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	130,181	108,302	115,202	115,298	117,870	107,483	115,752	115,596	113,840	116,692
2001	102,204	27,800	58,538	105,981	192,476	101,373	214,032	221,525	391,535	439,707
Change (%)										
1971-1976	0.5	-65.6	-41.6	11.7	10.2	-33.7	53.6	35.1	22.6	30.4
1976-1981	-8.4	-21.1	-19.3	-5.8	8.8	14.0	9.6	4.8	17.1	25.5
1981-1986	-7.9	-14.3	-11.3	7.2	10.5	12.9	14.3	8.1	17.2	23.3
1986-1991	-3.9	-3.8	-21.9	-6.1	-5.7	2.7	4.4	12.9	14.0	40.3
1991-1996	-0.7	16.3	-32.1	-15.9	19.0	-0.4	-2.1	15.0	32.1	27.4
1996-2001	-3.0	-1.4	-5.5	3.1	9.7	8.0	-5.9	-3.6	16.0	18.1
1971-2001	-21.5	-74.3	-49.2	-8.1	63.3	-5.7	84.9	91.6	194.0	325.5
Change relative to total employment growth (%)										
	-51.1	*-84.0*	*-68.3*	*-42.7*	*1.8*	*-41.2*	*15.2*	*19.4*	*83.2*	*165.2*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

As we move down the skill intensity distribution of male full-time employment, we can see that from the fifth highest decile to the lowest, the skill intensity of male full-time employment was in decline over the period. The strongest declines were at the second and fifth lowest decile, with falls of 28.7 and 27.6 per cent, respectively. In other deciles, declines ranged between 0.5 and 23.3 per cent. These declines are also quite consistent with those experienced by men in terms of GWA intensities. For

women, the changes in the lower deciles were similar to those of men, but were larger in magnitude.

Tables 8.5 and 8.6 show changes to the composition of the knowledge intensity of employment. The numbers in the last row of these tables are calculated using Equation 6.3. The knowledge intensity of male full-time employment increased in the top three deciles and declined in all others. For women, the picture was mostly similar to that of men, where the knowledge intensity of occupations increased in the top two and the sixth and seventh highest deciles. All other deciles declined in knowledge intensity.

Table 8.5 Number of male full-time employees and decile percentage change, arranged by knowledge intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	341,623	294,575	326,541	316,098	327,965	299,226	331,810	304,962	319,139	314,332
2001	240,300	266,907	290,633	297,022	320,962	302,393	345,325	350,028	463,300	568,846
Change										
1971-1976	- 4.1	-0.7	1.9	6.6	2.7	3.0	4.3	4.9	6.7	9.1
1976-1981	-9.3	-7.2	-4.9	1.5	4.6	-0.7	-1.0	4.6	1.6	5.3
1981-1986	-13.8	-2.4	-6.4	-1.8	-0.5	-2.4	-0.1	-0.8	7.5	11.2
1986-1991	-11.4	-2.0	-11.8	-8.4	-9.3	-4.7	-10.7	-5.6	1.6	23.7
1991-1996	3.0	5.4	6.7	-2.2	1.6	4.3	7.3	16.0	15.6	6.1
1996-2001	2.7	-2.5	4.4	-1.3	-0.7	1.9	5.4	-3.6	6.1	7.9
1971-2001	-29.7	-9.4	-11.0	-6.0	-2.1	1.1	4.1	14.8	45.2	81.0
Change relative to total employment growth (%)										
	-35.2	*-16.5*	*-18.0*	*-13.4*	*-9.8*	*-6.8*	*-4.1*	*5.8*	*33.8*	*66.8*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

The changes described above show a strong increase in demand for occupations that require high levels of skill and knowledge intensity. These jobs were concentrated in the top two deciles, where the relative demand rose sharply. For men, 61 per cent of growth in the skill index is attributed to nine occupations in the top decile. These occupations were computing professionals, general managers, project and program administrators, sales and marketing managers, accountants, secondary school teachers, computing support technicians, information technology managers and legal professionals. In terms of the knowledge intensity index for males, 64 per cent of employment growth was concentrated in the top two deciles. Two occupations not

listed above that significantly contributed to the rise included primary school teachers and production managers.

For women, in terms of skill intensity the top two deciles accounted for 43 per cent of total employment growth. Examples included general managers, computing professionals, sales and marketing managers, project and program administrators and office managers.

Table 8.6 Number of female full-time employees and decile percentage change, arranged by knowledge intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	118,382	117,791	115,642	104,441	109,358	125,191	123,550	121,009	110,071	110,785
2001	67,083	99,253	128,505	105,266	58,339	206,716	267,426	157,460	300,347	464,776
Change										
1971-1976	-4.9	-10.8	6.9	-41.9	41.4	19.4	28.2	12.8	28.1	30.9
1976-1981	-15.7	-1.6	-7.2	8.4	-13.7	3.4	11.5	7.1	16.8	30.4
1981-1986	-8.2	0.7	2.6	1.4	-3.6	5.6	17.4	9.3	22.6	18.7
1986-1991	-10.0	-6.6	-2.6	13.4	-20.9	5.7	5.9	6.6	11.7	38.3
1991-1996	-4.4	6.3	0.0	24.0	-25.0	2.2	16.1	1.1	20.3	27.6
1996-2001	-10.5	-4.0	12.1	12.2	-23.6	17.3	4.9	-8.5	10.7	17.4
1971-2001	-43.3	-15.7	11.1	0.8	-46.7	65.1	116.5	30.1	172.9	319.5
Change relative to total employment growth (%)										
	-64.7	*-47.5*	*-30.7*	*-37.2*	*-66.8*	*2.9*	*34.9*	*-18.9*	*70.1*	*161.5*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

In terms of knowledge intensity the following occupations accounted for 46 per cent of total employment growth which was clustered in the top two deciles: primary school teachers, project and program administrators, accountants, marketing and advertising professionals and general managers.

Comparisons of changes in the distribution of skills and knowledge show that the shapes of the two distributions are quite similar. Hence, what we see is a strong bias in demand for full-time jobs that require high levels of skill and knowledge intensity. This bias is quite consistent with the rise in demand in occupations that require high GWA intensity levels.

8.4.2 The skill and knowledge intensity of Australian part-time employment

This section details changes to the employment distribution in terms of the skill and knowledge intensities of part-time employment. Inspection of the first two rows of Tables 8.7 to 8.10 shows that the number of male and female employees in each decile of skill and knowledge intensity increased significantly over the period.

Table 8.7 Number of male part-time employees and decile percentage change, arranged by skill intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	15,576	15,775	14,536	15,683	15,035	17,449	13,208	15,140	15,746	14,704
2001	134,216	86,751	135,207	100,764	102,151	81,545	57,305	53,550	70,343	75,269
Change										
1971-1976	11.7	5.5	0.1	-2.4	-7.4	-14.6	-10.7	-1.8	6.6	-0.9
1976-1981	160.3	87.5	264.0	177.2	273.5	225.9	160.3	165.3	147.5	118.4
1981-1986	30.2	42.2	-10.7	26.4	7.7	12.4	0.6	-2.5	19.3	11.0
1986-1991	29.0	30.0	29.8	21.9	11.1	6.7	15.0	2.2	-9.8	24.1
1991-1996	46.1	28.0	67.8	31.1	36.8	29.3	25.8	9.3	30.8	24.8
1996-2001	20.8	17.4	31.2	17.6	20.1	8.3	28.1	24.7	20.3	37.5
1971-2001	761.7	449.9	830.2	542.5	579.4	367.3	333.9	253.7	346.7	411.9
Change relative to total employment growth (%)										
	46.8	*-6.3*	*58.5*	*9.5*	*15.8*	*-20.4*	*-26.1*	*-39.7*	*-23.9*	*-12.8*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

The pattern is different when we consider changes in employment deciles relative to changes in total employment growth. For men, the results show (Tables 8.7 and 8.9) that the skill and knowledge intensity of occupations declined in the higher deciles and increased in the lower ones. For women (Tables 8.8 and 8.10), the pattern of change was similar to that of full-time employment.

Table 8.8 Number of female part-time employees and decile percentage change, arranged by skill intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	35,000	42,412	34,896	37,361	37,514	32,717	42,389	39,221	31,222	41,623
2001	120,870	94,585	80,713	19,427	361,591	215,411	223,785	219,612	135,986	280,671
Change										
1971-1976	35.6	31.4	32.8	-82.3	145.4	45.7	51.1	50.8	42.0	53.2
1976-1981	38.8	18.2	19.3	44.8	31.7	49.1	45.4	47.8	92.4	64.3
1981-1986	23.8	22.2	14.9	13.4	45.6	38.6	29.6	16.8	11.6	34.2
1986-1991	23.7	15.1	11.5	16.9	29.9	29.4	25.5	31.9	7.8	29.0
1991-1996	18.5	1.5	5.5	21.1	28.3	40.6	30.3	41.1	4.8	30.6
1996-2001	1.1	0.6	8.1	26.0	22.9	20.1	13.4	15.6	26.4	18.5
1971-2001	245.3	123.0	131.3	-48.0	863.9	558.4	427.9	459.9	335.5	574.3
Change relative to total employment growth (%)										
	-26.2	*-52.4*	*-50.6*	*-88.9*	*105.9*	*40.6*	*12.8*	*19.6*	*-7.0*	*44.0*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

Table 8.9 Number of male part-time employees and decile percentage change, arranged by knowledge intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	15,298	15,548	19,753	10,901	15,009	18,878	13,339	13,651	15,318	15,159
2001	82,443	76,853	173,931	75,299	139,306	80,122	85,593	44,937	68,434	70,183
Change										
1971-1976	-12.3	-8.9	14.6	17.8	0.0	-15.1	6.7	12.6	-8.0	-13.9
1976-1981	181.9	214.2	159.1	159.1	218.3	190.1	158.5	169.2	114.5	198.8
1981-1986	6.2	7.3	30.0	21.0	11.6	11.2	8.6	1.0	21.6	5.2
1986-1991	26.4	10.8	29.5	20.9	23.3	10.8	18.9	-11.9	11.8	9.0
1991-1996	33.3	30.2	46.4	33.3	59.1	16.8	37.1	13.4	31.3	26.6
1996-2001	21.9	11.6	20.3	16.0	33.1	19.7	31.6	7.6	26.9	23.9
1971-2001	438.9	394.3	780.5	590.7	828.2	324.4	541.7	229.2	346.8	363.0
Change relative to total employment growth (%)										
	-8.2	*-15.8*	*50.0*	*17.7*	*58.1*	*-27.7*	*9.3*	*-43.9*	*-23.9*	*-21.1*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

In summary, these findings show increased demand for occupations that require high levels of skill and knowledge intensity for women in part-time employment. These changes are also similar to those of full-time employment, where the demand for high skill and knowledge intensity increased at the top but declined at the bottom of the distribution. For part-time employment for men, the skill and knowledge intensity of jobs declined at the top of the distribution and increased at the bottom. These changes can be interpreted as a decline in demand for occupations that require high levels of

skill and knowledge intensity, and an increase in demand for occupations that require low levels of skill and knowledge intensity. These employment changes are similar to those seen in our analysis of GWA intensity for part-time jobs in Chapter 7.

Table 8.10 Number of female part-time employees and decile percentage change, arranged by knowledge intensity, 1971-2001

Year	*Low intensity deciles*									*High intensity deciles*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1971	39,066	36,987	36,813	37,493	37,938	37,994	38,047	37,408	34,847	37,760
2001	127,143	120,167	99,489	203,403	65,796	282,015	249,665	174,369	177,757	252,847
Change										
1971-1976	18.1	3.7	60.2	43.5	3.0	69.8	65.4	48.8	52.0	45.8
1976-1981	42.0	30.9	19.8	33.7	23.2	36.6	42.0	48.4	78.9	78.5
1981-1986	18.7	24.4	17.8	37.9	26.0	32.3	36.5	27.2	20.0	31.6
1986-1991	20.7	30.8	13.8	33.2	6.2	37.9	31.9	21.7	7.5	27.5
1991-1996	23.4	28.7	5.8	29.5	7.9	39.8	31.1	18.5	17.6	31.0
1996-2001	9.7	14.2	-0.7	18.8	-5.3	25.4	18.4	15.0	23.5	17.1
1971-2001	225.5	224.9	170.3	442.5	73.4	642.3	556.2	366.1	410.1	569.6
Change relative to total employment growth (%)										
	-30.5	*-30.6*	*-42.3*	*15.9*	*-63.0*	*58.5*	*40.2*	*-0.4*	*9.0*	*43.0*

Note: 'Not stated' and 'inadequately described' not included in calculations. *Source:* ABS census of population, 1971 to 2001, and author's calculations.

8.5 The Skill and Knowledge Requirements of Australian Occupations

The themes emerging from the decile analysis of skill and knowledge intensities can be looked at from a different perspective. An alternative approach is to examine changes in specific skill and knowledge areas of Australian occupations, which it provides valuable information as to how the worker requirements of occupations have changed.

To understand the effect of these changes, an analysis of the different types of skill and knowledge requirements of Australian occupations is carried out. This provides an indication of which particular areas of skill and knowledge have increased in demand for full-time and part-time work and which have not. To understand how the occupational requirements have changed, seven areas of skill and ten areas of knowledge are examined over the period.

8.5.1 Describing skill and knowledge areas

As described in Chapter 6, the O*NET defines skills as a set of general procedures that underlie the effective acquisition and application of knowledge in various domains of endeavour. It organises the skill taxonomy with 46 descriptors divided into two areas known as basic skills and cross-functional skills. Basic skills are then further divided into two areas or clusters made up of content skills and process skills. Cross-functional skills consist of five areas classified as social skills, complex problem solving skills, technical skills, systems skills and resource management skills. The seven skill areas that describe the skill requirements of Australian occupations examined in this section are detailed in table 8.11.

Table 8.11 Description of skill areas

Label	*Fuller description of skill taxonomy/area*	*Number of descriptors*
Content Skills	Provides information on the background structures needed to work with and acquire more specific skills in a variety of different domains.	6
Process Skills	Lists the procedures that contribute to the more rapid acquisition of skill and knowledge across a variety of domains.	4
Social Skills	Details the developed capacities used to work with people to achieve goals.	6
Complex Problem Solving Skills	Provides information on the developed capacities used to solve novel, ill-defined problems in complex, real-world settings.	6
Technical Skills	These skills relate to the developed capacities used to design, set up, operate and correct malfunctions involving application of machines or technological systems.	12
Systems Skills	Provides information on the developed capacities used to understand, monitor and improve socio-technical systems.	6
Resource Management Skills	Lists the developed capacities used to allocate resources efficiently.	4

Source: Mumford et al. (1999).

Knowledge, on the other hand, is defined in the O*NET as a set of collected but related facts, information and principles about a particular area of work. The knowledge taxonomy is made up of 33 descriptors. For this analysis, attention is paid to ten areas, which describe the knowledge requirements of Australian occupations. These are detailed in Table 8.12.

Table 8.12 Description of knowledge areas

Taxonomy	*Taxonomy description*	*Number of descriptors*
Business and Management Knowledge	Refers to principles and facts related to business administration and accounting, human and material resource management in organisations, sales and marketing, economics, and office information and organising systems.	6
Manufacturing and Production	Refers to knowledge of principles and facts related to the production, processing, storage and distribution of manufactured and agricultural goods.	2
Engineering and Technology	This area refers to knowledge and design, development and application of technology for specific purposes.	5
Mathematics and Science	This includes knowledge of the history, theories, methods and applications of physics, biology, mathematics and geography for specific work purposes.	7
Health Services	Relates to knowledge of principles and facts regarding diagnosing, curing and preventing disease, and improving and preserving physical and mental health and wellbeing.	2
Education and Training	This knowledge cluster describes instructional methods and training techniques including curriculum design principles, learning theory, group or individual teaching techniques, design of individual development plans, and test design principles.	1
Arts and Humanities	Refers to knowledge of facts and principles related to the branches of learning concerned with human thought, language and the arts.	5
Law and Public Safety	This cluster is made up of the knowledge of regulations and methods for maintaining people and property free from danger, injury or damage, the rules of public conduct established and enforced by legislation, and the political process establishing such rules.	1
Communications	It describes the knowledge of the science and art of delivering information.	2
Transportation	Refers to the knowledge of principles and methods for moving people or goods by air, rail, sea or road, including their relative costs, advantages and limitations.	2

Source: Jeanneret et al. (1999).

The methodology used in this analysis is explained in Section 6.5.3 and is the same as that employed for worker activities in Section 7.4. The indices for each of the skill and knowledge areas are obtained by applying Equation 6.4.

8.5.2 The skill and knowledge requirement trends for full-time employment in Australia

Tables 8.13 and 8.14 detail changes to the seven areas of skill and the ten areas of knowledge in full-time employment for men and women for the 1971-2001 period. Figures 8.3 and 8.4 show changes in terms of the skill and knowledge intensity areas for full-time employment. All areas of skill increased for males and females, whereas for knowledge seven of the ten areas increased for men and eight for women.

Skill rankings and change in full-time employment

The skill intensity of Australian occupations increased in all areas, ranging from 1.4 to 35.5 per cent for men and from 8.8 to 112.0 per cent for women over the period. For all the skill areas, the increase was, as in the case of GWA areas, more pronounced for women than for men.

In terms of the ranking of skill areas (Column 3 for men and Column 6 for women in Table 8.13), the three most important for both men and women were content skills, complex problem solving skills, and process skills. *Content skills* were ranked highest of all the skill areas for men and women. Content skill is concerned with the background structures that are needed for the successful completion of job tasks and the acquisition of new and more specific skills needed to operate effectively at work. It is made up of the following skills: reading and comprehension, active listening, writing, speaking, mathematics, and science. The background structures needed for successful work performance are reading and listening, which represent the two major ways in which information is conveyed between individuals at work. These skills provide the necessary structures that assist in the acquisition of more specific skills and knowledge in different work situations. This area of skill increased by 21.2 and 37.7 per cent for men and women, respectively (Table 8.13). As the nature of Australian jobs changes and new technologies are introduced, these basic skills assist employees in adapting to new work situations and challenges.

Complex and problem solving skills ranked second for men and women in full-time employment and experienced significant increases, particularly for women. This skill area is concerned with solving ill-defined problems in complex work settings, and occurs in virtually all jobs. The ranking and increase in intensity indicates that this skill area is in high demand in full-time work for men and women and portrays the type of challenges people face in employment.

The third ranked area is process skills, which forms part of the basic skills classification. This area rose by 31.2 per cent for men and 84.5 per cent for women (Figure 8.3). It is concerned with the procedures that contribute to the acquisition of skill and knowledge in a variety of work situations, and with the application and use of a number of basic skills. These are critical thinking, the application of active

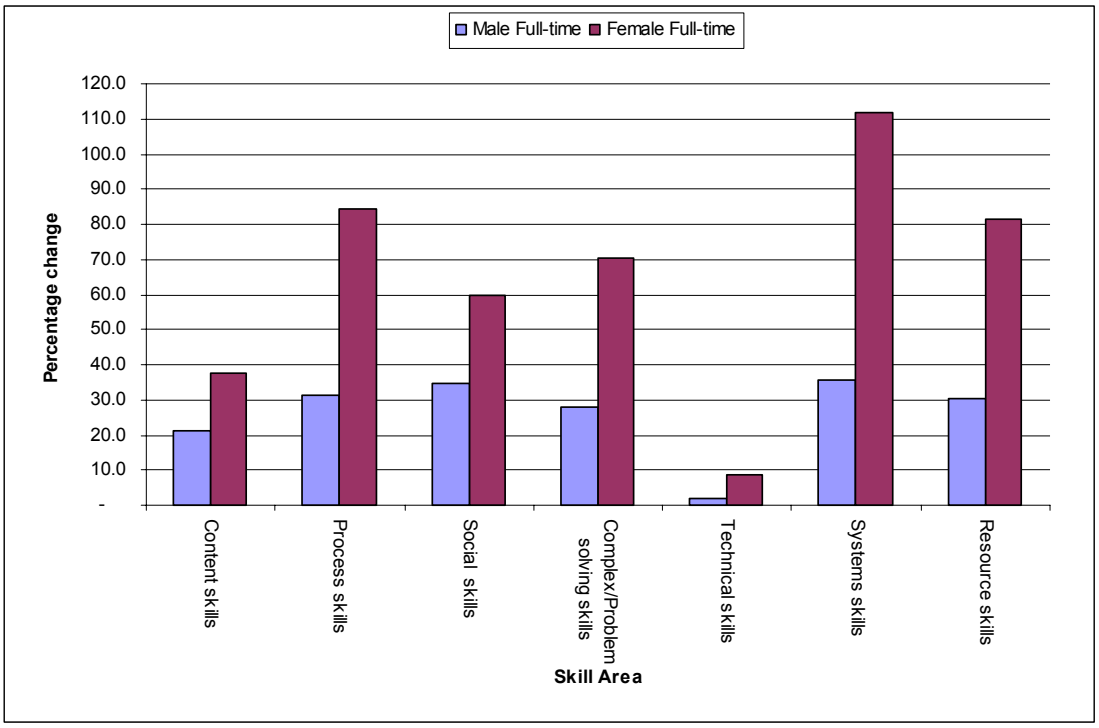
learning strategies when learning or teaching new things to colleagues at work, or the assessment of how well a particular job or task is being performed.

Table 8.13 Skill area requirement scores and change for male and female full-time employment, 1971-2001

Skill Area	*Male full-time*			*Female full-time*		
	1971	*2001*	*Change (%)*	*1971*	*2001*	*Change (%)*
Content skills	20.3	24.6	21.2	20.5	28.3	37.7
Process skills	15.4	20.2	31.2	11.7	21.5	84.5
Social skills	10.4	14.0	34.6	11.5	18.3	59.8
Complex/Problem solving skills	16.7	21.4	28.0	13.0	22.1	70.5
Technical skills	11.6	11.4	1.4	5.7	6.2	8.8
Systems skills	13.0	17.7	35.5	7.9	16.7	112.0
Resource skills	11.0	14.3	30.2	8.4	15.2	81.2

Source: Author's calculations.

Figure 8.3 Change in skill area requirement for full-time employment, 1971-2001



Source: Table 8.13.

Systems skills ranked fourth in terms of importance and increased the most for men (35.5 per cent) and women (112.0 per cent) over the period. This skill area is concerned with the developed capacities used to understand, monitor and improve socio-technical systems. Socio-technical systems are an approach to complex organisational work design that recognises the interaction between people and technology in workplaces. This type of skill requires employees to develop particular

work systems and to find ways of improving them over time. It also requires them to identify work procedures that need to be changed in order to improve productivity.

Resource management skills ranked fifth in terms of importance and experienced an increase of 30.2 per cent for men and 81.2 per cent for women, suggesting that the developed capacities used to allocate resources efficiently in Australian jobs have become increasingly important. These include skills in time management, management of financial and material resources, and management of personnel resources which have become necessary attributes of many full-time occupations in Australia.

Social skills were ranked sixth in terms of importance and these received high increases for men (34.6 per cent) and for women (59.8 per cent) respectively. This skill area is concerned with the developed capacities used to work with people and needed to achieve goals in work related situations. The large increases indicate that employees require a set of skills that are concerned with persuading colleagues in doing things differently or taking different approaches to work; negotiation skills required to bring employees together to reconcile differences or to solve work-related issues; coordination of the work of colleagues; teaching colleagues new work systems or procedures; and skills that are reliant on the provision and delivery of services.

Technical skills ranked the lowest for both men and women in full-time employment and experienced a small increase for women (8.8 per cent) and men (1.4 per cent). This skill area is concerned with the developed capacities used to design, set up, operate and correct malfunctions involving the use of machinery and technological systems. It includes technology design, equipment selection and installation, programming of computers for different purposes, testing of equipment, and product and equipment maintenance.

Knowledge rankings and change in full-time employment

Changes to the knowledge areas in full-time employment were also significant. In terms of individual areas, the two most important are business and management practices, and health services (see Columns 3 and 6 of Table 8.14). The highest ranked area is knowledge of health services, which increased by 26.4 per cent. For women this knowledge area ranked second, but experienced the largest increase over

the period (119.8 per cent). Health services knowledge is related to medicine, dentistry and therapy and counselling. Furthermore, it relates to the principles and facts regarding the diagnosis, cure and prevention of disease, and ensuring that the mental and physical health and wellbeing of individuals and the population at large are maintained.

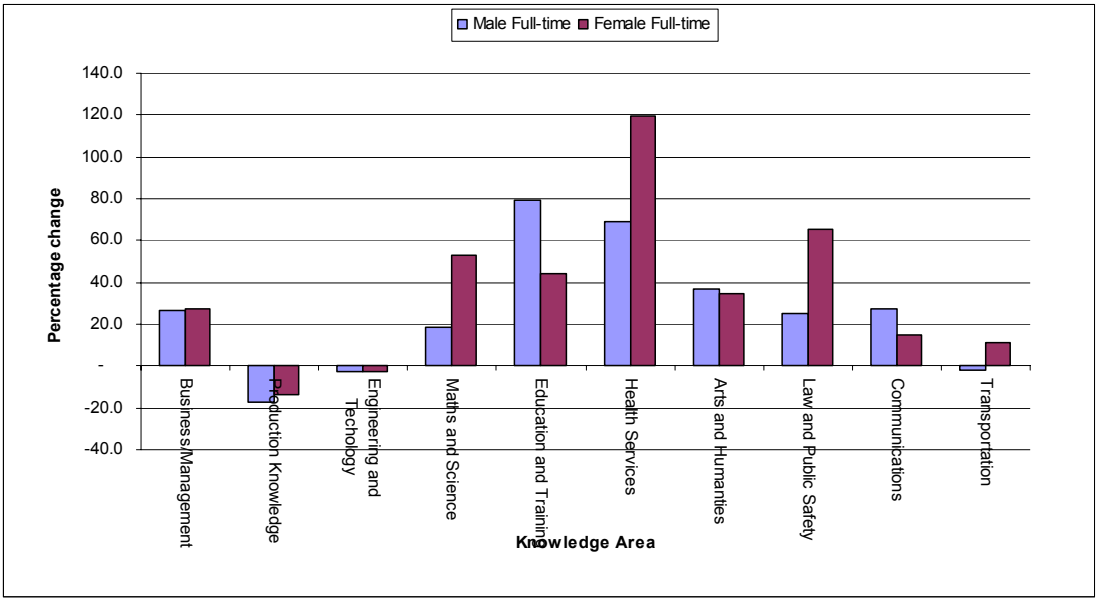
Table 8.14 Knowledge area requirement scores and change for male and female full-time employment, 1971-2001

Knowledge Area	*Male full-time*			*Female full-time*		
	1971	*2001*	*Change (%)*	*1971*	*2001*	*Change (%)*
Business/Management	10.1	12.8	26.4	14.5	18.4	27.5
Manufacturing/Production	7.6	6.3	-17.0	3.9	3.4	-13.4
Engineering and Technology	11.8	11.4	-2.9	5.0	4.8	-2.4
Maths and Science	5.8	6.9	18.5	5.4	8.2	52.8
Education and Training	1.2	2.1	79.3	4.1	6.0	44.1
Health Services	7.6	12.9	69.0	8.2	18.0	119.8
Arts and Humanities	3.1	4.3	36.5	4.6	6.2	35.0
Law and Public Safety	7.0	8.8	25.4	5.2	8.6	65.5
Communications	4.5	5.8	27.5	6.7	7.7	15.1
Transportation	5.9	5.8	-2.3	3.2	3.6	11.2

Source: Author's calculations.

Business and management knowledge ranked highest for women and second highest for men and increased by 27.5 and per cent 26.4 per cent, respectively (Figure 8.4). An explanation for this is that increasingly employees require knowledge in new and innovative management and business techniques. Many workplaces now require their employees to possess knowledge of the principles and facts related to the successful operation of businesses and their correct administration, especially at a time when the role of many occupations and the demands of work are changing rapidly. Many employees are now required to possess knowledge in areas such as human and material resource management, sales and marketing, economics and office information, and organisational systems. It is thus no surprise to see the importance of this knowledge requirement in terms of its ranking and change over the period. Changes to this knowledge area are consistent with changes in the GWA requirements in the area of administration, and with the increase in the area of systems skills.

Figure 8.4 Change in knowledge area requirement for full-time employment, 1971-2001



Source: Table 8.14.

Manufacturing and production declined for men and women and was ranked fifth for men and tenth for women. It declined by 17.0 per cent for men and 13.4 per cent for women, the two largest declines over the period. This knowledge is concerned with the principles and facts related to the production, processing, storage and distribution of products ranging from manufacturing to farming. Its decline is closely tied to the decline in manufacturing in Australia, accompanied by a corresponding shift towards the services sector. Another reason is that the farming sector has faced many significant changes over the last two to three decades. These changes have manifested themselves in the form of increasing farm sizes, declines in employment opportunities for farm employees and use of higher levels of technology for crop production and animal husbandry. This decline in knowledge intensity in full-time work is consistent with the decline in work activities that require physical activities.

Knowledge in the area of engineering and technology ranked third highest for men and eighth for women. In this area, the knowledge intensity declined for men by 2.9 per cent and 13.4 per cent for women. This knowledge is concerned with the design, development and application of technology in different settings. It consists of knowledge related to engineering and technology, design, building and construction, mechanical, and computer and electronics. The decline can be attributed to a shift in job creation away from manufacturing towards the service sector.

Transportation was also an area which experienced a decline for men (2.3 per cent) but an increase for women (11.2 per cent). This was ranked seventh in terms of importance for men and ninth for women. It is concerned with the knowledge of principles and methods for moving people or goods by air, rail, sea or road, including their relative costs, advantages and limitations. The increase in this area of knowledge indicates that women are branching out into areas of employment that were commonly the domain of men.

Maths and science ranked sixth highest for men and fourth for women. This area of knowledge increased by 18.5 per cent for men and 52.8 per cent for women. It is concerned with the application of physical, biological, social, mathematical and geographical knowledge in occupations. These changes show that mathematical and scientific knowledge are becoming important aspects of full-time employment for both men and women. It also indicates how complex and knowledge intensive occupations have become over the last three decades.

Education and training ranked ninth and tenth for men and women, respectively. Both areas experienced large increases of 79.3 per cent for men and 44.1 per cent for women. They are concerned with instructional methods and training techniques designed to improve productivity. This knowledge requirement has become increasingly important as a result of constant changes in work practices and the need to adapt to a rapidly evolving work environment. More employees are now required to participate in training programs. Furthermore, this is a sign that workplaces and occupations have become more knowledge intensive.

Knowledge of the law and public safety was ranked fourth for men and third for women and experienced increases of 25.4 per cent for men and 65.5 per cent, respectively. This area is concerned with having an understanding of the regulations and methods for maintaining people and property free from danger, injury or damage. The sharp increases in this area of knowledge intensity in full-time employment may be due to the emergence and rise of the security industry in Australia since the late 1980s, and an increase in awareness and importance of health and safety issues at work.

Arts and humanities ranked sixth for both men and women and experienced increases of 36.5 per cent for men and 35.0 per cent for women. This area of knowledge is concerned with the facts and principles related to the branches of learning that deal with human thought, language and the arts. It is made up of variables that include knowledge of English and foreign languages, fine arts, history and archaeology, and philosophy and theology. Its increasing importance in employment creation is due to the significance of learning and instructing on the job and is closely related to skill areas such as content and process skills.

Finally, communication ranked seventh for men and fifth for women and increased in intensity for men (27.5 per cent) and women (15.1 per cent). This area of knowledge is concerned with the technical areas of telecommunications and the knowledge of media production, communication and dissemination techniques used to inform and entertain via written, oral or visual media. The increasing importance of communication in workplaces is reflected in these increases over the last three decades.

8.5.3 The skill and knowledge requirements of part-time employment

Inspection of Table 8.15 and Figure 8.5 shows that the trends in areas of skill intensity for part-time work were different for men and women. This contrasts with full-time work, where men and women experienced similar trends.

Table 8.15 Skill area requirement scores and change for male and female part-time employment, 1971-2001

Skill Area	*Male part-time*			*Female part-time*		
	1971	*2001*	*Change (%)*	*1971*	*2001*	*Change (%)*
Content skills	21.7	19.7	-9.3	20.2	23.6	16.8
Process skills	17.5	13.9	-20.6	11.8	14.8	24.7
Social skills	13.0	11.3	-13.5	12.3	14.8	20.2
Complex/Problem solving skills	17.9	14.6	-18.1	12.7	15.0	17.9
Technical skills	9.7	8.8	-8.9	5.5	4.8	-12.5
Systems skills	14.4	11.1	-22.8	7.9	9.9	25.0
Resource skills	12.2	8.9	-27.0	8.5	9.1	6.2

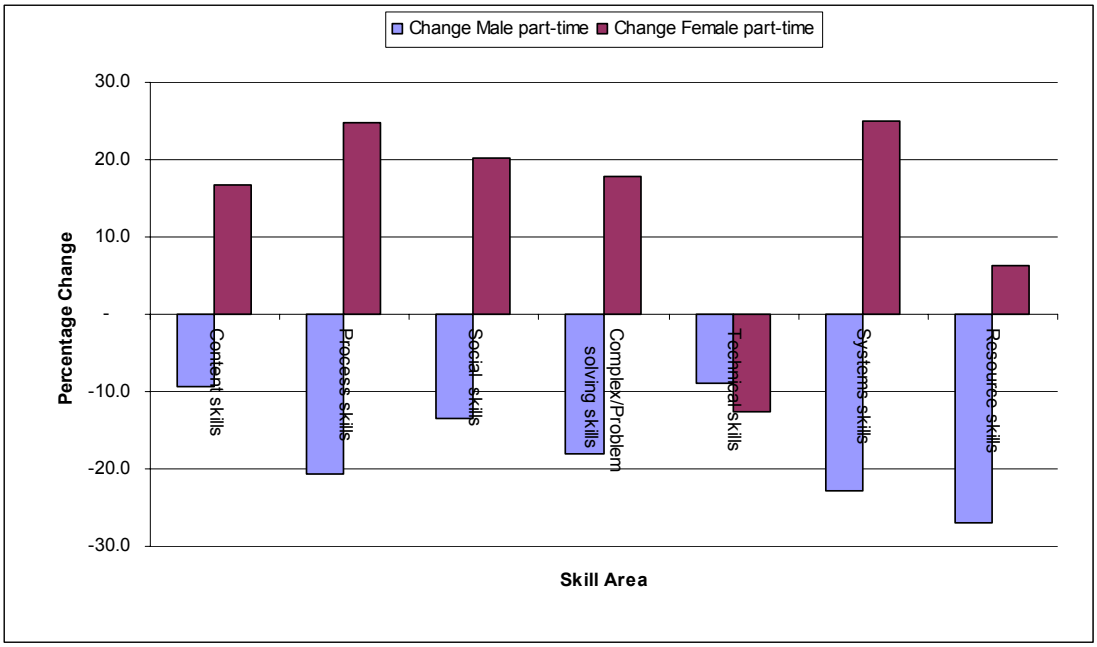
Source: Author's calculations.

For male part-time employment, unlike full-time employment, all skill areas declined by between 9.3 and 27.0 per cent. This shows that the quality of part-time employment for men has declined considerably in a skill requirement sense. The

largest decline was in resource management skills, indicating that part-time employees are provided with less autonomy and decision making opportunities than full-time employees. For women this skill requirement rose by 6.3 per cent, indicating that this type of skill is more important in full-time than part-time work. The strongest increase for women was in the area of systems skills (25.0 per cent), but this declined for men (22.8 per cent). This was the second highest decline in skill intensity for male part-time employees, showing that this type of work requires less developed capacities needed to understand, monitor and improve socio-technical systems. The next highest rise for females was in the area of process skills (24.7 per cent), while for men it fell (20.6 per cent). This shows that skills that require active learning, use of different learning strategies, monitoring and critical thinking have become less important for men in part-time work but more important for women. Social skills also rose for women and declined for men. For men, this shows that their work requires less negotiation, coordination and service provision than for women.

Complex problem solving declined for men but increased for women. This suggests that the background structures needed to work with and acquire more specific skills have become less important for men. Content skills increased for women but declined for men, while technical skills declined for both men and women, indicating the declining importance of technical skills in part-time work.

Figure 8.5 Change in skill area requirement for part-time employment, 1971-2001



Source: Table 8.15.

Inspection of Table 8.16 also reveals different trends in terms of changes to knowledge areas, with six of the ten declining for men and three for women. Manufacturing and production, and engineering and technology knowledge, declined the most for men and women. This may be attributed to the declining importance of manufacturing in Australia. The third area to decline for women was transportation, but this area experienced the opposite trend for men, and rose by 5.4 per cent.

Five areas of knowledge registered opposite trends for men and women. These were business and management knowledge, mathematical and scientific knowledge, arts and humanities, transportation, and law and public safety. These opposite trends indicate that, in terms of employment creation, these areas of knowledge are becoming more relevant for women than for men.

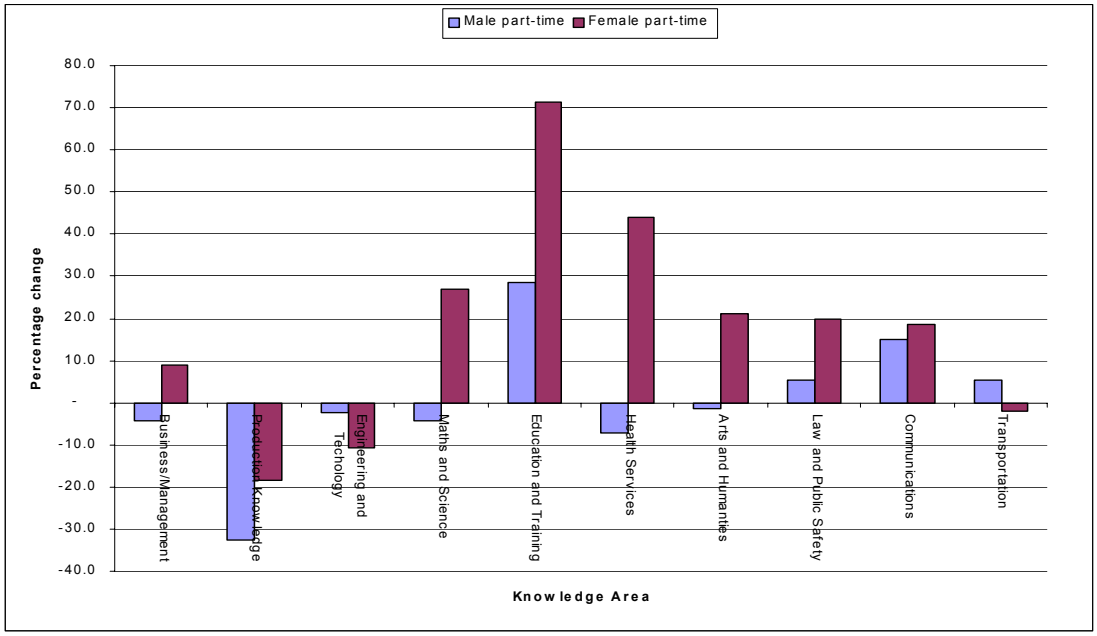
Figure 8.6 shows that three areas of knowledge increased for men and women in part-time employment: education and training, communication, and law and public safety. In summary, the findings of this analysis suggest that part-time employment creation for women favours jobs that require more skill and knowledge intensive areas, whereas for men, employment creation favours occupations that require low skill and knowledge intensity areas.

Table 8.16 Knowledge area requirement scores and change for male and female part-time employment, 1971-2001

Knowledge Area	*Male part-time*			*Female part-time*		
	1971	*2001*	*Change (%)*	*1971*	*2001*	*Change (%)*
Business/Management	11.1	10.6	-4.1	14.3	15.6	8.7
Manufacturing/Production	7.8	5.2	-32.8	3.4	2.8	-18.5
Engineering and Technology	8.5	8.3	-2.5	4.8	4.3	-10.8
Maths and Science	6.2	5.9	-4.4	5.7	7.2	27.1
Education and Training	1.8	2.4	28.5	3.9	6.7	71.2
Health Services	11.2	10.4	-7.1	9.6	13.8	44.1
Arts and Humanities	3.7	3.7	-1.4	4.3	5.2	21.0
Law and Public Safety	6.8	7.2	5.4	5.8	6.9	20.0
Communications	4.5	5.1	14.9	6.1	7.2	18.5
Transportation	6.1	6.4	5.4	3.3	3.2	-2.0

Source: Author's calculations.

Figure 8.6 Change in knowledge requirement for part-time employment, 1971-2001



Source: Table 8.16.

8.5.4 Interpreting changes to skill and knowledge areas

The analyses conducted in sections 8.5.2 and 8.5.3 provide information about which skill and knowledge areas have increased in demand and which have not. For full-time employment, increases in demand have occurred in all areas of skill. The most important increases relate to four areas: systems skills, technical skills, social skills and process skills. These increases in demand have been of a larger magnitude for women than for men. Similarly, the increases in demand for knowledge areas have been stronger for women.

Seven of these ten areas increased for men, while eight increased for women. The derived demand for knowledge increased the most in the areas of health and education and training for men and women. Three other areas which grew significantly were business and management, arts and humanities, and law and public safety. These increases are closely related to increases in the demand for system skills, resource skills and process skills. They are similar to the increases in demand for worker activities that involve coordination and management.

Demand for knowledge intensity declined in two areas for men and women, namely, production knowledge, and engineering and technology knowledge. These declines are consistent with the decline in physical and manual work activities found in full-

time employment and may reflect a decline in the relative importance of the manufacturing sector in Australia over the last 30 years.

Part-time employment for men experienced different trends to those found in full-time employment for skill and knowledge areas. Women in part-time work experienced similar trends of increasing demand in skill and knowledge areas as those found in full-time employment. The demand in part-time work for men declined in all of the seven skill areas and rose only in three of ten knowledge areas. These changes show that skill and knowledge areas in part-time employment for men have declined in importance relative to those of part-time work for women, and full-time work for men and women.

8.6 Conclusion

The analysis conducted in this chapter on skill and knowledge intensity changes to the composition of Australian employment reveals different trends for full-time and part-time work.

The index of skill and knowledge intensity increased for males and females in full-time employment, with the increase in the index for females being more than twice that for males. In part-time employment, the index rose for women but declined for men. These changes are quite consistent with those found in the analysis of worker activities. Changes to the index in full-time work have been driven by employment growth in occupations that require high levels of skill and knowledge intensity. The increase in the index for female part-time employment also appears to be driven by the same employment growth pattern. Conversely, for male part-time work, the decline in the index seems to be driven by increases in demand for occupations that require low levels of skill and knowledge intensity. These changes, as in the case of full-time employment, are quite similar to those found for worker activities in Section 7.2.

The decile analysis conducted in Section 8.4 also showed different trends for men and women in full-time and part-time employment. For men in full-time work, growth generally occurred in the top three deciles of skill and knowledge intensity, but declined in most others. The strong increase in skill and knowledge intensity in these

deciles indicates increased relative demand for occupations that require high levels of skill and knowledge intensity in full-time work.

Full-time and part-time employment for women experienced similar patterns of change in the skill and knowledge intensity of occupations, where the demand for occupations requiring high levels of skill and knowledge intensity rose at the top but declined at the bottom of the distribution. Unlike part-time work for women, men in part-time employment experienced declines in the skill and knowledge intensity of occupations at the top of the distribution and increases at the bottom. This shows a decline in the demand for part-time occupations requiring high levels of skill and knowledge intensity and an increase in those that require low levels.

In terms of our analysis of skill intensity areas, it was found that full-time employment experienced increases in all areas for both men and women. This shows that all the O*NET skill areas have increased in demand for the period. The knowledge intensity analysis, on the other hand, found that for men it increased in seven out of ten areas, while for women the growth was in eight areas. The declines for men occurred in transportation, engineering and technology, manufacturing and production knowledge. For women it occurred in engineering and technology, and manufacturing and production knowledge, indicating a decline in derived demand for these knowledge areas. These declines were also consistent with falls in work activities in the area of physical work, which can also be attributed to the declining importance of the manufacturing sector.

Part-time employment for men experienced different trends to full-time employment. All the skill intensity areas declined quite significantly, indicating that part-time employment for men is undergoing a period of deskilling. Women experienced increases in all skill areas, with the exception of technical skills. In terms of knowledge intensity areas, the demand for part-time employment for men declined in six out of ten areas, while that for women fell in only three areas. This indicates that part-time employment for women is more knowledge intensive than for men.

Part D:

Analysis and Findings

Chapter 9
Skill-Bias in the Demand for Labour in Australia

9.1 Introduction

The analysis conducted in the previous two chapters reveals that the O*NET is a valuable resource that can be applied in the analysis of labour market change in Australia. It found that the demand for labour increased in full-time employment that requires high levels of GWA, knowledge and skill intensity. This trend was also seen in female part-time employment. Conversely, the demand for labour declined for occupations in full-time employment and female part-time employment that required low levels of GWA, knowledge and skill intensity. For male part-time employment, the demand for labour increased in occupations that required low levels of GWA, knowledge and skill intensity, and fell in occupations that needed high levels of GWA, knowledge and skill intensity.

As discussed in Chapter 3, a feature of labour market change in Australia has been the rapid rise in part-time and casual employment (Norris, 2000, p. 57; Vanden Heuvel and Wooden, 2000), accompanied by a corresponding decline in permanent full-time employment (Borland et al., 2001, p. 11). Aungles et al. (1993) concluded that employment growth between 1971 and 1986 resulted in a general upskilling of the workforce. Research conducted by Sheehan and Dunlop (1998) showed that the evidence for upskilling was not sufficiently clear, while Cully concluded that 'there appears to be an increasing polarisation in the Australian labour market between jobs that are high-skilled (high paid) and jobs that are unskilled (low paid)' (1999, p. 103). More recent work by Wooden (2000a) and Keating (2003) found that the demand for labour has favoured occupations that require higher levels of skill and that the economy has experienced generalised upskilling of the workforce.

In light of the conflicting evidence, this chapter explores a number of central questions related to changes seen in the pattern of job creation in the labour market. Principally following the approach by Cully (1999) and Wooden (2000a), I explore whether Australia is experiencing upskilling in the demand for labour.

9.2 Skill-Bias in the Demand for Labour

Skill-bias is a proposition that suggests that the demand for labour has become more skill intensive and that there has been a shift in demand towards skilled workers and away from less skilled workers. Thus, if a process of upskilling is occurring, 'changes in relative employment levels (and relative wages) have favoured more highly skilled workers at the expense of relatively less skilled', (Wooden, 2000a, p. 191).

In most studies about changes in the skill composition of labour, there seems to be consensus that nearly all OECD economies are experiencing upskilling. One way of establishing this is to look at changes in the structure of employment by occupation. Most of the international evidence points to a shift in labour demand towards the more skilled. For example, Colecchia and Papaconstantinou (1996) show that in most OECD countries in the 1980s employment grew fastest in high-skill occupations and either slowed or declined in jobs that required lower skill levels. Furthermore, they found that the share of high-skill occupations rose relative to low-skill occupations in all of the countries that they examined. Similarly, Berman, Bound and Machin (1998) found that the demand for low-skilled workers dropped considerably in the twelve developed countries that they studied, while the proportion of skilled workers in most industries increased considerably. Acemoglu (2002) argues that in the US skill-bias has been widespread in the last 60 years and that an acceleration in skill-bias took place in the last two to three decades.

For Australia the evidence is not as clear as that seen overseas. For example, Aungles et al. (1993) analyse employment growth by ASCO major group between 1971 and 1986 to investigate whether the labour market was upskilling. They decomposed employment growth by ASCO major group using a skill index that showed that employment growth favoured highly skilled occupations. This upskilling of the workforce over the period could be seen both in terms of changes to occupational share and changes in the structure of industry (Aungles et al., 1993, p. 111). In their comparative labour market study of upskilling for the US and Australia, Dunlop and Sheehan (1998) analysed employment change using detailed occupational data. In the case of Australia, the source data were unpublished four-digit data obtained from the ABS and aggregated to ASCO 1st edition major group level. For the US, unit record data were obtained from the Current Population Survey, and these detailed occupation

data were aggregated to the same eight Australian occupation groups. These data were then grouped into four skill categories, namely, white-collar high-skill, white-collar low-skill, blue-collar high-skill and blue-collar low-skill. These skill categories were the same as those used by Colecchia and Papaconstantinou (1996). Dunlop and Sheehan (1998) arrived at the following conclusions. Firstly, for neither country was there clear evidence of upskilling in aggregate over the decade to 1995, in contrast to the OECD findings reported by Colecchia and Papaconstantinou (1996). Secondly, for neither Australia nor the US was the growth rate of employment in the high-skill category in aggregate above that for the low-skill category. Thirdly, in spite of evidence of upskilling for women in Australia (particularly for white-collar women), there was no real evidence in either country of pronounced upskilling in the white-collar area in aggregate. For example, for the US the employment growth rates in the white-collar area were the same for high-skill and low-skill persons, while in Australia the differences were marginal. Furthermore, there was persistent deskilling in blue-collar jobs, with low-skill employment growing significantly faster than high-skill employment.

To investigate upskilling in the Australian labour market, Cully (1999) examined changes to the composition of employment by using ASCO 2nd edition major group classification of occupations and the skill hierarchy that is embedded in ASCO occupational classification. ASCO 2nd edition assigns each of the major groups to one of the five skill levels (see Table 9.1). This hierarchical structure allows for the nine major occupational categories to be grouped into five skill levels.

Cully (1999) reports that over the six years all occupations experienced net employment growth, with the exception of advanced clerical and service workers. The most notable growth was seen in professionals and elementary clerical, sales and service workers. His research also found differences in growth in the pattern of employment for men and women. He then looked at the relative demand for different occupations and how these had changed over time by using ASCO 2nd edition skill hierarchy detailed in Table 9.1. For all employees he reported increases in the share of employment in skill categories I and V and declines in categories II, III and IV. The analysis found similar results for men and women. Cully (1999) concluded that the change in the composition of employment favoured the most skilled and the least skilled, implying that the demand for labour had polarised.

These findings contrast with those found in the international literature and conclude, 'Australia constitutes a distinct case in experiencing relative growth in both skilled and unskilled positions' (Cully, 1999, p. 103). Wooden (2000a) argues that neither the findings by Dunlop and Sheehan (1998) or by Cully (1999) are correct. To show that these explanations are not accurate, Wooden (2000a) uses both aggregate employment and aggregate hours as a measure of labour demand. He justifies his methodology by pointing out that the records of employment are not often the same as labour demand for two reasons. Firstly, labour demand is often not satisfied because for some types of jobs the available supply of skills and qualifications do not match the corresponding demand. Secondly, the total number of hours worked may differ substantially across occupations. For example, he shows that the average hours worked by managers and administrators and professionals tend to be substantially higher than those of workers who are employed in low-skill occupations. A reason for this is that the former tend to do much more unpaid overtime work, whereas the latter are employed in occupations where the incidence of part-time employment is much higher and as a result work fewer hours. Applying the occupational categories and the skill hierarchy of ASCO 2nd edition to both employed persons and hours worked, his results suggest that the demand for labour in Australia has considerably favoured the most skilled occupations.

> This widening gap in the demand for high-skill jobs compared with low-skill jobs is emphasised even further when the analysis is undertaken in terms of hours worked rather than the number of persons employed … while the number of low-skill jobs has continued to rise, especially low-skill sales and service jobs, there has been virtually no growth in the total volume of low-skill work. (Wooden, 2000a, p. 197)

According to Wooden (2000a), the growth in the share of occupations that are low-skilled is due to the rapid increase in part-time and casual employment over the last three decades. The merits of Wooden's approach is that it draws attention to the importance of hours worked as a way of accounting for upskilling in the demand for labour. This is evident in a submission by the Commonwealth of Australia (2002) which adopted Wooden's methodology.

In a submission to the Safety Net Review on wages, the Commonwealth grouped 282 occupations into three categories of employment to analyse growth in full-time employment by hours worked from 1996 to 2001. These were grouped into low,

middle and high paid occupations. The Commonwealth's submission found that growth in hours worked in high paid occupations accounted for 65 per cent of the total, while growth in middle and low paid occupations each accounted for 18 per cent. Declines in hours worked were detected in low paid and middle paid occupations. For low paid occupations, the declines occurred amongst hospitality workers, textile, clothing and other machine operators and factory workers. In the middle paid category, the following occupations experienced the strongest declines: electrical and electronic tradespersons, intermediate plant operators, and intermediate numerical clerks (Commonwealth of Australia, 2002, p. 95).

More recently Keating (2003) analysed changes to the distribution of employment in two ways. He first looked at occupational change and found that the shift occupations has been biased towards the more highly skilled and highly paid occupations for males and females. His results are similar to those found by Wooden in terms of hours worked for the same period (1989-2000) but in terms of occupations. In his second analysis, Keating investigated changes to employment and earnings by detailed occupation. Occupations were grouped by income deciles according to their corresponding level of average weekly ordinary time earnings (AWOTE) for two separate periods: 1986 and 1996 and 1996 and 2000. He found that employment for males and females grew much faster than average in the eight, ninth and tenth earnings deciles. This tends to confirm the findings reported for the major occupational groups where employment grew in the most skilled (higher paid) occupations and declined in the least skilled (less paid) occupations. The evidence of upskilling found by Keating (2003), the Commonwealth of Australia (2002) and Wooden (2000a) is also backed up to some extent by the analysis conducted in Chapters 7 and 8 using the O*NET measures. These similarities can be seen by looking at the changes in GWA intensity displayed in Figure 7.2 in Chapter 7, and Tables 8.3 to 8.6 in Chapter 8 for skill and knowledge intensity in full-time employment.

9.2.1 The O*NET and ASCO: A brief comparison

In spite of the similarity of these results, the O*NET provides a number of features not found in occupational categories such as ASCO 2nd edition. Unlike the three studies mentioned above, the O*NET has the capability of providing a numerical value for each of the 340 occupations of ASCO and as a result can rank all the

occupations from highest to lowest in terms of our intensity measure of GWA, knowledge and skill. As shown in Table 3.3, this feature is not available in the highly aggregated ASCO skill categories (five in all) or at ASCO four-digit level.

Table 9.1 lists ASCO 2nd edition occupations in terms of the major group and corresponding skill levels. These are detailed in Columns 1 and 2. Columns 3 and 4 provide examples of occupations at ASCO four-digit level, and their corresponding O*NET skill intensity score. For example, policy and planning managers (ASCO code 1291) are ranked highest with a skill intensity score of 38.8 and a corresponding skill level ranking I in terms of ASCO, and a major group coding of 1. A clear limitation of this approach at such an aggregated level is that it is not possible to provide a distinction between occupations in the same skill level in the cluster of skill, or for that matter within the same major group occupational classification of ASCO. For example, according to the five categories of skill, mixed crop and livestock farmers, policy and planning managers, and civil engineers all belong to the same ASCO skill category and the same ASCO major group level (1). It is clear that the skill levels of a civil engineer or a policy and planning manager are higher than those of a mixed crop and livestock farmer, but this distinction cannot be made with ASCO skill categories as the aggregation treats them as having the same skill and occupational level.

Table 9.1 Skill category by ASCO grouping and O*NET skill scores for selected occupations

ASCO skill	*ASCO major group*	*Occupation code and name*	*Skill O*NET score*
I	1. Managers and administrators	1291 Policy and Planning Managers	38.8
I	1. Managers and administrators	1311 Mixed Crop and Livestock Farmers	21.5
I	2. Professionals	2221 Marketing and advertising professionals	34.2
I	2. Professionals	2124 Civil Engineers	33.1
II	3. Associate professionals	3996 Retail Buyers	17.7
III	4. Tradespersons and related workers	4115 Precision Metal Tradespersons	17.5
III	4. Tradespersons and related workers	4981 Marine Construction Tradespersons	15.0
III	5. Advanced clerical and service workers	5993 Insurance Agents	17.1
IV	6. Intermediate clerical, sales and service workers	6143 Bank Workers	10.0
IV	7. Intermediate production and transport workers	7121 Engine and Boiler Operators	7.3
V	8. Elementary clerical, sales and service workers	8211 Sales Assistant	5.7
V	9. Labourers and related workers	9111 Cleaners	4.4

Source: ABS cat. no. 1220.0 and author calculations of O*NET knowledge scores.

In contrast, the O*NET skill scores provide a clear distinction between these three occupations, where both policy and planning managers and civil engineers have a higher skill ranking than mixed crop and livestock farmers. Furthermore, the numerical ranking provided by the O*NET skill level (or for that matter knowledge and GWA) gives direct information as to which occupations at ASCO four-digit level are having the strongest impact in terms of upskilling or deskilling. The aggregated numbers in the five skill categories of ASCO do not provide the information contained in the O*NET intensity rankings.

Finally, as mentioned in Section 6.6, one major drawback of the O*NET data is that the content of the informational data contained in each of the intensity measures is fixed in time. This limitation also applies to ASCO skill measure used in the analysis that follows.

In the next section, I present an analysis of occupational change using Cully's methodology for the Australian labour market between 1971 and 2001.

9.3 Is Upskilling Occurring in Terms of Jobs Created?

This section presents information and analysis on whether occupations in Australia are upskilling, becoming polarised between high-skill and low-skill jobs, or whether other phenomena are at play. This investigation adapts Cully's (1999) approach using employment data between 1971 and 2001. Changes in the number of occupations created over the period are analysed in terms of:

- total employment;
- full-time male and female employment;
- part-time male and female employment.

9.3.1 Employment change by occupation: 1971-2001

Occupational classification systems have changed twice in Australia since 1971. This means that comparisons over time of changes in employment can only be done by applying concordances that allow the construction of time series data. The methodology used to concord employment data used to arrive at the numbers detailed in this section is explained in Chapter 5.

As shown in Table 9.2 total employment grew between 1971 and 2001 by 3.09 million jobs, a percentage increase of 63.6 per cent. The strongest increase occurred in professional occupations, rising by 215.0 per cent. The second largest increase occurred in elementary sales and service worker occupations, which rose by 103.0 per cent.

In terms of occupational growth (Column 6), it is clear that the majority of employment growth occurred in the top three occupations. These occupations accounted for 58.2 per cent of job growth (1.799 million new jobs), occupations in the middle of the occupational distribution grew by 26.4 per cent (871,881 new jobs), while the three bottom occupations grew by 15.3 per cent (473,894 new jobs).

Table 9.2 Growth in total employment, by occupation, 1971-2001

Occupation	*Number of employees ('000s)*		*Net job growth*	*Average annual net job growth*	*Total job growth*
	1971	*2001*	*1971-2001 (%)*	*1971-2001 (%) p.a.*	*(%)*
1. Managers and administrators	440.5	749.3	70.1	2.3	10.0
2. Professionals	473.5	1,491.4	215.0	7.2	32.9
3. Associate professionals	486.8	959.3	97.0	3.2	15.3
4. Tradespersons and related workers	886.4	991.2	11.8	0.4	3.4
5. Advanced clerical and related workers	189.0	304.5	61.1	2.0	3.7
6. Intermediate clerical, sales and service workers	742.2	1,339.8	80.5	2.7	19.3
7. Intermediate production and transport workers	608.6	650.2	6.8	0.2	1.3
8. Elementary clerical, sales and service workers	379.9	771.1	103.0	3.4	12.7
9. Labourers	652.8	693.9	6.3	0.2	1.3
Total	*4,859.7*	*7,950.6*	*63.6*	*2.1*	*100.0*

Note: Estimates for the 1971 data are derived by applying the concordance methodology described in Chapter 6. Occupations are aggregated to ASCO 2nd edition major group. 'Inadequately described' and 'not stated' are not included in calculations. *Source:* ABS census employment data for 1971 and 2001.

The data reported in Table 9.2 show a similar trend to those presented by Cully (1999) and Wooden (2000a, p. 192) but over a much longer period. When measured in terms of net employment growth, the high-skill professional group (professionals and associate professionals) and the low-skill occupation group of elementary clerical, sales and service workers increased the most. These findings appear to suggest that, in the long run, growth in employment shows a tendency towards polarisation and is not consistent with the notion that the labour force has been upskilling.

9.3.2 Employment change by job type: 1971-2001

So far we have seen that at an aggregate level all occupations have experienced net employment growth and a tendency towards polarisation. But what can be said about employment growth in terms of job types, namely, full-time and part-time employment for males and females?

Between 1971 and 2001, male and female full-time employment grew by 269,445 and 698,956 jobs respectively. The rise in part-time employment was even stronger. In total, 744,248 jobs were created for men, while 1,378,296 new jobs were created for women. Table 9.3 details the growth in full-time employment for males and females over the 1971-2001 period. Net employment growth for male full-time employment over the period rose by 8.5 per cent.

Table 9.3 Growth in full-time employment, by occupation, 1971-2001

Occupation	*Male full-time ('000s)*			*Female full-time ('000s)*		
	1971	*2001*	*Net growth 1971-2001 (%)*	*1971*	*2001*	*Net growth 1971-2001 (%)*
1. Managers and administrators	362.7	485.7	33.9	43.1	155.9	261.4
2. Professionals	287.1	583.4	103.2	118.4	467.3	294.7
3. Associate professionals	343.8	460.4	33.9	98.3	285.9	191.0
4. Tradespersons and related workers	798.7	744.4	-6.8	50.5	60.7	20.3
5. Advanced clerical and related workers	33.9	26.4	-22.2	124.6	144.8	16.2
6. Intermediate clerical, sales and service workers	295.0	291.5	-1.2	335.6	460.0	37.1
7. Intermediate production and transport workers	495.8	440.8	-11.1	80.3	48.3	-39.8
8. Elementary clerical, sales and service workers	149.0	136.3	-8.6	158.4	139.9	-11.7
9. Labourers	410.3	276.9	-32.5	146.9	92.3	-37.2
Total	*3,176.3*	*3,445.7*	*8.5*	*1,156.2*	*1,855.2*	*60.5*

Source: As for Table 9.2. Author's calculations.

The most noticeable feature for male full-time employment is the growth in jobs for managers and administrators, professionals and associate professionals. A total of 535,845 jobs were created in these categories. Professional jobs had the most dramatic increase, a rise of 103.2 per cent. All other full-time occupations experienced a decline of 266,400 jobs. Labourers lost 32.5 per cent of jobs, the sharpest decline. For women, employment growth was much stronger than for males. Total full-time employment grew by 60.5 per cent. The top three occupations accounted for 92.9 per cent of the total share of employment growth. The middle jobs accounted for 22.2 per

cent, while the lowest three occupations accounted for a decline of 15 per cent of the share of employment growth. A total of 105,192 jobs were lost in these occupations.

Table 9.4 shows the massive growth in part-time employment that has occurred in the Australian economy between 1971 and 2001. Of the total number of jobs created 2.1 million (68.7 per cent) were part-time.

Table 9.4 Growth in part-time employment, by occupation, 1971-2001

Occupation	*Male part-time ('000s)*			*Female part-time('000s)*		
	1971	*2001*	*Net growth 1971-2001 (%)*	*1971*	*2001*	*Net growth 1971-2001 (%)*
1. Managers and administrators	21.0	54.0	156.7	13.6	53.8	295.2
2. Professionals	23.3	124.6	434.7	44.7	316.1	607.3
3. Associate professionals	14.6	75.9	420.2	30.2	137.1	353.9
4. Tradespersons and related workers	24.6	137.5	460.1	12.7	48.5	282.9
5. Advanced clerical and related workers	1.7	8.2	383.1	28.8	125.1	334.8
6. Intermediate clerical, sales and service workers	13.6	90.7	565.5	98.0	497.5	407.6
7. Intermediate production and transport workers	19.7	119.0	505.6	12.8	42.0	228.8
8. Elementary clerical, sales and service workers	9.6	126.8	1,218.4	62.8	368.1	486.0
9. Labourers	24.8	160.3	546.9	70.8	164.4	132.2
Total	*152.9*	*897.1*	*486.9*	*374.4*	*1,752.7*	*368.2*

Source: As for Table 9.2. Author's calculations.

Overall, the highest levels of employment growth, in net terms, occurred in the four lowest job categories for males. For females, the strongest rise in employment creation occurred in professional jobs, followed by elementary clerical, sales and service workers.

The data reported in Tables 9.3 and 9.4 show different trends compared to those of total employment growth. For full-time male and female employment, the growth in occupations clearly favoured the managerial and professional group, and disadvantaged the relatively unskilled occupations. These trends, unlike total employment, suggest that for the long run, full-time occupational growth has been upskilling. For part-time employment, however, the trends suggest an even pattern of employment growth.

9.3.3 Are skill levels increasing in numbers?

A different way of looking at the changes reported above is to look at the 'relative demand for different types of labour and how this has changed over time' (Cully, 1999, p. 101). In trying to determine whether the Australian labour market is upskilling in terms of employment growth, I begin this analysis by assigning each of the nine occupations their respective skill level as categorised by ASCO 2nd edition and detailed in Table 3.3.

Table 9.5 shows the total employment change and the change in the share of employees by skill level. Although employment growth occurred in all the five skill categories, changes to the shares show that skill level I experienced the strongest growth followed by a modest rise in skill level II. Skill levels III to V, however, experienced declines in the share, indicating that the labour market is showing clear signs of long-term upskilling.

Table 9.5 Change in Share of employees by skill level, 1971-2001

	Employment ('000s)			*Shares (%)*		
Skill Level	*1971*	*2001*	*Growth (%)*	*1971*	*2001*	*Change (%)*
I Managers/Professionals	914.0	2,240.7	145.2	18.8	28.2	9.4
II Associate Professionals	486.8	959.3	97.0	10.0	12.1	2.0
III Skilled vocations	1,089.0	1,386.4	27.3	22.4	17.4	-5.0
IV Intermediate skills	1,337.2	1,899.2	42.0	27.5	23.9	-3.6
V Elementary skills	1,032.7	1,465.0	41.9	21.2	18.4	-2.8
Total	*4,859.7*	*7,950.6*	*63.6*	*100.0*	*100.0*	

Source: As for Table 9.2. Author's calculations.

Table 9.6 continues with the analysis carried out in Table 9.5, with total employment disaggregated to include changes for men and women in full-time and part-time work. Full-time employment for men exhibits strong signs of upskilling in terms of job creation with increases in the demand for skill occurring in the top two skill categories, where the shares grew by 10.6 and 2.5 per cent, respectively. All other skill categories fell, not only in terms of shares, but also in terms of employment growth. Full-time female employment exhibited the same trend in terms of

employment shares as full-time male employment, however, employment creation declined in the lowest skill category.

Table 9.6 Change in share for full-time and part-time male and female employees by skill level, 1971-2001

Skill Level	*1971*	*2001*	*Employment growth (%)*	*Change in share (%)*
Males	*Full-time employees ('000s)*			
I Managers/Professionals	649.8	1,069.0	64.5	10.6
II Associate Professionals	343.8	460.4	33.9	2.5
III Skilled vocations	832.6	770.8	-7.4	-3.8
IV Intermediate skills	790.8	732.3	-7.4	-3.6
V Elementary skills	559.3	413.1	-26.1	-5.6
Total	*3,176.3*	*3,445.7*	*8.5*	
Females	*Full-time employees ('000s)*			
I Managers/Professionals	161.5	623.2	285.8	19.6
II Associate Professionals	98.3	285.9	191.0	6.9
III Skilled vocations	175.1	205.5	17.4	-4.0
IV Intermediate skills	415.9	508.3	22.2	-8.5
V Elementary skills	305.4	232.2	-24.0	-13.8
Total	*1,156.2*	*1,855.2*	*60.5*	
Males	*Part-time employees ('000s)*			
I Managers/Professionals	44.3	178.5	302.9	-9.1
II Associate Professionals	14.6	75.9	420.2	-1.1
III Skilled vocations	39.9	236.5	492.9	0.3
IV Intermediate skills	19.7	119.0	505.6	0.4
V Elementary skills	34.4	287.1	734.7	9.5
Total	*152.9*	*897.1*	*486.9*	
Females	*Part-time employees ('000s)*			
I Managers/Professionals	58.3	370.0	534.4	5.5
II Associate Professionals	30.2	137.1	353.9	-0.3
III Skilled vocations	41.4	173.5	319.0	-1.2
IV Intermediate skills	110.8	539.6	386.9	1.2
V Elementary skills	133.6	532.5	298.6	-5.3
Total	*374.4*	*1,752.7*	*368.2*	

Source: As for Table 9.2. Author's calculations.

In terms of part-time jobs, employment growth occurred in all of the five skill categories for men and women. However, part-time employment growth for men showed clear signs of deskilling. This can be seen by the decline in demand for skilled occupations (skill levels I ands II) and increases in demand for low-skilled jobs (skill levels II, IV and V). Women experienced a mixed pattern of skill level changes, favouring upskilling as shown by the growth in employment for managers and professionals (skill I).

These trends in upskilling reported in Table 9.6 show a very similar pattern of skill-bias in the demand for labour to those reported in Chapters 7 and 8 using our O*NET measures of GWA, knowledge and skill intensity. Thus, we can conclude that over the long term the Australian labour market has shown clear signs of upskilling in full-time employment for males and females. Similarly, there are strong signs of upskilling in part-time employment for women, but these are not as pronounced as those found in full-time work. Conversely, for male part-time employment, the trends in employment growth show a clear pattern of deskilling. These trends of upskilling in full-time employment and female employment, and deskilling in male part-time employment, are evident irrespective of the skill measures employed.

9.4 Upskilling in Employment Growth and Hours Worked

The previous section analysed changes in relative employment levels and investigated skill-bias in the demand for labour over the long run. The analysis found that over the 1971-2001 period, the Australian labour force was upskilling. However, when it was disaggregated into job types, the data showed different upskilling trends, particularly for part-time employment. This section extends this analysis by replicating the work of Wooden (2000a), looking at both changes in occupational employment and changes in the occupational composition of hours worked between 1989 and 2002. The reason for conducting an analysis of hours worked is to ensure that labour demand is measured more accurately, particularly across different types of occupations. As pointed out by Wooden (2000a). For example, average hours worked in managerial and professional occupations tend to be higher than in lower skilled occupations. This is because people in these positions tend to work longer hours without pay. In the case of lower skilled occupations such as sales and services, hours worked tend to be smaller because of the high incidence of part-time employment.

9.4.1 Data issues

The data chosen for this analysis were obtained from the Employee Earnings, Benefits and Trade Union Membership survey (cat. no. 6310.0). The survey is a supplement to the monthly Labour Force Survey (LFS) and has been collected since 1988 in the month of August. It provides data on full-time and part-time employees (based on the

hours worked in the 'main job') as well as on permanent and casual employees (based on their leave entitlements). The advantage of using these data are that they disaggregate both hours worked and employed persons into the various forms of job types in which Australians are employed. These data provide far more information relating to changes in the demand for labour in terms of job types.

Until 1999, the survey distinguished between 'casual' and 'permanent' employees. 'Casual' employees were defined as those persons engaged in employment but who were entitled to 'neither paid holiday leave nor sick leave'. 'Permanent' employees were defined as those who were entitled to paid holiday leave, sick leave or both in their main job. In 2000, 'permanent' and 'casual' employees were reclassified as employees 'with leave entitlements' and 'without leave entitlements'. Employees who work under 'leave entitlement' conditions are entitled to either paid holiday leave or paid sick leave (or both) in their main job. Employees working 'without leave entitlements' are not entitled to paid holiday leave or paid sick leave in their main job. To simplify the analysis, all employees 'with leave entitlements' are categorised as 'permanent', while those 'without leave entitlements' are categorised as 'casual'.

The data on employment by occupation and total hours worked for 1989 were classified under ASCO 1st edition. To allow for comparability, the 1989 data were obtained at the four-digit level and concorded to ASCO 2nd edition. The concordance was performed using the methodology detailed in Chapter 6 and then aggregated to the major group of ASCO 2nd edition.

9.4.2 Change in the occupational composition of Australia: the growth in employment and hours worked

Table 9.7 presents data on changes in the distribution of employment across the major occupational groups, and reports changes in aggregate hours and the share of hours worked. The major increases in employment and hours worked occurred in the managers and administrators and professional occupations. Declines can be seen in the middle of the employment distribution, where tradespersons and related workers, and advanced clerical and service workers, experienced employment declines of 11.4, and 20.2 per cent. Labourers also experienced declines in employment (4.9 per cent), and in total hours worked (12.5 per cent).

Table 9.7 Employment growth and growth in aggregate hours worked per week by occupation, August 1989 to August 2002

ASCO major group	*Employment ('000s)*		*Aggregate hours (millions)*		*Net change (%)*		*Share change (%)*	
	1989	*2002*	*1989*	*2002*	*Persons*	*Hours*	*Persons*	*Hours*
1. Managers and Administrators	283.7	473.4	12.9	21.4	66.9	65.7	1.5	2.3
2. Professionals	979.8	1,595.5	36.8	57.1	62.8	55.0	4.8	5.0
3. Associate Professionals	713.9	870.6	26.0	33.4	21.9	28.3	-0.2	0.9
4. Tradespersons and Related Workers	981.6	869.3	37.3	33.4	-11.4	-10.5	-4.4	-4.1
5. Advanced Clerical and Service Workers	405.8	323.8	12.4	9.7	-20.2	-22.2	-2.3	-1.9
6. Intermediate Clerical, Sales and Service Workers	990.9	1,489.0	30.9	44.1	50.3	42.9	3.3	2.8
7. Intermediate Production and Transport workers	658.8	681.3	25.1	25.2	3.4	0.4	-1.7	-1.8
8. Elementary Clerical, Sales and Service Workers	605	886.3	17.8	20.6	46.5	15.8	1.7	-0.2
9. Labourers and Related Workers	775.7	737.7	23.7	20.8	-4.9	-12.5	-2.8	-2.8
Total	*6,395.0*	*7,926.9*	*223.1*	*265.7*	*24.0*	*19.1*		

Source: ABS cat. no. 6310.0, 1989 and 2002 issues. Disaggregated data provided by the ABS. Estimates for 1989 derived by applying concordance weights as detailed in Chapter 6. Author's calculations.

A different way of reporting the figures in Table 9.7 is to look at the relative demand for different types of labour and how this has changed over time, both in terms of employment numbers and hours worked. Table 9.8 reports changes in the composition of employment after organising them into the five skill level categories of ASCO.

In terms of employment growth, the data show clear signs of upskilling, with the share of employment increasing in occupations requiring the highest level of skill, and declines in the share of employment in skill levels III and V. The only exception is the rise in occupations requiring intermediate skills (skill level IV). Analysis of the change in the aggregate hours share further confirms that the labour market is upskilling. Both the top two skill level categories experienced increases in the demand for hours, while skilled vocations and elementary skills reported declines in the share of aggregate hours.

Table 9.8 Total employment and total aggregate hours growth by skill level category, August 1989 to August 2002

Skill level category	*Employment growth (%)*	*Aggregate hours growth (%)*	*Change in employment share (%)*	*Change in aggregate hours share (%)*
I Managers/Professionals	63.7	57.7	6.3	7.2
II Associate Professionals	22.0	28.3	-0.2	0.9
III Skilled vocations	-14.0	-13.4	-6.6	-6.1
IV Intermediate skills	31.6	23.8	1.6	1.0
V Elementary skills	17.6	-0.4	-1.1	-3.0
Total	*24.0*	*19.1*		

Source: As for Table 9.7. Author's calculations.

9.4.3 Upskilling in job types: permanent and casual full-time employment

The previous section has shown that, between 1989 and 2002, changes in the composition of employment have favoured the more skilled. This confirms the findings of other international studies (e.g. Colecchia and Papaconstantinou, 1996; Berman, Bound and Machin, 1998; Acemoglu, 2002).

Table 9.9 Growth in male permanent and casual full-time employment and aggregate hours worked per week by skill level category, August 1989 to August 2002

Skill Category	*Employment (000s)*		*Aggregate hours (millions)*		*Net change (%)*		*Share change (%)*	
			Male permanent full-time					
	1989	*2002*	*1989*	*2002*	*Persons*	*Hours*	*Persons*	*Hours*
I Managers/Professionals	707.8	895.6	30.6	39.4	26.5	28.7	6.9	7.0
II Associate Professionals	381.8	415.3	15.9	18.0	8.8	13.1	1.5	1.7
III Skilled vocations	846.2	675.7	32.9	27.3	-20.1	-16.8	-4.6	-4.1
IV Intermediate skills	755.8	729.3	30.2	29.6	-3.5	-1.9	0.0	-0.3
V Elementary skills	510.2	373.2	20.1	14.5	-26.9	-28.0	-3.9	-4.3
Total	*3,201.7*	*3,089.1*	*129.6*	*128.8*	*-3.5*	*-0.7*		
			Male casual full-time					
	1989	*2002*	*1989*	*2002*	*Persons*	*Hours*	*Persons*	*Hours*
I Managers/Professionals	49.3	120.7	2.5	5.7	144.8	128.6	2.1	1.6
II Associate Professionals	23.9	59.8	1.2	2.8	150.2	134.3	1.3	1.1
III Skilled vocations	62.5	103.9	2.6	4.3	66.2	65.8	-6.7	-5.6
IV Intermediate skills	52.8	124.3	2.3	5.2	135.4	125.9	1.3	1.2
V Elementary skills	45.9	112	1.8	4.3	144.0	137.0	1.9	1.8
Total	*234.3*	*520.7*	*10.4*	*22.4*	*122.2*	*114.7*		

Source: As for Table 9.7. Author's calculations.

However, given the changes in employment type experienced in the Australian labour market over the last three decades, it is important to ask whether these are consistent across different types of employment arrangements. To explore upskilling in terms of job types, the two following sub-sections investigate changes in full-time and part-time permanent and casual employment for men and women. The analysis that

follows is the same as in the previous section. The difference is that total employment is disaggregated into full-time and part-time permanent and casual work for men and women between 1989 and 2002.

Tables 9.9 and 9.10 examine the growth in both employment and aggregate hours worked by skill level category for men and women in permanent and casual full-time work. In terms of full-time male permanent employment, the labour market has been upskilling, both in jobs growth and total hours worked. In contrast, casual employment shows changes that indicate a 'disappearing middle' or 'hollowing out' effect. This can be seen by both the decline in employment and hours worked in skill category III, followed by increases in all other skill categories.

Table 9.10 Growth in permanent and casual female full-time employment and aggregate hours worked per week by skill level category, August 1989 to August 2002

Skill Category	*Employment (000s)*		*Aggregate hours (millions)*		*Net change (%)*		*Share change (%)*	
			Female permanent full-time					
	1989	*2002*	*1989*	*2002*	*Persons*	*Hours*	*Persons*	*Hours*
I Managers/Professionals	350.3	597.9	13.4	23.9	70.7	78.9	12.0	13.1
II Associate Professionals	152.6	230.9	5.9	9.0	51.3	53.5	3.6	3.5
III Skilled vocations	296.6	194.2	10.7	7.2	-34.5	-32.9	-7.7	-7.6
IV Intermediate skills	468.5	520.6	17.0	18.9	11.1	11.0	0.1	-0.8
V Elementary skills	306.2	199.7	11.1	7.2	-34.8	-35.0	-8.0	-8.3
Total	*1,574.2*	*1,743.3*	*58.1*	*66.2*	*10.7*	*14.0*		
			Female casual full-time					
	1989	*2002*	*1989*	*2002*	*Persons*	*Hours*	*Persons*	*Hours*
I Managers/Professionals	15.8	42.4	0.6	1.7	168.4	201.9	2.1	4.5
II Associate Professionals	11.4	24.5	0.6	1.0	114.9	80.7	-1.3	-3.9
III Skilled vocations	13.5	21.1	0.5	0.8	56.3	56.0	-5.3	-5.0
IV Intermediate skills	22.4	70.4	0.8	2.7	214.3	216.5	7.8	8.2
V Elementary skills	26.1	55.7	1.0	2.0	113.4	104.3	-3.2	-3.9
Total	*89.3*	*214.1*	*3.5*	*8.3*	*139.8*	*136.6*		

Source: As for Table 9.7. Author's calculations.

For women, the upskilling trend is similar to that of men in permanent employment where both the share of aggregate hours worked and employment increased at the top of the skill level categories but declined thereafter. The magnitude of upskilling for females is stronger than that of males. This could be attributed to the increase in women entering the labour market and taking up relatively high positions of responsibility. This can be seen by the rise in shares at the top skill level category, where the employment and aggregate hours shares grew by 13.2 and 3.5 per cent, respectively (Table 9.10).

For male casual full-time employment, the demand for labour increased both in terms of employment shares and total hours worked in the top two skill categories and the bottom two categories, and declined in the vocational skill category. Employment for women had significant increases in the demand for labour in managerial and professional, and intermediate skilled work, and declines in all other skilled categories.

This analysis shows a clear pattern of skill-bias in the demand for labour in high-skilled occupations in permanent employment. In contrast, for casual full-time employment we can see signs of skill-bias in the demand for labour for women and polarisation in the demand for labour in casual full-time work for men.

9.4.4 Upskilling in job types: permanent and casual part-time employment

This section continues with the analysis of upskilling, focusing on permanent and casual part-time employment for males and females over the same period. Table 9.11 shows changes in the share of aggregate hours and employment. The demand for male part-time permanent employment declined in terms of total hours worked, indicating clear signs of deskilling.

Table 9.11 Growth in employment and aggregate hours worked per week by skill level for male and female permanent and casual part-time employment, August 1989 to August 2002

Skill Category	*Net Change (%)*		*Share Change (%)*		*Net Change (%)*		*Share Change (%)*	
	Male permanent part-time				*Male casual part-time*			
	Persons	*Hours*	*Persons*	*Hours*	*Persons*	*Hours*	*Persons*	*Hours*
I Managers/Professionals	388.7	258.3	3.2	-0.1	142.9	140.4	1.2	0.6
II Associate Professionals	198.6	131.5	-3.9	-4.9	-13.5	12.1	-7.6	-5.5
III Skilled vocations	245.5	203.3	-2.3	-2.0	39.9	33.6	-4.3	-5.8
IV Intermediate skills	290.3	276.0	-2.1	0.9	122.5	152.5	0.5	2.7
V Elementary skills	403.7	347.9	5.1	6.1	173.9	175.2	10.2	8.0
Total	*328.2*	*260.0*			*118.2*	*128.4*		
	Female permanent part-time				*Female casual part-time*			
	Persons	*Hours*	*Persons*	*Hours*	*Persons*	*Hours*	*Persons*	*Hours*
I Managers/Professionals	162.6	176.1	5.7	6.6	250.5	203.4	6.9	6.5
II Associate Professionals	62.4	62.2	-2.2	-2.3	-45.7	-51.3	-6.8	-8.4
III Skilled vocations	44.1	33.3	-4.1	-4.9	-16.8	-23.1	-5.4	-6.6
IV Intermediate skills	159.8	167.7	6.9	7.8	65.2	75.8	4.6	7.3
V Elementary skills	60.2	54.9	-6.4	-7.3	44.1	41.8	0.8	1.2
Total	*106.7*	*108.6*			*41.5*	*37.9*		

Source: As for Table 9.7. Author's calculations.

Casual part-time employment for men showed clear signs of polarisation, where the demand for skilled labour rose in the top two skilled categories, declined in the middle and rose at the bottom. Part-time employment for women experienced skill-bias in the demand for labour in permanent work and strong signs of polarisation in casual part-time employment.

9.5 Conclusion

This chapter has continued the analysis of skill-bias in the demand for labour initiated in Chapters 7 and 8. Underlying the phenomenon of upskilling in labour markets in advanced economies is the fundamental question of what skill is and how best it can be measured. This issue was addressed in Chapter 3, and a comparison of the advantages and limitations of using the O*NET and ASCO in the analysis of upskilling was presented in Section 9.2.1. In spite of the limitations discussed, both ASCO 2nd edition and the O*NET measures are very useful tools in the analysis of skill-bias in the demand for labour.

By using ASCO 2nd edition it was possible to examine upskilling in the demand for labour. This study was divided into two parts. The first part investigated upskilling in the labour market in terms of occupational change in aggregate between 1971 and 2001. The analysis then focused on changes in full-time and part-time employment for men and women over the same period in terms of employment growth and skill change.

The second part of the study explored upskilling in terms of aggregate employment growth and aggregate hours worked between 1989 and 2002. It then disaggregated the data to analyse upskilling in terms of job types, namely, full-time, part-time, permanent, casual, male and female employment and hours worked. These analyses provide the following conclusions.

The first is that the Australian labour market exhibited strong signs of upskilling in terms of occupational growth in aggregate over the long term (i.e. between 1971 and 2001). Upskilling was also detected when the analysis focused on job types. When occupations were disaggregated into full-time and part-time male and female employees, different trends were observed in different job types. There were very strong signs of upskilling in male and female full-time jobs, where the labour market

exhibited strong growth in employment in highly skilled occupations and declines in low-skilled occupations. In terms of part-time employment, there were strong signs of deskilling for men, whereas women experienced upskilling trends. These upskilling and deskilling trends were quite consistent with those found in Chapters 7 and 8 in terms of the O*NET measures of GWA, knowledge and skill.

The second conclusion is that over the 1989-2002 period, the patterns of upskilling are mixed for different job types in terms of total employment and total hours worked. At the aggregate level, upskilling was clearly detected for both employment growth and hours worked. This pattern is consistent with that found overseas (e.g. Colecchia and Papaconstantinou, 1996; Berman, Bound and Machin, 1998; Acemoglu, 2002). Permanent male and female full-time employment exhibited clear signs of upskilling both in terms of employment growth and hours worked. This can be seen by the increase in the share of employment and aggregate hours worked in the top two skill categories for men and women, with corresponding declines in occupations requiring medium to low-skill levels. In terms of casual full-time employment, the picture is mixed for men and women. Casual full-time employment for men exhibited signs of polarisation, where increases in employment and hours worked occurred in the top two skill level categories, declined in the middle and increased in the two lowest skill categories. These trends reflect what Gregory (1993) identified as the 'disappearing middle'.

Employment and total hours worked increased for women in casual full-time employment in the highest skill categories and declined for all others. In terms of part-time employment, men experienced deskilling in permanent employment and polarisation in casual employment. Women in part-time work experienced upskilling trends in permanent work and polarisation in casual employment.

The results described above also show that, to understand more clearly changes to the composition of skills in the Australian context, it is important to divide the labour market into job types. This is because aggregate changes in employment do not necessarily reflect changes in types of employment.

Chapter 10
Increasing Earnings Inequality in Full-Time Earnings

10.1 Introduction

The previous chapter investigated skill-bias in the demand for labour and upskilling of the labour force in Australia in terms of employment growth and total hours worked. The analysis found definite evidence of upskilling in full-time employment but not in part-time employment over the long run. The study first looked at employment change and skill change using ASCO 2nd edition classification of occupations and the implicit definition of skill derived from ASCO 2nd edition over a 30-year period (1971-2001). The findings confirmed the trends found in Chapters 7 and 8 in terms of our O*NET measures of GWA, knowledge and skill. Skill-bias in the demand for labour was also investigated in terms of employment and total hours worked for permanent and casual full-time and part-time, male and female employment between 1989 and 2002. The analysis found different upskilling effects for casual and permanent employment, although there was clear evidence of upskilling in permanent full-time employment. In general terms, the findings confirm those of Wooden (2000a) who found that the relative demand for skilled labour has been increasing. This is consistent with the international literature where job growth has favoured the most skilled in aggregate terms (e.g. Machin, 1996; Berman, Bound and Machin, 1998; Acemoglu, 2002). In light of these signs of upskilling in the Australian labour market, a key issue that has arisen is that of increasing earnings inequality in full-time employment and its causes.

In this chapter, I now turn to look at whether there is any evidence of skill-bias in the generation of increasing earnings inequality across occupations. The analysis that follows takes a different approach to that found in the literature. I analyse increasing inequality in full-time earnings in terms of occupations rather than individual earnings. Thus, the first objective of this chapter is to measure the increased earnings variability across occupations between the periods of 1989-1995 and 1997-2002, using occupational data from the ABS's Employee Earnings, Benefits and Trade Union

Membership (EEBTUM) (6310.0).[1] There are two reasons for choosing these two periods for the analysis. Firstly, it is important to find out whether changes in earnings inequality in terms of occupations have been consistent over the last decade and a half. The second is to find out whether changes in occupational inequality have been consistent across different occupational distributions (i.e. ASCO 1st edition and ASCO 2nd edition). To do this, I measure the level and change over these two periods in occupational earnings inequality.

The second objective of this chapter is to examine whether there is evidence of a role of skill-bias in the generation of earnings inequality. The approach taken is that of Borland and Wilkins (1996) and Pappas (2001). The difference taken in the approach to explain the causes of earnings inequality is the use of occupational earnings data and the O*NET data on Worker Requirements described in Chapter 6. This involves two stages. The first uses the O*NET data on skill and knowledge measures of occupations to estimate the relationship between the log of weekly earnings and the O*NET measures of skill and knowledge. The second uses the results to decompose growth in occupational earnings inequality between changes in the distribution of and return to skill and knowledge, and other unobserved factors.

The next sections detail the data used in this study and discuss the limitations of data used in other Australian studies. Section 10.3 examines changes in occupational earnings using Australian occupational data. Section 10.4 calculates the return to skill and knowledge for two separate periods. By conducting a residual analysis, I identify the role that our measures of skill and knowledge play in increasing earnings inequality in full-time earnings. The final section presents the conclusions.

10.2 Data Issues

As discussed in the literature review, studies over the last three decades have arrived at similar conclusions, namely, that inequality of earnings has been increasing in Australia. Three main sources of data have been used. Information on employees is obtained from two surveys, namely, the Labour Force Survey (LFS) and the Survey of Employee Earnings and Hours (SEEH), while a measure of individual earnings

[1] Prior to 1998 this survey was known as the Weekly Earnings of Employees (Distribution) Australia, (ABS cat no. 6310.0).

inequality can be derived from the Survey of Income and Housing Costs (SIHC).[2] Borland and Wilkins (1996) used the LFS to describe changes in earnings inequality in the 1970s and 1990s, while King et al. (1992), Gregory (1993) and McGuire (1994) have used the SEEH survey. More recently, Borland and Kennedy (1998b) and Pappas (2001) used the IDS survey to measure individual earnings inequality over time.

The approach taken here is to examine earnings inequality across occupations rather than individuals. The reason for this is the difficulty of doing unit record data type analysis in Australia using detailed occupational data on individuals. If a full unit record database were available (such as the March files from the US Current Population Survey), with earnings, detailed occupation and other variables for each individual, then it would be possible to approach earnings inequality across individuals through occupations. These data would make it possible to decompose the increase in inequality into that due to changes in employment across occupations, changes in average earnings across occupations, and a residual, which is change in inequality within groups (that is, the component that cannot be explained through an occupational analysis). The justification for using occupations in my analysis rather than individuals is not only constrained by data limitations, but also follows research conducted by Sheehan, Dunlop and Yu (2004) who use the US Current Population Survey. Their research shows that inequality of earnings across occupations is quite significant in the US.

In their study they undertake an analysis of the contribution of changes in the distribution of employment across occupations and in mean occupational earnings to increasing earnings inequality across individuals over the 1979-2000 period. The method used is to partition the total change in variance across individuals for selected periods into three components: those due to changes in these two occupational variables and the residual variance, which must be explained by within occupational effects. The data employed are the unit record files of the March Current Population Surveys, providing annual data on earnings for the previous year. To increase the sample size, the data are aggregated in three-year blocks. This means that, rather than being undertaken for 1980, 1990 and 2000, the analysis is undertaken for the income years 1979-1981, 1989-1991 and 1999-2001.

[2] Prior to 1994-1995 this survey was known as the Income Distribution Survey (IDS).

Table 10.1 The contribution of changes in employment and mean earnings to changes in earnings inequality, USA, 1979 to 2000

1979-1981 to 1989-1991	*All persons*	*Males*	*Females*
Total change in variance of log earnings across individuals	0.033	0.057	0.077
Change due to:			
Occupational employment effect	0.003	0.005	0.004
Occupational wage effect	0.018	0.037	0.040
Within occupational effect	0.012	0.015	0.033
Shares of total change in variance		(%)	
Occupational employment effect	9.1	8.8	5.2
Occupational wage effect	54.5	64.9	51.9
Within occupational effect	36.4	26.3	42.9
1989-1991 to 1998-2000	*All persons*	*Males*	*Females*
Total change in variance of log earnings across individuals	0.066	0.084	0.050
Change due to:			
Occupational employment effect	0.004	0.004	0.008
Occupational wage effect	0.025	0.035	0.014
Within occupational effect	0.037	0.045	0.028
Shares of total variance in variance		(%)	
Occupational employment effect	6.1	4.8	16.0
Occupational wage effect	37.9	41.7	28.0
Within occupational effect	56.1	53.6	56.0

Source: Sheehan, Dunlop and Yu (2004), based on analysis of CPS data.

The results of this analysis are summarised in Table 10.1. For the 1979-1981 to 1989-1991 period, the two occupational effects explain 73.7 per cent of the change in the variance in individual earnings for males, and 57.1 per cent for females. For all persons the explained share is 63.6 per cent, while only 36.4 per cent remains to be explained by the change in variance in occupational employment and average earnings. Thus for the 1980s nearly two-thirds of the increase in earnings inequality across individuals, as measured by the change in the variance of log earnings, can be explained by an employment effect (9.1 per cent) and by an occupational effect (54.5 per cent). Similarly, for the 1989-1991 and 1998-2000 period, for all persons the explained share is 44.0 per cent, while only 56.1 per cent remains to be explained by the change in variance in occupational employment and average earnings. Although the trends of the 1990s are not as strong as those of the 1980s, for this period nearly two-fifths of the increase in earnings inequality across individuals, as measured by the change in the

variance of log earnings, can be explained by an employment effect (6.1 per cent) and by an occupational effect (37.9 per cent). The findings reported in Table 10.1 and described above provide some evidence that the analysis of earnings inequality in terms of occupations is a sensible approach to follow in Australia.

To investigate changes in the dispersions of earnings across occupations, I use the results of the ABS's EEBTUM survey (ABS cat. no. 6310.0) for the periods 1989-1995 and 1997-2002. This source provides information by detailed occupation, numbers employed, mean hours worked and mean weekly earnings of non-managerial employees. Two major problems arise with this data source. As discussed in Chapter 1, the first is that earnings concordances across the two occupation classifications cannot be constructed with any degree of accuracy for the two periods in question. For this reason, occupations for male and female employees are analysed using two separate periods, namely, 1989-1995, which corresponds to ASCO 1st edition, and 1997-2002, which corresponds to ASCO 2nd edition. The second problem relates to missing occupations, which as advised by the ABS are due to unacceptably high sampling errors. Hence, for the 1989-1995 period 161 female and 263 male occupations are used in the analysis out of a total of 282 occupations. For females the 161 occupations account for 91 per cent of the total full-time employed population for 1989-1995, while for males the 263 occupations account for 94 per cent of total full-time employment for 1989-1995. For ASCO 2nd edition, 195 occupations for females and 294 occupations for males are used in the analysis out of a total of 340 occupations. This accounts for 93 per cent of the total of full-time employed women and 96 per cent of the total of full-time employed men for 1997-2002. For the analysis of distributional changes over time, real earnings are calculated by deflating nominal earnings by using the Consumer Price Index (CPI).

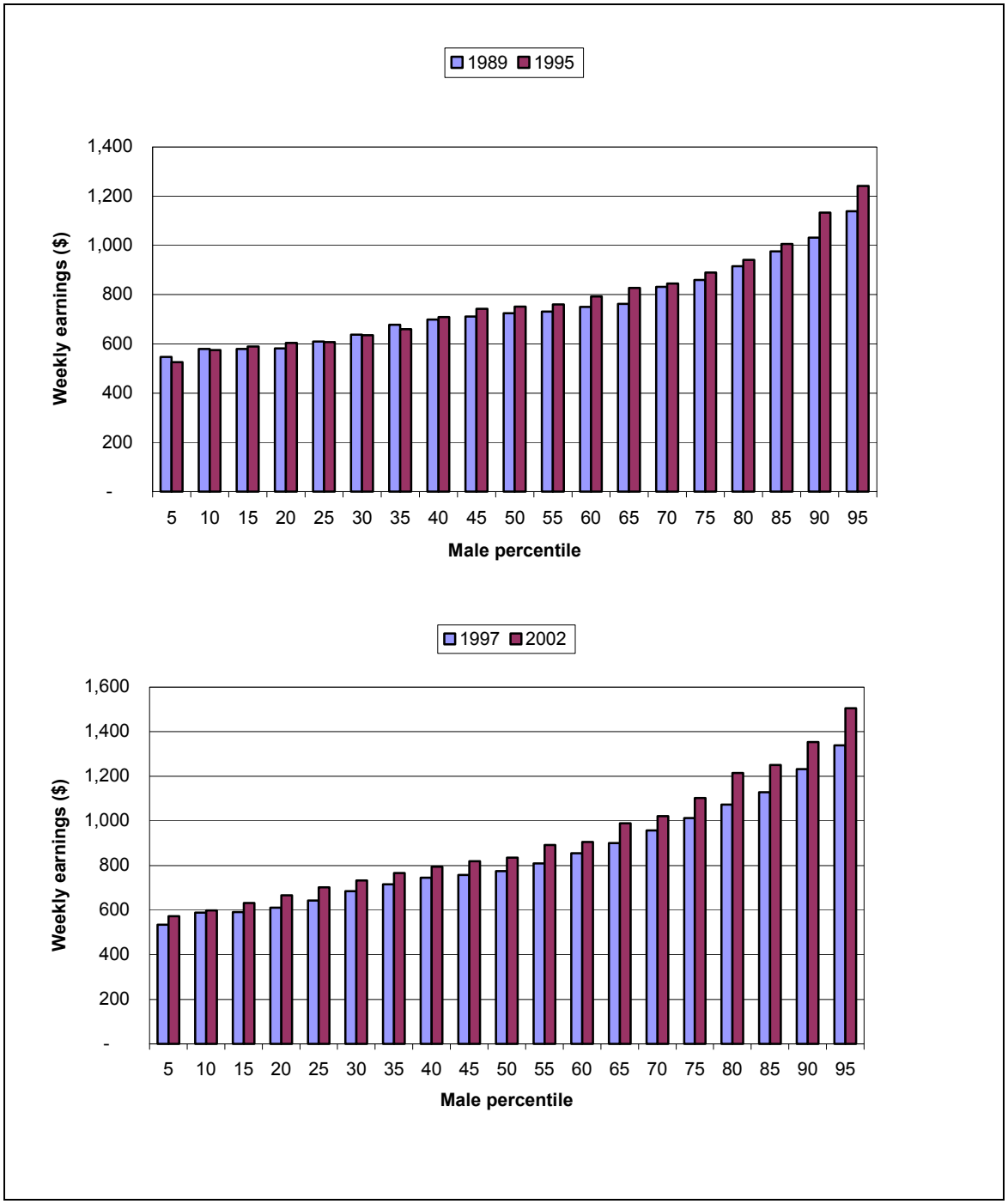
10.3 Measuring Earnings Inequality Across Occupations

The objective of this section is to measure changes in the distribution of earnings across occupations using the results of the EEBTUM survey for males and females for the 1989-1995[3] and 1997-2002 periods. To do this I calculate the percentile difference in current weekly earnings for males and females, the percentile difference in log earnings and four inequality measures. The inequality measures are the variance, the Gini coefficient, the mean log deviation, and half the coefficient of variation. The last two measures belong to the family of generalised entropy inequality measures. The mean log deviation is sensitive to changes at the lower end of the distribution, while half the coefficient of variation is responsive to changes in the upper end of the distribution. The Gini coefficient, for its part, is sensitive to changes in inequality around the median. Thus, these measures of inequality may not rank the same distribution in the same way. By computing these four measures, even if the level and percentage changes differ, if all indices are changing in the same direction, it is possible to draw conclusions about increasing or decreasing earnings inequality (Johnson and Shipp, 1995). The inequality measures and changes in the log of earnings are reported in Figures 10.3 and 10.4, and Tables 10.3 and 10.4. I start the analysis by describing current weekly earnings of full-time male and female occupations for four years in Figures 10.1 and 10.2. These figures show the increases in earnings inequality over the four years in question.

As shown in Figures 10.1 and 10.2, for males the increase in inequality can be seen by the increases in occupational earnings in the top quartile. For example, in 1989, the 95th percentile of male occupations earned 1.3 times more than the 70th percentile, but by 2002 this had increased to 1.5 times. Similarly, occupations at the 90th percentile earned 1.8 times more in 1989 than the 10th percentile, but by 2002 the earnings gap was 2.3 times larger. In comparing the middle to the bottom of the distribution, the gap between the 50th percentile and the 10th percentile had increased from 1.2 times to 1.4 times between 1989 and 2002, indicating increases in occupational earnings inequality even in the bottom half of the distribution.

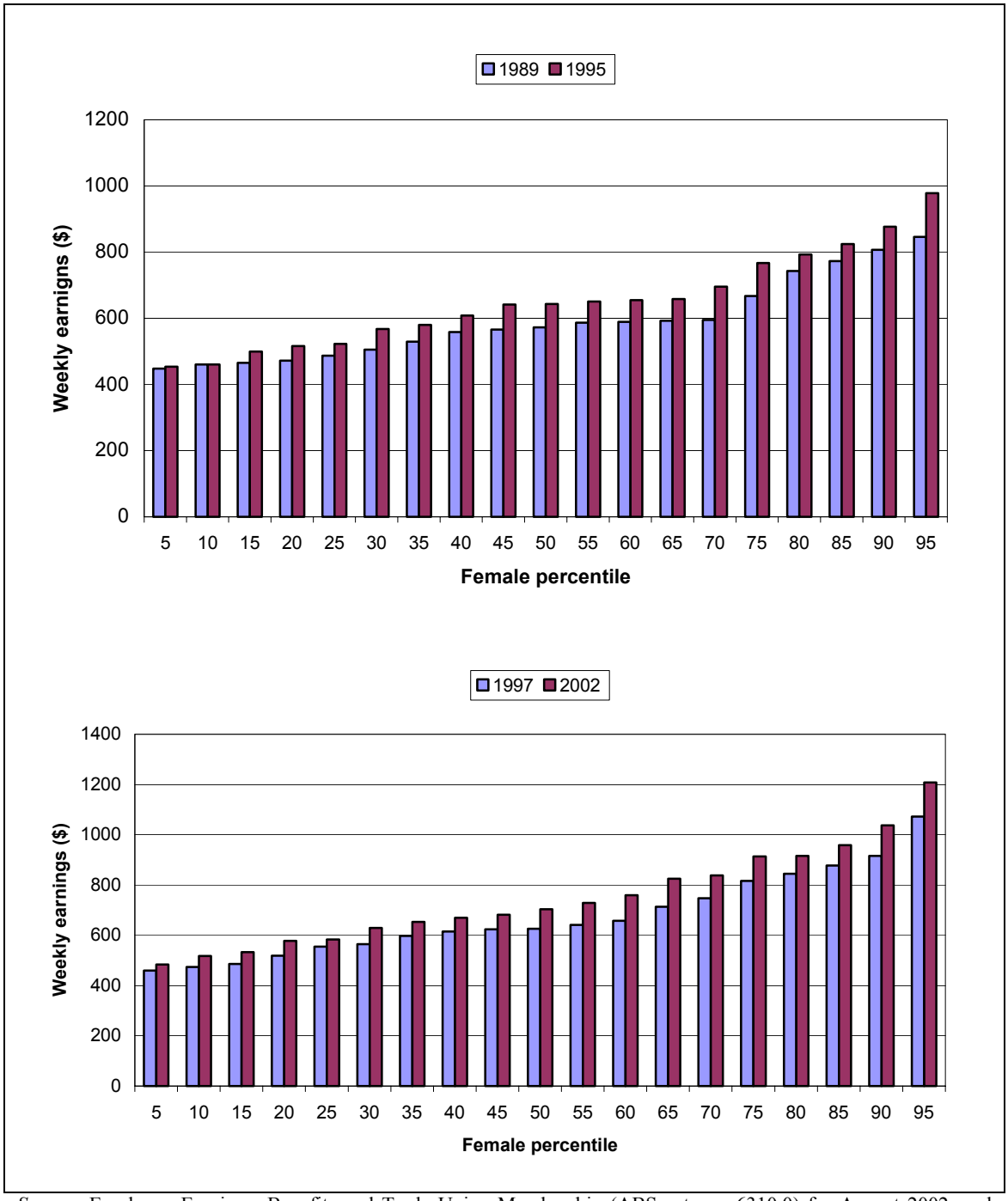
[3] Comparisons between 1989 and 1995 may be affected by the business cycle. In August 1989 the economy was travelling towards the peak of 1990, whereas in 1995 Australia was at the recovery phase of the recession of 1991-1993.

Figure 10.1 Current weekly earnings of full-time male non-managerial occupations by percentile, 1989-2002



Source: Employee Earnings, Benefits and Trade Union Membership (ABS cat. no. 6310.0) for August 2002, and Weekly Earnings of Employees (Distribution) (ABS cat. no. 6310.0) for August 1989, 1995 and 1997. Using Consumer Price Index, base 2002 = 100.

Figure 10.2 Current weekly earnings of full-time female non-managerial occupations by percentile, 1989-2002

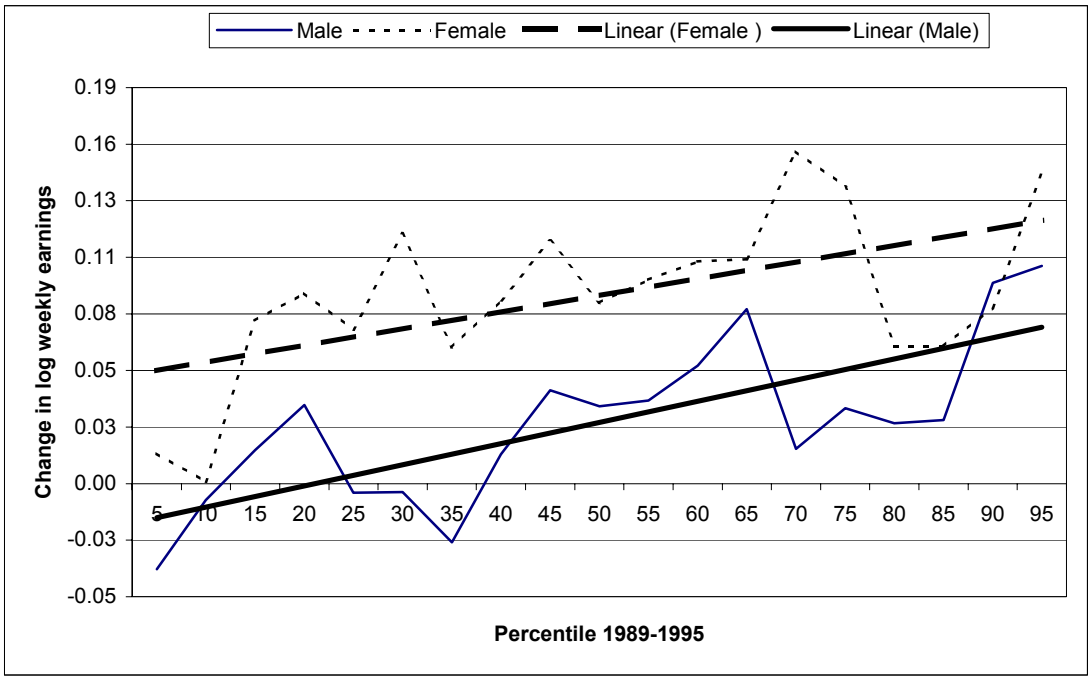


Source: Employee Earnings, Benefits and Trade Union Membership (ABS cat. no. 6310.0) for August 2002, and Weekly Earnings of Employees (Distribution) (ABS cat. no. 6310.0) for August 1989, 1995 and 1997. Using Consumer Price Index, base 2002 = 100.

The trends across occupations for females are similar to those experienced by males, but the changes in earnings inequality are not as pronounced. For example, in 1989 occupations at the 95th percentile earned 1.4 times more than those at the 70th percentile; by 2002, this had risen to 1.5 times. At the 90th and 10th percentiles the ratio was 1.7 times in 1989, and by 2002 this had risen to two times the earnings. At the bottom half

of the distribution, the 50th to 10th percentile ratios grew from 1.2 times to 1.3 times in each period, indicating that the increase in inequality for women was not as pronounced as for men.

Figure 10.3 Change in log weekly earnings of full-time male and female non-managerial occupations, 1989-1995



Source: Author calculations.

Figures 10.3 and 10.4 show the change in log real weekly earnings for male and female occupations between 1989 and 1995, and 1997 and 2002, together with a regression trendline. To obtain the regression trendline, the following equation was used.

$$\Delta Ln(WE) = \alpha + \beta Y + \varepsilon \qquad (10.1)$$

where $\Delta Ln(WE)$ is the change in log weekly earnings; α is the regression intercept; β is the slope of the regression line or the coefficient of the independent variable; Y is the log average weekly earnings ranking shown by percentiles; and ε is the error term. Table 10.2 shows the regression results for each of the trendlines shown in Figures 10.3 and 10.4.

Table 10.2 Trendline regression results for males and females, 1989-1995 and 1997-2002 periods

Males					
Dependent variable	*Constant*	*Percentile log weekly earnings*	*Degrees of freedom*	*Adjusted R squared*	*F-Statistic*
1989-1995					
ΔLn(WE)	-0.0209	0.0009	17	0.520	20.546
	(0.0124)	(0.0002)			
1997-2002					
ΔLn(WE)	0.0514	0.0005	17	0.410	13.527
	(0.009)	(0.0001)			
Females					
Dependent variable	*Constant*	*Percentile log weekly earnings*	*Degrees of freedom*	*Adjusted R squared*	*F-Statistic*
1989-1995					
ΔLn(WE)	0.0489	0.0007	17	0.274	7.822
	(0.016)	(0.0002)			
1997-2002					
ΔLn(WE)	0.120	0.0001	17	-0.058[4]	0.0041
	(0.0133)	(0.0002)			

Source: Employee Earnings, Benefits and Trade Union Membership, Australia – August 1989, 1995, 1997 and 2002. Using Consumer Price Index, base 2002 = 100. Numbers in brackets denote standard errors.

The diagnostic results detailed in the above regressions reveal the following findings. First, the adjusted R squared figures of 0.520 and 0.410 for the regression of occupations for males for both periods indicate that the change in the log average weekly earnings ranking shown by percentiles explains a good deal of the variation in the change in the log of earnings across occupations. Second, the log average weekly earnings percentile rankings have a significant positive influence upon the change in log weekly earnings in occupations for men.[5]

For women, between 1989 and 1995 the adjusted R squared figure of 0.275 for the regression of occupations indicates that the change in the average weekly earnings ranking shown by percentiles explains some of the variation in the change in the log of earnings across occupations. Second, the average log weekly earnings percentile rankings have a significant positive influence upon the change in log weekly earnings for male employees. Conversely, for women in the 1997-2002 period, the regression results are not statistically[6] significant and the adjusted R squared value shows that the

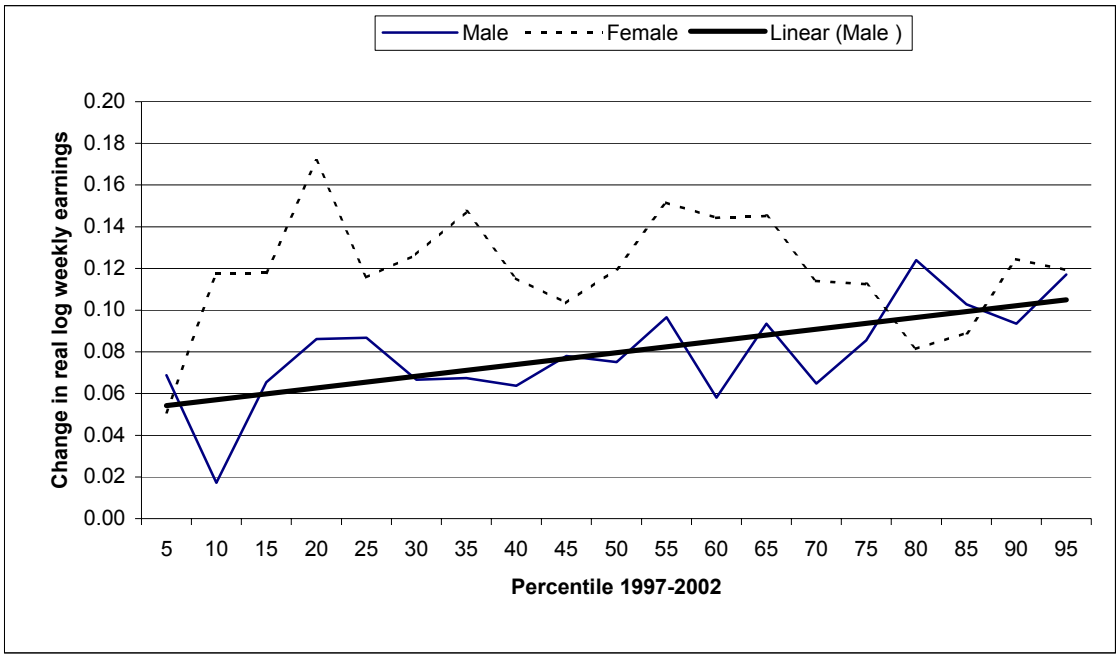
[4] The R squared value for the 1997-2002 regression for females is 0.0002.
[5] The t-value for men in the 1989-1995 regression is 4.5, while for the 1997-2002 regression is 5.0.
[6] The t-value for women in the 1989-1995 regression is 3.5, while for the 1997-2002 regression is 0.5.

change in the average weekly earnings percentile rankings does not explain any of the variation in the change in log earnings across occupations.

For the 1989-1995 and 1997-2002 periods, the trendlines for occupations for men reveal a relatively positive relationship between the change in log average weekly earnings and the ranking of log of average weekly earnings shown by percentiles. This was also the case for occupations for women between 1989 and 1995. However, as shown in Figure 10.4, for the 1997-2002 period, no statistically valid trendline is discernible for women.

Between 1989 and 1995 female and male occupations experienced a relatively large increase in earnings in the middle and top of the earnings distribution. Above the 80th percentile the increase in log real earnings was stronger for females than for males. On the other hand, males experienced a decline in real earnings at the 10th and between the 25th and 35th percentiles of earnings.

Figure 10.4 Change in log weekly earnings of full-time male and female non-managerial occupations, 1997-2002



Source: Author's calculations.

Figure 10.4 shows the pattern of change in log weekly earnings during the 1997 and 2002 period. During this time, weekly earnings for males rose strongly, especially above the 80th percentile.

The pattern of increasing inequality in the distribution of occupational earnings over the two periods for men and women can also be seen by examination of changes in the

summary inequality statistics detailed in Tables 10.3 and 10.4. For male and female occupations, each of the summary measures of earnings inequality (i.e. the Gini coefficient, the mean log deviation, half the squared coefficient of variation and the variance) show that earnings inequality increased in the two periods. In terms of the difference in the log weekly earnings of occupations, between 1989 and 1995, males experienced rises in inequality in each of the log weekly earnings with the exception of the 75th and 25th decile differences. Between 1997 and 2002, the dispersion of earnings in occupations for men increased between the top and the bottom of the distribution, but declined in the 75th and 25th decile differences and the 50th and 25th decile differences.

Table 10.3 Summary statistics of the distribution of log weekly earnings of full-time non-managerial male occupations, 1989-2002

Males	*1989*	*1995*	*1997*	*2002*	*1989-1995*	*1997-2002*
	Percentile ratio				*Change in percentile ratio*	
90-10	0.577	0.679	0.740	0.816	0.102	0.076
90-50	0.353	0.410	0.464	0.482	0.057	0.018
50-10	0.224	0.268	0.276	0.334	0.044	0.058
75-25	0.342	0.382	0.453	0.452	0.040	-0.001
75-50	0.170	0.169	0.267	0.277	-0.001	0.010
50-25	0.172	0.213	0.186	0.174	0.041	-0.012
Inequality Measures						
Gini	0.097	0.107	0.119	0.129	0.010	0.010
MLD	0.040	0.051	0.053	0.056	0.011	0.003
Half squared coefficient of variation	0.040	0.061	0.072	0.078	0.021	0.006
Variance	0.076	0.097	0.111	0.119	0.021	0.008

Source: Employee Earnings, Benefits and Trade Union Membership, Australia – August 1989, 1995, 1997 and 2002. Using Consumer Price Index, base 2002 = 100. Note: '90-10' is the difference in log weekly earnings of occupations at the 90th and 10th percentiles of the distribution of earnings. Other measures of earnings inequality are defined in the same way.

Table 10.4 Summary statistics of the distribution of log weekly earnings of full-time non-managerial female occupations, 1989-2002

Females	*1989*	*1995*	*1997*	*2002*	*1989-1995*	*1997-2002*
		Percentile ratio			*Change in percentile ratio*	
90-10	0.562	0.643	0.659	0.696	0.082	0.037
90-50	0.312	0.309	0.381	0.388	-0.002	0.007
50-10	0.250	0.334	0.278	0.308	0.084	0.030
75-25	0.316	0.383	0.387	0.450	0.067	0.063
75-50	0.122	0.176	0.266	0.261	0.054	-0.005
50-25	0.194	0.207	0.121	0.189	0.013	0.068
Inequality measures						
Gini coefficient	0.088	0.093	0.110	0.117	0.006	0.007
MLD	0.039	0.044	0.051	0.054	0.005	0.003
1/2 squared coefficient of variation	0.039	0.044	0.054	0.061	0.005	0.007
Variance	0.080	0.088	0.088	0.104	0.008	0.016

Source: Employee Earnings, Benefits and Trade Union Membership, Australia – August 1989, 1995, 1997 and 2002. Using Consumer Price Index, base 2002 = 100. Note: '90-10' is the difference in log weekly earnings of occupations at the 90th and 10th percentiles of the distribution of earnings. Other measures of earnings inequality are defined in the same way.

Females experienced similar trends to males in terms of differences in log weekly earnings of occupational changes. Between 1989 and 1995, the 90th and 50th decile differences experienced declines, while for the 1997-2002 period, the 75th and 50th decile difference experienced a decline in earnings inequality.

Although the above analysis has concentrated on understanding the earnings distribution in occupations for men and women, the results confirm the findings of other researchers (e.g. Borland and Wilkins, 1996; Norris and Mclean 1999; Borland et al., 2001; Keating, 2003) that earnings inequality in Australia has been increasing.

10.4 The Role of Skill and Knowledge in Earnings Inequality

The previous section provided evidence that earnings inequality in Australia has been increasing across male and female occupations over the 1989-1995 and 1997-2002 periods. The aim of this exploratory study is to identify what role our intensity measures play in these changes through the analysis of residuals from earnings regressions. This method was used by Borland and Wilkins (1996) to explain changes in individual log earnings using education and experience to proxy skill. Pappas (2001) used a different approach in which he sought to explain the change in occupational log

earnings using cognitive, interactive and motor skill variables derived from the DOT (1991). This analysis, on the other hand, uses the O*NET data on worker requirement measures to analyse the change in occupational earnings. The independent variables used are knowledge, and skill intensity scores, which are obtained using Equation 6.2 in Chapter 6. The dependent variable is the log of weekly earnings.

The reason for choosing worker requirement measures of skill and knowledge in our analysis is that these are closely related to the concept of human capital. As explained in Chapter 6, they correspond to a set of developed attributes of individuals that have the potential and capacity for influencing work output and these can be measured across the range of occupations of ASCO 1st edition and ASCO 2nd edition. Human capital is concerned with the skills, knowledge and other pertinent attributes that are embodied in individuals and how these facilitate the creation of personal, social and economic wellbeing. The definitions of skill and knowledge in the O*NET closely follow the notion of human capital, and the analysis of their impact on earnings inequality may provide important insights in trying to explain the causes for the rise in earnings inequality in Australia.

10.4.1 Data

The data used for this analysis are the same as those used in our analysis of changes to the distribution of earnings. As described in the previous section, the occupational data are from two separate periods. The 1989 and 1995 occupational data for males and females are from ASCO 1st edition, while the data for the 1997 and 2002 period are from ASCO 2nd edition.

To conduct the regressions, each Australian occupation at the four-digit level of ASCO 1st edition and ASCO 2nd edition were assigned to an O*NET occupation. Thus in this analysis there is an element of assignment of the 'most appropriate' O*NET code to a particular occupation in the employment data for 1989 and 1995, and 1997 and 2002. In doing so, it was assumed that there was a similarity in the description of US and Australian occupations. The assignment of an O*NET occupation to an ASCO 1st edition occupation was conducted in the same manner as was done with ASCO 2nd edition occupations as described in Section 5.7 of Chapter 5. The reason for conducting the analysis in two separate periods is that the occupational data are from

different occupational distributions, and comparisons of changes in earnings cannot be performed effectively across two different occupational distributions, namely, ASCO 1st edition and ASCO 2nd edition.

10.4.2 Method

This chapter seeks to explain the change in log occupational weekly earnings using skill and knowledge variables derived from the O*NET. The method used here follows to some extent the approaches taken by Borland and Wilkins (1996) and Pappas (2001). The approach is simpler than that taken by Borland and Wilkins and that taken in a number of US studies (e.g. Katz and Autor, 1999). It does not attempt to estimate the impact of the O*NET measures of skill and knowledge after correcting for other individual factors such as years of education and experience, gender and race. The data used in this study are solely based on occupations and are used to estimate the relationship between the log of earnings and the O*NET measures of skill and knowledge, but it is not possible to correct for other factors influencing individual earnings.

The first step is to regress the log of weekly occupational earnings on the skill and knowledge O*NET variables. Separate regressions are conducted for males and females for 1989 and 1995, and for 1997 and 2002. The second step is to recover the regression residuals, and measures of dispersion in the regression residuals are made up in the same way as for weekly earnings reported in Section 10.3. Thus, changes in the dispersion of regression residuals between 1989 and 1995 and between 1997 and 2002 represent the return on earnings dispersion of changes in the distribution of and return to unobserved factors. Calculating the difference between the changes in the dispersion of log weekly earnings and changes in the dispersion of the regression residuals provides a measure of the net effect on earnings dispersion of changes in the distribution of and return to skill and knowledge.

To conduct the analysis of residuals from an earnings regression, the following earnings equation was utilised:

$$\mathbf{O}_{it} = \mathbf{X}_i \beta_{it} + \varepsilon_{it} \qquad (10.2)$$

where O_{it}: is a vector of the log of weekly earnings of occupation i in period t; X_i is a vector of skill and knowledge characteristics of occupation i which do not change over time; and ε_{it} is the residual.

10.4.3 Results

Separate regressions of log real hourly occupational earnings on our intensity measures were carried out and the corresponding results are reported in Table 10.5. The table shows the coefficient estimate, standard error, degrees of freedom, F-statistic, adjusted R squared, and estimate coefficients for skill and knowledge.

Table 10.5 Skill and knowledge regression results, 1989-2002

Males						
Dependent variable	*Constant*	*Skill*	*Knowledge*	*Degrees of freedom*	*Adjusted R squared*	*F-Statistic*
1989						
Ln (WE)	6.393	0.002	0.004	260	0.340	66.486
	(0.025)	(0.0004)	(0.0014)			
1995						
Ln (WE)	6.391	0.002	0.004	260	0.318	62.001
	(0.029)	(0.0004)	(0.0016)			
1997						
Ln (WE)	6.421	0.001	0.007	291	0.304	59.514
	(0.031)	(0.0005)	(0.002)			
2002						
Ln (WE)	6.442	0.003	0.007	291	0.413	103.906
	(0.026)	(0.001)	(0.001)			
Females						
Dependent variable	*Constant*	*Skill*	*Knowledge*	*Degrees of freedom*	*Adjusted R squared*	*F-Statistic*
1989						
Ln (WE)	6.161	0.001	0.008	158	0.319	39.411
	(0.004)	(0.0006)	(0.002)			
1995						
Ln (WE)	6.184	0.002	0.006	158	0.421	59.057
	(0.034)	(0.0005)	(0.0005)			
1997						
Ln (WE)	6.155	0.002	0.008	192	0.365	55.012
	(0.038)	(0.00050	(0.002)			
2002						
Ln (WE)	6.237	0.002	0.007	192	0.488	93.356
	(0.0034)	(0.0004)	(0.002)			

Source: Employee Earnings, Benefits and Trade Union Membership, Australia – August 1989, 1995, 1997 and 2002. Using Consumer Price Index, base 2002 = 100. Numbers in brackets denote standard errors.

In all the regressions, multicollinearity was not strong enough to make any corrections, and statistical tests for heteroscedasticity (Breusch-Pagan) failed to reject the null hypothesis – H_0: $\rho_i = \rho_k$.

The diagnostic results detailed in the above regressions reveal the following findings. First, the adjusted R squared figures of between 0.304 and 0.488 for all the regressions in both periods indicate that skill and knowledge explain a good deal of the variation in log earnings across occupations for males and females. Second, both skill and knowledge have a significant positive influence upon log earnings for male and female employees.

The final step in our analysis is to use the effect of change in the distribution of and return to skill and knowledge upon the change in the dispersion of log real weekly occupational earnings for 1989-1995 and 1997-2002. The results are detailed in Tables 10.6 and 10.7 for the 1989-1995 and 1997-2002 periods, respectively.

Table 10.6 Change in percentile differences in log real weekly earnings between 1989 and 1995, attributed to skill and knowledge and other factors

Percentile	*Log Earnings*	*Residuals*	*Effect of change in the distribution of and return to skill and knowledge*
Males			
90-10	0.102	0.045	0.056
90-50	0.058	0.174	-0.116
50-10	0.044	-0.129	0.173
75-25	0.040	-0.044	0.084
75-50	-0.001	-0.012	0.011
50-25	0.040	0.100	0.140
Variance	0.021	0.016	0.005
Females			
90-10	0.082	-0.031	0.112
90-50	-0.002	-0.045	0.043
50-10	0.084	0.015	0.069
75-25	0.067	-0.134	0.201
75-50	0.054	-0.183	0.237
50-25	0.013	0.015	-0.002
Variance	0.008	-0.018	0.026

Source: Author's calculations.

For the 1989-1995 period, Table 10.6 shows that changes in the distribution of and return to skill and knowledge are responsible for the increase in inequality (the only

exception being the $75^{th}/50^{th}$ percentile, where inequality declined by a small amount). This is evidenced by the increase in the $90^{th}/10^{th}$ percentile difference in log earnings between 1989 and 1995 of 0.102 being largely attributed (55 per cent explained) to changes in the distribution of and return to skill and knowledge.

The increase in the $75^{th}/25^{th}$ percentile difference in log earnings is more than explained by the changes in the distribution of and return to skill and knowledge, while the increase in the $90^{th}/50^{th}$ percentile difference in log occupational earnings of 0.058 is also attributed to factors other than skill and knowledge measures. Similarly, one quarter of the increase in the variance of log weekly earnings is explained by changes in the return to observable skill and knowledge. This suggests that much of the increase in the dispersion of earnings in occupations for men between 1989 and 1995 in the top of the distribution is due to changes in the distribution of and returns to our skill and knowledge measures. For females, observed factors more than explain the increase in earnings inequality at the $90^{th}/10^{th}$ percentile of the earnings distribution. Similarly, at the $75^{th}/50^{th}$ percentile, observed factors explain one-third of the increase in earnings inequality, the $50^{th}/10^{th}$ percentile explained 82 per cent of the variation, while for the lower half of the distribution, the observed factors of skill and knowledge were responsible for most of the increase in earnings inequality. In contrast to males, the increase in the variance of log weekly earnings more than explains changes in the return to observable skill and knowledge, also indicating that much of the increase in female occupational earnings inequality in the top of the distribution for the period is due to changes in the distribution of and returns to our skill and knowledge measures. These findings are unlike those reported by Borland and Wilkins (1996) and Borland and Kennedy (1998b) who attributed most of the increase in inequality in full-time individual earnings to unobservable factors.

For the 1997-2002 period, most of the increase in the dispersion of earnings for men at the top of the distribution can be explained by changes in the distribution of and return to skill and knowledge. For example, at the $90^{th}/10^{th}$ percentile one-third of the increase in earnings inequality can be explained by our skill and knowledge measures. The increase at the $90^{th}/50^{th}$ percentile is explained by unobservable factors. In contrast, the $75^{th}/25^{th}$ percentile for males experienced a slight decrease in earnings inequality, which is totally explained by our observed factors. Finally, the increase in the variance of log

weekly earnings more than explains changes in the return to observable skills and knowledge, also indicating that much of the increase in male occupational earnings inequality in the distribution of earnings is due to changes in the distribution of and returns to our skill and knowledge measures.

Table 10.7 Change in percentile differences in log real weekly earnings between 1997 and 2002, attributed to skill and knowledge and other factors

Percentile	*Log Earnings*	*Residuals*	*Effect of change in the distribution of and return to skill and knowledge*
Males			
90-10	0.076	0.051	0.025
90-50	0.018	0.102	-0.084
50-10	0.058	-0.051	0.109
75-25	-0.001	-0.071	0.069
75-50	0.010	0.038	-0.027
50-25	-0.012	-0.108	0.097
Variance	0.007	-0.015	0.016
Females			
90-10	0.037	0.013	0.024
90-50	0.007	-0.137	0.144
50-10	0.030	0.149	-0.119
75-25	0.063	-0.269	0.332
75-50	-0.005	-0.204	0.199
50-25	0.068	-0.065	0.133
Variance	0.016	-0.012	0.028

Source: Author's calculations.

The results for females in the 1997-2002 period show that changes in the distribution of and return to skill and knowledge are responsible for the large increase in earnings inequality in the top half of the occupational earnings distribution. Evidence for this can be seen at the $90^{th}/10^{th}$ percentile where 64 per cent of the increase is explained by our observable factors. Similarly, the increase in inequality at the $90^{th}/50^{th}$ and $75^{th}/25^{th}$ percentiles more than explains changes in the return to observable skills and knowledge. These findings show that much of the increase in male and female occupational earnings inequality in the top of the distribution is due to changes in the distribution of and returns to our skill and knowledges measures. As with the 1989-1995 period, these findings are not consistent with those reported by Borland and Wilkins (1996) and Borland and Kennedy (1998b).

10.5 Conclusion

This chapter sought to establish whether there is any evidence that skill-bias in the demand for labour is a significant factor in the rise in earnings inequality. To establish this link, the first objective was to measure changes in the distribution of earnings in terms of occupations rather than individuals for males and females over the 1989-1995 and 1997-2002 periods. The analysis found that earnings inequality for males and females across occupations had increased overall in both periods, irrespective of the inequality measures used. Earnings inequality grew stronger for males and females in the top of the occupational distribution between 1989 and 1995 but grew at a slower pace between 1997 and 2002. The difference in inequality growth could be explained by the fact that between 1989 and 1995 the Australian economy was recovering from a relatively strong recessionary period, whereas between 1997 and 2002, there was a period of steady economic growth.

The second objective of this chapter was to explain the causes of earnings inequality using measures of skill and knowledge derived from the O*NET. To do this, log occupational earnings are regressed on skill and knowledge characteristics of occupations for the 1989-1995 and 1997-2002 periods for males and females. The analysis found that differences in skill and knowledge explained a good deal of the variation in earnings across occupations for men and women across the two periods.

These findings provide some evidence, using average earnings across occupations rather than individual earnings that support the skill-bias hypothesis for full-time work in Australia. They contrast with those of Borland and Wilkins (1996) who found that 'between 1982 and 1990 changes in the distribution of and return to unobservable skill characteristics have increased earnings dispersion' (p. 22). Similarly, Borland and Kennedy (1998b) using a different technique found that changes in unobservable factors explained most of the growth in male earnings inequality between the 1980s and mid-1990s.

Chapter 11
Job Types, Inequality and Skill-Bias

11.1 Introduction

The analysis conducted in the previous two chapters addressed the first two questions of this thesis: whether there has in fact been skill-bias in the demand for labour in Australia and, if so, whether there is any evidence that it plays a significant role in explaining the increase in earnings inequality in full-time employment. Chapter 9 showed that there has indeed been skill-bias in Australia across a variety of job types over the 1971-2001 period. But, although there was clear evidence of skill-bias in full-time employment for both males and females, the extent was not homogenous across job types.

Chapter 10 investigated the potential role of skill-bias in increasing earnings inequality over two shorter periods, 1989-1995 and 1997-2002, using an approach based on occupations. It found that the dispersion of earnings across occupations had increased, irrespective of the measures used. It also found that, over the two periods for both males and females, the O*NET measures of knowledge and skill were useful tools in explaining the rise in earnings dispersion across occupations. In particular, for the 1997-2002 period, rising inequality of earnings across occupations may be partly explained by the effect of changes in the distribution of, and in return to, knowledge and skill. Using the $90^{th}/10^{th}$ ratio, for example, over one-third of the increase in the dispersion of earnings across occupations for males, and 64 per cent for females, can be explained by the knowledge and skill measures. These results are interpreted as providing some evidence that skill-bias, whether driven by technological change or other factors, may be important in explaining rising inequality in individual earnings in Australia.

In this final chapter I turn to the third question: can the increasing role of part-time and casual work in Australia be interpreted as, in substantial part, a response to skill-

bias in the demand for labour, and as indicative of rising inequality in the labour market?

Chapter 2 presented the concept of the Transatlantic Consensus, which centres on the idea that increased earnings inequality in the US and high levels of unemployment in parts of Europe are due to a shift in demand towards skilled employees, away from unskilled ones. Atkinson (1999) argues that this provides 'a unified explanation as to how a single cause has a differential impact on the United States and on mainland Europe' (p. 2). Chapter 3 discussed the growth in different job types in Australia, and how firms may minimise the cost of hiring workers by using alternative arrangements such as casual and part-time work. This could be seen as a way in which employers have responded to the phenomenon of skill-bias in the demand for labour in order to minimise the cost of less skilled labour.

Thus, one aim of this chapter is to revisit and explore the hypothesis presented in Chapter 3 that there may be in Australia a third expression of skill-bias, namely, the growth of alternative forms of employment other than full-time permanent jobs. The other aim is to enquire whether the trend to greater part-time and casual work in Australia is itself indicative of rising inequality in the labour market.

11.2 The Empirical Implications of the Hypothesis

The hypothesis presented in Chapter 3 states that if wages are inflexible downwards in the Australian labour market, but there exists flexibility of job types (i.e. in the use of alternative job types such as permanent part-time employment and casual full-time and part-time employment arrangements), one way in which employers may reduce wage costs for lower skill workers, in the face of skill-bias in the demand for labour, is by opting to employ workers on a part-time or casual basis, thus reducing their wages bill for a given level of skill adjusted hours of employment. So, in the case of Australia, as opposed to the US and Europe, if wages are relatively inflexible downwards (i.e. wages are sticky because there exists an effective minimum wage protection scheme regulated by government, or for other reasons) but the type of job creation is flexible in nature and this provides a lower cost alternative to employers, then the demand for labour will favour those types of jobs, especially in lower skill

occupations where wages are inflexible downwards. Thus a combination of skill-bias and flexibility in terms of lower cost job types might explain the rise in employment creation at the high skill levels (where the demand for skilled labour is stronger) accompanied by increasing wages, whilst at the same time we see a decline in permanent full-time employment creation from the middle to the bottom of the employment distribution (where the demand for less skilled labour is not so strong). This decline in the demand for permanent jobs that require lower skill levels (and perhaps lower wage rates) may then be partly matched by an increase in part-time and casual employment creation in the middle to lower skill occupations.

To test whether the data are consistent with this hypothesis, it is useful to specify it more precisely and draw out some of its empirical implications. In doing so, the following terminology is adopted:

- w is the wage level of a particular group, measured in terms of the hourly wage rate, and Δw is the percentage change in that rate over a specified period;
- e is the employment level of a particular group, measured in terms of either persons employed or hours worked, and Δe is the percentage change in employment over a specified period;
- subscripts h and l refer to high and low skill, subscripts m and c refer to permanent and casual job types, and subscripts f and p refer to full-time and part-time job types respectively.

There are five elements to the hypothesis, and I draw five empirical, testable implications. The five elements are as follows:

- there is skill-bias in the demand for labour, so that the demand for skilled labour increases relative to the demand for unskilled labour;
- for a given level of skill, hourly wage rates in alternative job types, that is, part-time and casual jobs, are lower than in full-time permanent jobs;
- real wages are inflexible downwards for unskilled work;

- there is flexibility in job types, that is, the institutional and supply arrangements permit employers to shift employment to alternative job types, and the elasticity of the supply of labour in these job types at the given hourly wage rate is high;

- as a result, there is a shift in the pattern of demand to alternative job types generally, and particularly at the unskilled end of the labour market.

The five empirical implications are as follows:

(i) Opening wages: For a given level of skill, it should be cheaper per hour to hire a casual worker than a permanent worker, and a part-time worker than a full-time one. For example, the hourly wage rate for permanent full-time jobs in high skill occupations would be expected to be higher than the equivalent hourly wage rate for casual full-time work. Similarly, for a given level of skill, it would be cheaper to hire a casual part-time worker than a permanent part-time worker, on an hourly basis, in the same occupation. If the hypothesis also applies to full-time and part-time work, it implies that, again for a given skill level, full-time permanent employment has a higher per hour cost than part-time permanent employment, and similarly for casual work. That is, for given skill levels:

$$w_m > w_c \text{ and } w_f > w_p ,$$

and, more specifically:

$$w_{fm} > w_{fc};\ w_{pm} > w_{pc};\ w_{fm} > w_{pm} \text{ and } w_{fc} > w_{pc}.$$

(ii) Pattern of change in wages: Reflecting the skill-bias element of the hypothesis, the growth in the hourly wage would be expected to be higher in high skilled occupations than in less skilled occupations, for each job type. Reflecting the relative labour cost element, for a given level of skill the increase in the demand for labour, and hence in wages, should be greater in casual than permanent employment and in part-time than in full-time employment. If we assume that, for low skilled jobs in alternative job types (that is, casual and part-time employment), the elasticity of supply at the opening wage level is high, then the increased demand for labour in low skilled alternative job types generates little increase in wages for those jobs. Hence, for all job types:

$$\Delta w_h > \Delta w_l ,$$

and, for given skill levels:

$$\Delta w_c > \Delta w_m, \text{ and hence } \Delta w_{fc} > \Delta w_{fm} \text{ and } \Delta w_{pc} > \Delta w_{pm}; \text{ and}$$
$$\Delta w_p > \Delta w_f, \text{ and hence } \Delta w_{pm} > \Delta w_{fm} \text{ and } \Delta w_{pc} > \Delta w_{fc}.$$

(iii) Employment change: The skill-bias element of the hypothesis implies strong growth in employment and total hours worked in high skill occupations relative to that in employment or hours worked in low skill occupations. Reflecting the relative labour cost element, for a given level of skill the increase in the demand for labour, and hence in employment given abundant supplies of labour, should be greater in casual than in permanent employment and in part-time than in full-time employment. Moreover, the demand for employment in alternative job types in low skilled occupations is expected to increase because employers engage part-time and casual workers in such occupations, substituting them for higher cost full-time permanent employees. From this it follows that for full-time permanent employment:

$$\Delta e_h > \Delta e_l ,$$

but that there is no clear prediction for other job types, because for alternative job types the positive impact of substitution on employment may or may not offset the negative impact of skill-bias.

However, as a result of the lower wage cost and substitution effects, it follows that, for given skill levels:

$$\Delta e_c > \Delta e_{m,} \text{ and hence } \Delta e_{fc} > \Delta e_{fm} \text{ and } \Delta e_{pc} > \Delta e_{pm}; \text{ and}$$
$$\Delta e_p > \Delta e_f \text{ hence } \Delta e_{pm} > \Delta e_{fm} \text{ and } \Delta e_{pc} > \Delta e_{fc}.$$

(iv) Wages in low skill occupations: Given the assumption of inflexibility downwards in the real wage rate, no decline is anticipated in the real hourly wage rate for permanent full-time employment in low skilled occupations. Further, since the demand for labour is higher in alternative job types than in full-time permanent employment, no decline in the real wage rate for other job types is anticipated either. Thus, for all job types and for all skill levels, it is predicted that Δw_l is not less than zero.

(v) Decline in demand for low skill occupations: As noted above, it is anticipated that there will be a relative, and perhaps an absolute, decline in the demand for full-time permanent employment in low skilled occupations, because of skill-bias generally, the higher relative cost of permanent employment and the downward

inflexibility of wages for such employment. Thus full-time permanent employment in low skilled occupations may be declining, in spite of overall employment growth. An increase in casual and part-time employment in low skilled occupations should partly offset this decline, but to an extent consistent with the prediction above that the growth in total hours worked in low skilled occupations is lower than that in high skilled occupations.

11.3 Testing the Empirical Implications

In this section I examine the extent to which the data are consistent with these implications of the hypothesis. The analysis is undertaken for the 1997-2002 period, the latest period for which we have consistent occupational data, and examines changes in hourly earnings and in total employment and hours worked in terms of skill levels and across different job types. In measuring skill levels, I use the classification criteria employed in ASCO 2nd edition, described in Table 3.3 in Chapter 3, and the five skill categories of the ABS. Preliminary analyses, not reported here, have been undertaken using the other two approaches to measuring skill used in this thesis – the nine one-digit ABS classifications of occupations and the approach based on the O*NET variables – and these generate similar results.

It is important to note, at the outset, that many other factors than those contained in the hypothesis may be shaping the data trends detailed below. For example, given the high level of aggregation of the data, it is likely that compositional effects within particular skill levels and job types are significant. This may mean that observed changes in the hourly wage rates and in employment may reflect changes in the composition of a particular skill level or job type, rather than more fundamental economic factors. Thus I am concerned to investigate only whether the data are *consistent with* these five empirical implications of the hypothesis, rather than to establish the hypothesis in any stronger sense.

11.3.1 Measurement issues and pay rate adjustment for casual workers

The data chosen for this analysis were obtained from the Employee Earnings, Benefits and Trade Union Membership (EEBTUM) (ABS cat no. 6310.0) for the years 1997 and 2002. As noted above, the reason for using this period is that prior to 1996, the

occupational classification was coded in terms of ASCO 1st edition. Choosing the 1997-2002 period means that we are able to compare hourly earning levels in terms of casual and permanent employment across consistent occupations. Permanent and casual employment is defined using the ABS definition described in Chapter 3, while the hourly rates presented in Tables 11.1 to 11.4 are calculated as the quotient of the average earnings and of the average hours worked by persons in a particular skill category.

The reported wage rates for permanent and casual workers are not directly comparable, as permanent workers typically get holiday pay and sick leave in addition to wage payments whereas casual workers are paid a loading in lieu of such payments. In order to directly compare hourly pay rates between casual and permanent employees, the hourly pay rates of casual workers were deflated by 19.5 per cent to account for the premium which is paid to them. Casual employee conditions vary across occupations as they are generally covered according to the relevant award. Casual hourly rates are deflated because these employees must take leave without pay when ill and for holidays, whereas permanent employees can draw on sick leave and annual leave entitlements. The figure of 19.5 per cent is based on work conducted by Dawkins and Norris (1990) who estimated that this represents the amount required to offset casual workers for loss of holiday and paid sick leave entitlements (p. 158). This figure has been used in other studies, such as Dunlop (2002).

11.3.2 Analysis of hypothesis implications

Implication i: Opening wages

The first implication of the hypothesis concerns the relative levels of opening wages, here 1997. It suggests that, across skill levels, hourly rates of pay for permanent employees are higher than those for casual employees, and those for full-time workers are higher than those for part-time workers. That is, for given skill levels:

$$w_m > w_c \text{ and } w_f > w_p,$$

and, more specifically:

$$w_{fm} > w_{fc};\ w_{pm} > w_{pc};\ w_{fm} > w_{pm} \text{ and } w_{fc} > w_{pc}.$$

These implications are examined using Tables 11.1 to 11.3.

Table 11.1 Level of and change in real hourly rates of pay ($ per hour in 2002 prices) for full-time and part-time permanent and casual employment by skill level, 1997-2002

Skill level	*Earnings in permanent full-time employment*			*Earnings in casual full-time employment*			*Hourly rate ratio permanent to casual, full-time, 1997*
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*	*1997*
Skill I	24.7	27.0	9.3	16.7	21.4	28.0	1.48
Skill II	20.7	22.4	8.2	11.8	13.9	17.6	1.75
Skill III	17.8	19.4	8.7	13.3	15.3	15.0	1.34
Skill IV	18.3	18.8	2.3	13.1	13.8	5.4	1.40
Skill V	16.0	16.2	1.2	11.1	12.2	9.2	1.44
Total	*20.1*	*21.8*	*8.2*	*13.4*	*15.6*	*15.9*	1.50

Skill level	*Earnings in permanent part-time employment*			*Earnings in casual part-time employment*			*Hourly rate ratio permanent to casual, part-time, 1997*
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*	*1997*
Skill I	22.1	29.9	35.2	18.6	24.6	32.1	1.19
Skill II	18.9	22.9	21.5	13.8	17.0	23.0	1.37
Skill III	19.0	21.8	14.7	15.9	15.7	-0.9	1.19
Skill IV	16.9	17.7	4.8	12.5	13.4	7.0	1.35
Skill V	13.6	15.5	14.0	11.4	11.4	-0.1	1.19
Total	*18.0*	*21.3*	*18.7*	*13.0*	*14.2*	*9.0*	1.38

Source: Employee Earnings, Benefits and Trade Union Membership (ABS cat. no. 6310.0) for August 2002 and for August 1997. In 1997 this survey was referred to as Weekly Earnings of Employees (Distribution) (ABS cat. no. 6310.0). Wages rates for 1997 are adjusted to 2002 values using Consumer Price Index.

The top panel of Table 11.1 shows that in 1997 the ratio of the hourly wage for permanent full-time to casual full-time employment (Column 8) was higher in each of the five skill categories. Across skill levels, the cost of employing a permanent employee in skill categories I, III, IV and V was 34 to 48 per cent higher, while for skill category II the differential was 75 per cent. In this year, the average hourly rate for employing a permanent employee was 50 per cent higher than that for employing a casual employee, although comparisons at the aggregate level may be especially influenced by compositional effects. A similar pattern of higher costs of employing permanent full-time employees relative to casual full-time employees can be seen in Table 11.2, for both men and women. For men, the highest ratio was in skill level II, while for women it was in skill levels II, III and IV, but the differential was higher for men than for women in each skill level.

Table 11.2 Level of and change in real hourly rates of pay ($ per hour in 2002 prices) for male and female full-time permanent and casual employment, 1997-2002

Skill level	*Earnings in male permanent employment*			*Earnings in male casual employment*			*Hourly rate ratio permanent to casual, 1997*
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*	*1997*
Skill I	25.8	28.3	9.4	16.7	21.4	28.0	1.54
Skill II	21.4	23.4	9.1	11.8	13.9	17.6	1.81
Skill III	18.3	19.7	7.7	13.3	15.3	15.0	1.38
Skill IV	19.1	19.7	3.2	13.1	13.8	5.4	1.46
Skill V	16.5	17.0	3.0	11.1	12.2	9.2	1.49
Total	*20.8*	*22.5*	*8.5*	*13.4*	*15.6*	*15.9*	1.55
Skill level	*Earnings in female permanent employment*			*Earnings in female casual employment*			*Hourly rate ratio permanent to casual, 1997*
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*	*1997*
Skill I	22.2	25.0	12.3	15.7	21.7	38.4	1.41
Skill II	18.8	20.4	8.4	14.2	15.0	5.6	1.32
Skill III	16.5	18.3	10.8	12.9	12.9	0.0	1.28
Skill IV	16.4	17.3	5.3	11.8	12.7	8.1	1.39
Skill V	14.6	14.6	0.2	10.3	11.7	13.3	1.42
Total	*18.4*	*20.3*	*10.6*	*12.5*	*14.7*	*16.8*	1.47

Source: As for Table 11.1.

The second panel of Table 11.1 provides evidence on the relative costs of permanent and casual part-time workers. Again the costs of permanent workers are significantly higher in all skill groups, although the differentials are generally lower than in the full-time case, ranging from 19 to 37 per cent. But for both full-time and part-time work the data are consistent with implication (i).

The second part of this implication relates to the relative cost of full-time and part-time workers. Information on this question can also be inferred from Tables 11.1 and 11.2, and the ratios are made explicit in Table 11.3. Column 2 of Table 11.3 shows that the average wage rate of employing a full-time permanent employee was somewhat higher than that of employing a permanent part-time employee, especially at the highest and lowest skill levels. But the differentials were modest, amounting to 9 per cent on average. Column 3 shows that the average hourly cost of employing a casual worker on a full-time basis is lower than on a part-time basis for the three higher skill levels, and about the same for the other two skill levels. For skill levels II and III the differential in favour of full-time work is about 15 per cent. While the

average cost ratio across all casual employees suggests a higher cost for full-time workers, this appears to be heavily influenced by compositional factors. Overall I interpret these data as providing no convincing evidence that the costs of employing part-time workers are lower than those of employing full-time workers.

Table 11.3 Hourly rate of pay ratios for full-time and part-time permanent and casual employment, 1997

Skill level	*Full-time permanent to part-time permanent*	*Full-time casual to part-time casual*
Skill I	1.12	0.90
Skill II	1.10	0.86
Skill III	0.94	0.84
Skill IV	1.08	1.03
Skill V	1.18	0.97
Total	*1.09*	*1.07*

Source: As for Table 11.1.

Thus the empirical pre-conditions for the hypothesis we are investigating – that the cost of employing workers in alternative job types to full-time permanent ones, as measured by the effective hourly rate – are confirmed for casual workers but not for part-time workers. The evidence is that it is much cheaper, at least in terms of hourly wages, for employers to engage casual than permanent workers, but that the same is not true for part-time as opposed to full-time workers.

Implication ii: Pattern of change in wages

The next part of our hypothesis considers the pattern of change in wages for different job types. This proposition suggests that the growth in wages is expected to be strong in high skilled occupations relative to less skilled occupations in each job type. Hence, for all job types:

$$\Delta w_h > \Delta w_l \, .$$

Also, for given skill levels, wage growth is predicted to be faster for casual than permanent employment and for part-time than full-time employment:

$$\Delta w_c > \Delta w_m, \text{ and hence } \Delta w_{fc} > \Delta w_{fm} \text{ and } \Delta w_{pc} > \Delta w_{pm}; \text{ and}$$

$$\Delta w_p > \Delta w_f, \text{ and hence } \Delta w_{pm} > \Delta w_{fm} \text{ and } \Delta w_{pc} > \Delta w_{fc}.$$

Table 11.1 shows the change in earnings over the 1997-2002 period by skill levels for each of the four job types, and confirms that the change in the hourly rate in skill level

follows a pattern of declining increase in earnings with declining skills levels, with the exception of one skill level for each job type. The main exceptions are the relative strength in wage rate growth for lower skill workers (skill level V) in full-time casual and permanent part-time employment. Wage rate growth in skill level IV for part-time casual employees is also stronger than predicted.

However, the general trend for all job types is clearly for wage rates in high skill occupations to grow more rapidly than in low skill occupations. The rapid growth in real hourly wage rates for the three job types other than permanent full-time employment is particularly notable. In the case of part-time casual jobs, for example, real hourly wages rates increased by 32.1 and 23.0 per cent for skill levels I and II respectively over the 1997-2002 period, but declined marginally for skill level V. This same pattern can also be seen for male and female full-time permanent and casual employment (Table 11.2), although there is somewhat stronger growth than predicted in wage rates in low skill employment for women. Thus the results detailed in Tables 11.1, 11.2 and 11.3 generally confirm the implication that, across job types, the growth in real hourly wages is stronger in high skill than in low skill jobs.

Turning to wage rate growth for given skill levels across job types, Table 11.4 shows that, for all skill levels, the growth in real hourly wage rates over 1997-2002 was greater in casual employment than in permanent employment (top panel), and that this was true for all skill levels other than level III for part-time employment relative to full-time employment (bottom panel). Again the differentials in favour of casual and part-time work were particularly pronounced in the high skill levels. In terms of the different job types, Table 11.1 confirms that $\Delta w_{fc} > \Delta w_{fm}$ and $\Delta w_{pm} > \Delta w_{fm}$ for all skill levels, but that the two inequalities involving part-time casual work are problematic. Thus $\Delta w_{pc} > \Delta w_{pm}$ is definitely contradicted by the data, while $\Delta w_{pc} > \Delta w_{fc}$ holds for three out of five skill levels in a marginal way, and for the other two skill levels Δw_{fc} is considerably greater than Δw_{pc}.

Overall, the prediction that $\Delta w_h > \Delta w_l$ is strongly confirmed for all job types and for virtually all skill levels. At the aggregate level, the prediction that $\Delta w_c > \Delta w_m$ and that $\Delta w_p > \Delta w_f$ is confirmed for all skill levels. But the more detailed inequalities involving part-time casual work are not confirmed by the data.

Table 11.4 Level of and change in real hourly rates of pay ($ per hour at 2002 prices) for total permanent and casual employment and total full-time and part-time employment, by skill level, 1997-2002

	Earnings in total permanent employment			*Earnings in total casual employment*		
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*
Skill I	24.5	27.2	11.1	17.2	22.2	28.6
Skill II	20.6	22.4	8.7	12.2	14.5	19.2
Skill III	17.9	19.5	9.1	14.1	15.4	9.6
Skill IV	18.2	18.6	2.4	12.8	13.6	6.5
Skill V	15.7	16.1	2.4	11.3	11.7	3.5
Total	20.0	21.7	8.9	13.3	15.0	13.4
	Earnings in total full-time employment			*Earnings in total part-time employment*		
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*
Skill I	24.1	26.9	12.0	22.2	29.7	33.7
Skill II	19.8	21.8	10.2	17.8	22.0	23.7
Skill III	17.8	19.2	8.3	19.0	20.5	7.6
Skill IV	18.0	18.5	2.7	15.8	16.9	7.0
Skill V	15.5	15.8	2.4	13.6	14.3	5.1
Total	*19.6*	*21.4*	*9.2*	*16.6*	*19.1*	*15.5*

Source: As for Table 11.1.

Implication iii: Employment change

This implication relates to changes in employment and total hours worked. In terms of changes in employment across skill levels, it is the case that for full-time permanent employment:

$$\Delta e_h > \Delta e_l ,$$

but there is no clear prediction for other job types. As a result of the lower wage cost and substitution effects it is predicted that, for given skill levels:

$$\Delta e_c > \Delta e_{m,} \text{ hence } \Delta e_{fc} > \Delta e_{fm} \text{ and } \Delta e_{pc} > \Delta e_{pm}; \text{ and}$$
$$\Delta e_p > \Delta e_f, \text{ hence } \Delta e_{pm} > \Delta e_{fm} \text{ and } \Delta e_{pc} > \Delta e_{fc}.$$

In testing these employment implications here we use data on total hours worked in the different categories, but the results are similar if the number of persons employed is used as the employment variable.

Table 11.5 shows the change in total hours worked for the four job types by skill level for the 1997-2002 period. It broadly confirms that, for full-time permanent work, $\Delta e_h > \Delta e_l$ across skill levels. Growth in hours worked in full-time permanent employment is strong at high skill levels – in skill levels I and II total hours worked grew by between 19.3 and 15.9 per cent respectively – but fell by 6.5 per cent in skill level V. The exception is skill level IV, where employment rose by 5.6 per cent.

Table 11.5 Change in total hours worked per week for full-time and part-time, permanent and casual, 1997-2002

	Full-time permanent hours (millions)			*Part-time permanent hours (millions)*		
Skill level	*1997*	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*
Skill I	53.0	63.2	19.3	4.2	5.4	28.4
Skill II	23.2	26.9	15.9	0.9	1.6	68.4
Skill III	35.4	34.6	-2.4	1.3	1.8	35.0
Skill IV	46.0	48.5	5.6	4.4	6.4	46.9
Skill V	23.2	21.7	-6.5	3.5	4.5	30.4
Total	180.8	195.0	7.8	14.3	19.6	37.8
Skill level	*Full-time casual hours (millions)*			*Part-time casual hours (millions)*		
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*
Skill I	5.5	7.4	33.9	2.1	2.4	12.9
Skill II	3.1	3.8	23.2	0.7	1.0	35.8
Skill III	4.6	5.0	10.2	1.9	1.7	-10.6
Skill IV	5.4	7.9	46.0	6.1	6.5	6.8
Skill V	4.7	6.3	35.2	9.0	8.8	-1.4
Total	23.3	30.5	30.9	19.8	20.4	3.2

Source: As for Table 11.1.

Turning to wage rate growth for given skill levels across job types, Table 11.4 shows that, for all skill levels, the growth in real hourly wage rates over 1997-2002 was greater in casual employment than in permanent employment (top panel), and that this was true for all skill levels other than level III for part-time employment relative to full-time employment (bottom panel). Again the differentials in favour of casual and part-time work were particularly pronounced in the high skill levels. In terms of the different job types, Table 11.1 confirms that $\Delta w_{fc} > \Delta w_{fm}$ and $\Delta w_{pm} > \Delta w_{fm}$ for all skill levels, but that the two inequalities involving part-time casual work are problematic. Thus $\Delta w_{pc} > \Delta w_{pm}$ is definitely contradicted by the data, while $\Delta w_{pc} > \Delta w_{fc}$ holds for three out of five skill levels in a marginal way, and for the other two skill levels Δw_{fc} is considerably greater than Δw_{pc}.

Table 11.6 shows that $\Delta e_c > \Delta e_m$ and $\Delta e_p > \Delta e_f$ for all skill levels without exception. That is, for each level the growth in casual employment has been greater than the growth in permanent employment, and that in part-time work has been greater than the growth in full-time work. The picture is somewhat more complex when the four

job types are introduced. These aggregate results are driven by two central cases, namely, $\Delta e_{fc} > \Delta e_{fm}$ and $\Delta e_{pm} > \Delta e_{fm}$, where the inequality holds for all skill levels, but neither of the inequalities hold for the cases involving part-time casual work, $\Delta e_{pc} > \Delta e_{pm}$ and $\Delta e_{pc} > \Delta e_{fc}$.

Table 11.6 Change in total hours worked per week, for full-time permanent and casual employment and total full-time and total part-time employment, 1997-2002

	Total hours in permanent employment (millions)			*Total hours in casual employment (millions)*		
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*
Skill I	57.2	68.6	20.0	7.7	9.8	28.1
Skill II	24.2	28.5	18.0	3.9	4.8	25.6
Skill III	36.8	36.4	-1.1	6.5	6.7	4.1
Skill IV	50.3	54.9	9.2	11.5	14.5	25.2
Skill V	26.6	26.2	-1.7	13.6	15.1	11.2
Total	*195.0*	*214.6*	*10.0*	*43.1*	*50.9*	*18.2*
	Total hours in full-time employment(millions)			*Total hours in part-time employment (millions)*		
	1997	*2002*	*Change (%)*	*1997*	*2002*	*Change (%)*
Skill I	59.1	70.5	19.3	6.3	7.8	23.5
Skill II	26.5	30.7	15.9	1.7	2.6	56.3
Skill III	39.7	39.6	-0.1	3.2	3.5	8.4
Skill IV	51.6	56.4	9.3	10.5	13.0	23.3
Skill V	28.0	28.0	-0.1	12.4	13.3	7.3
Total	*204.9*	*225.3*	*9.9*	*34.1*	*40.2*	*17.7*

Source: As for Table 11.1.

Implication iv: Wages in low skilled occupations

The fourth implication relates to the assumption of downward inflexibility of real wages in the face of declining relative demand for skill, and hence for all job types it is predicted that the change in real hourly wage rates at low skill levels (i.e. Δw_l) is not less than zero. This prediction is particularly relevant for full-time permanent employment where, according to the hypothesis, the relative demand for labour should be weakest.

This implication is effectively confirmed by the data in Table 11.1. Between 1997 and 2002 the real hourly rate for full-time permanent workers in skill level V rose by 1.2 per cent. Real wages for skill level V employees in casual full-time and in permanent part-time jobs rose significantly, and for those in part-time casual jobs fell by 0.1 per cent. Given the margins of error surrounding this aggregate measure of real wages, this result is also taken as consistent with the implication.

Implication v: Decline in demand for low skilled occupations

The final implication is that there will be a relative, and perhaps an absolute, decline in the demand for full-time permanent employment in low skilled occupations, because of skill-bias generally, the higher relative cost of permanent employment and the downward inflexibility of wages for such employment. Table 11.5 confirms this hypothesis, as noted implicitly above. The growth in hours worked in full-time permanent employment is strong at high skill levels – in levels I and II total hours worked grew by between 19.3 and 15.9 per cent respectively – but fell by 6.5 per cent in skill level V. This prediction also holds to some extent for casual full-time work, where job growth was strong in the top two skill categories. Skill level II grew the strongest, followed by skill levels IV and V. In terms of part-time employment, the prediction that growth in employment and total hours worked would grow in low skilled occupations did not hold for part-time casual work, but held for part-time permanent employment.

11.3.3 Conclusion

This section examined the five implications to the hypothesis that there may be a third expression of skill-bias in the Australian labour market. The overall evidence obtained for the 1997-2002 period is consistent with the hypothesis in relation to casual employment but not in general terms for part-time work. The first implication indicated that it is more economical to employ workers in alternative job types to full-time permanent employment. The analysis was confirmed for casual workers but not for part-time ones. The second implication suggests that the growth in wages is stronger in high skilled work relative to less skilled work in each job type. This prediction that the change in wages for high skilled jobs is much larger than for less skilled jobs is confirmed for all job types and for the majority of skill levels. However, as in the first proposition, the growth in wages could not be confirmed for part-time work. The implication that growth in employment and total hours worked would favour high skilled occupations relative to low skilled occupations was again confirmed for casual work but not for part-time. The evidence shows that for each skill level the growth in casual employment has been greater than in permanent employment but, when the analysis involves the four job types, the predictions for part-time work do not hold. The fourth implication predicts that changes to the real

wage rate would be inflexible downwards. Although there was a small decline in the hourly rate for two skill levels (III and V – Table 11.1) for casual part-time employment, given the aggregate nature of the measure of wages utilised, the overall results are consistent with the implication that there will not be a decline in the hourly rate of pay for different job types. Finally, the implication that there will be a relative or absolute decline in the demand for full-time work in low skilled occupations is supported by the data analysed over the period.

In summary, the proposition that there may be a third expression to the phenomenon of skill-bias in Australia seems to be supported by the data analysed, but in particular for casual rather than part-time work. However, the results of the analysis need to be considered with a degree of caution for two reasons. Firstly, the data are highly aggregated, and secondly, the period under examination is rather short.

Table 11.7 Summary of results of hypothesis testing, 1997-2002

Implication	*Outcome*
1. Opening wage levels	
For given skill levels (h/l): $w_m > w_c$ $w_f > w_p$	Permanent/casual: For skill levels I-V in 1997, $w_{fm} > w_{fc}$ and $w_{pm} > w_{pc}$. Full-time/part-time: $w_{fm} > w_{pm}$ for three of five skill levels, but small effect; but $w_{pc} > w_{fc}$ for three of five skill levels. Overall little convincing evidence of $w_f > w_p$.
2. Change in wage levels	
For all job types : $\Delta w_h > \Delta w_l$ For all skill levels: $\Delta w_c > \Delta w_m$ $\Delta w_p > \Delta w_f$ For all skill levels: $\Delta w_{fc} > \Delta w_{fm}$; $\Delta w_{pc} > \Delta w_{pm}$ $\Delta w_{pm} > \Delta w_{fm}$; $\Delta w_{pc} > \Delta w_{pc}$	For all four job types, and for virtually all skill levels for 1997-2002, $\Delta w_h > \Delta w_l$. For all skill levels $\Delta w_c > \Delta w_m$ and $\Delta w_p > \Delta w_f$. For all skill levels over 1997-2002, $\Delta w_{fc} > \Delta w_{fm}$ but $\Delta w_{pc} > \Delta w_{pm}$ for 3 of 5 skill levels only. For all skill levels over 1997-2002, $\Delta w_{pm} > \Delta w_{fm}$ but $\Delta w_{fc} > \Delta w_{fm}$; other implications not confirmed.
3. Change in employment levels	
For full-time permanent employment: $\Delta e_h > \Delta e_l$ No clear prediction for other job types For all skill levels: $\Delta e_c > \Delta e_m$ $\Delta e_p > \Delta e_f$ For all skill levels: $\Delta e_{fc} > \Delta e_{fm}$; $\Delta e_{pc} > \Delta e_{pm}$ $\Delta e_{pm} > \Delta e_{fm}$; $\Delta e_{pc} > \Delta e_{pc}$	For all skill levels over 1997-2002 for full-time permanent work $\Delta e_h > \Delta e_l$, other than $\Delta e_{IV} > \Delta e_{III}$ For all skill levels $\Delta e_c > \Delta e_m$ and $\Delta e_p > \Delta e_f$ For all skill levels over 1997-2002, $\Delta e_{fc} > \Delta e_{fm}$ and $\Delta e_{pc} > \Delta e_{fc}$. But neither $\Delta e_{pc} < \Delta e_{pm}$ nor $\Delta e_{pc} > \Delta e_{fc}$ are supported.
4. Wages in low skilled occupations	
For all job types, Δw_l not less than zero.	For all four job types over 1997-2002, Δw_l not significantly less than zero (casual part-time –0.1per cent).
5. Employment in low skilled occupations	
Full-time permanent employment in low skilled occupations may be declining, in spite of overall employment growth.	Full-time permanent hours worked in skill level V fell by 6.5 per cent over 1997-2002, in spite of growth in total full-time permanent employment of 7.8 per cent and in skill level I of 19.3 per cent.

Source: Author's summary.

11.4 Are Job Types a New Dimension of Inequality in the Labour Market?

The previous section tested the hypothesis that, in response to skill-bias in the demand for labour, businesses minimise wage costs by employing workers on casual or part-time arrangements. In Chapter 2, the literature review discussed a number of dimensions of earnings inequality that have been researched in Australia and overseas. Two of these relate to increasing earnings inequality in full-time earnings and increasing inequality in total household income. One feature of the study of these dimensions of inequality is that, while the links between the two are clearly recognised, the analyses of increasing earnings inequality in full-time earnings and of increasing inequality of household income have been largely conducted independently of one another and are reported in separate strands of the literature. One reason for treating these dimensions of inequality separately has been data availability, with the data sources available for detailed study of the distribution of earnings not providing data on household incomes, and vice-versa. In consequence, little attention has been given to the implications for inequality of the growth in alternative job types, as they are considered in neither type of study. This issue is discussed briefly in this final section.

11.4.1 Hours worked, hourly rates and household income inequality

As discussed in the literature review, the work of Harding and Richardson (1998, 1999) and Burbidge and Sheehan (2001) indicates that a possible contributor to the rise of inequality between households may be changes in the number of hours worked by household members. The research by Harding and Richardson (1999) showed that hours worked impacted strongly on where in the distribution of income a family would be placed. Their study showed that full-time work, even at low wages, is more likely to add enough to income to lift a family from the lowest income deciles. This contrasts with part-time employment at low wages, which is consistent with many families remaining in the lower income deciles. This finding points to the importance of increasing total hours worked by households as a means of reducing household

income inequality. Their study also showed that families with an unemployed member were more likely to be disadvantaged than families with a low wage member, again indicating the importance of the total number of hours worked as a way of reducing inequality in households (pp. 42-43).

Sheehan and Burbidge (2001) showed that polarisation of families in terms of total hours worked seems to be a significant attribute of increasing inequality in the Australian labour market. Their analysis showed that between 1986 and 1996 the number of couples with children who worked a combined total of less than 20 hours per week grew by 42 per cent (p. 137). Couples without dependent children who worked more than 90 hours per week grew by 69.8 per cent (p. 139). Polarisation in hours worked is also shown in terms of skill and educational attainment across work-rich and work-poor families. Families with no post-school qualifications had reductions in their total working hours, while those with post-school qualifications experienced increases in the number of hours worked (p. 140).

It is thus apparent that changes in the distribution of hours worked may be a significant factor in the changing distribution of income across households, and a similar point may apply to changes in the hourly wage rates attached to those hours worked. These points apply not just to earnings from full-time employment, but to both hours worked and hourly rates in all forms of employment. The question then arises of whether, short of a full analysis of the sources of household income with detailed data on hours worked and hourly wage rates, we can say anything useful about whether the growth of alterative job types contributes to increasing earnings inequality. In other words, can it be argued that the emergence of new types of employment over the last three decades is a distinct component or dimension of earnings inequality in the Australian labour market?

11.4.2 Analysis of changes in hours, hourly rates and earnings by job type

In trying to provide some information in relation to this question, we examine the distribution of changes in hours worked, hourly rates and total earnings between 1997 and 2002 across the two ABS skill measures used previously, namely, the nine

aggregate occupations and the five skill levels. As in other studies, these frameworks are treated as interim structures for analysing the distribution of earnings. The justification for this approach is shown in Table 11.8 which shows that hourly wage rates in 1997 decline generally in line with declining skill levels.

Table 11.8 Change in total employment, total earnings and hourly rate, for occupations, 1997-2002

Occupation	*Hourly rate, $ per hour, 1997*	*Persons (%)*	*Total hours worked (%)*	*Total earnings (%)*	*Hourly rate (%)*
Managers and Administrators	23.9	29.5	26.1	41.9	12.5
Professionals	23.6	22.8	18.2	34.0	13.3
Associate Professionals	19.4	24.1	19.2	30.3	9.3
Tradespersons and Related Workers	17.1	2.1	0.7	8.8	8.1
Advanced Clerical and Service Workers	18.0	2.0	-2.5	8.3	11.1
Intermediate Clerical, Sales and Service Workers	17.1	18.6	15.5	19.1	3.1
Intermediate Production and Transport Workers	17.4	4.2	3.8	8.0	4.0
Elementary Clerical, Sales and Service Workers	14.0	12.9	10.0	10.6	0.6
Labourers and Related Workers	14.5	-0.6	-4.2	-0.3	4.1
Change in Skill level					
Skill I	23.7	24.3	20.3	36.1	13.2
Skill II	19.4	24.1	19.2	30.3	9.3
Skill III	17.3	2.1	-0.1	8.7	8.8
Skill IV	17.2	13.6	10.9	14.7	3.4
Skill V	14.2	6.3	2.4	4.6	2.2
Total change		*13.7*	*11.0*	*21.7*	*9.6*

Source: As for Table 11.1.

Table 11.8 also shows changes in the total employment, total earnings, total hours worked and hourly rate of pay over the 1997-2002 period. It again shows striking evidence of increasing earnings inequality. For the upper panel, the pattern of change in terms of total earnings and total hours worked for all Australian occupations shows strong increases in the top three, a slowing middle, and a falling bottom in the lowest occupation. The largest increases in employment, total earnings and total hours worked occurred in the top three occupational categories, namely, managers and administrators, professionals and associate professionals. Growth in total employment, total earnings and total hours worked was not very significant in occupations in the middle of the employment distribution. Tradespersons and related

workers and advanced clerical and service workers experienced an increase in total earnings, but the latter experienced a decline in total hours worked. The only occupation to experience a decline in total employment, total earnings and total hours worked was labourers and related workers. This indicates a decline in demand for the least skilled occupation.

The lower panel of Table 11.8 details the changes in total employment, total earnings, total hours worked and rate of pay in terms of skill level as described by ASCO 2nd edition. Changes to total earnings and total hours worked show a strong bias towards highly skilled occupations. Skill level III experienced an increase of 8.7 per cent in total earnings, but a small decline in the total number of hours worked, indicating a decline in the demand for occupations requiring middle level skills. The least skilled occupations experienced modest increases in both total earnings and total hours worked. This shows that the labour market has polarised in terms of changes in employment, total earnings and total wage rate. This polarisation has clearly favoured high skilled occupations.

I now investigate whether the pattern of change in these variables over 1997-2002 varies substantially across job types. Tables 11.9 and 11.10 report changes in hours worked, total earnings and hourly rates for five job types, in each case relative to the overall change for each job type. They also report simple measures of the change in dispersion of these variables within job types: the difference in the average growth rate between occupations 1-3 and 7-9 in Table 11.9 and the difference in the average growth rate between skill levels I-II and IV-V in Table 11.10. The job types provided are the one used in most studies of earnings inequality in Australia, full-time employment, and the four disaggregated job types that have been used throughout this thesis.

Table 11.9 Change in relative total hours worked, total earnings and hourly rate relative to the overall change in each job type, by ASCO 2nd edition occupation, 1997-2002, per cent

Total hours worked per week	*Total full-time*	*Permanent full-time*	*Permanent part-time*	*Casual full-time*	*Casual part-time*
1 Managers and Administrators	14.8	16.5	1.5	-8.0	-28.0
2 Professionals	6.1	8.5	-7.2	9.6	15.3
3 Associate Professionals	5.4	7.5	22.2	-5.9	31.6
4 Tradespersons and Related Workers	-7.7	-8.5	13.2	-14.8	-26.9
5 Advanced Clerical and Service Workers	-14.7	-13.3	-8.7	-22.5	2.6
6 Intermediate Clerical, Sales and Service Workers	2.5	1.4	9.1	17.3	11.9
7 Intermediate Production and Transport Workers	-4.6	-7.1	-13.4	7.4	-18.6
8 Elementary Clerical, Sales and Service Workers	-5.6	-6.9	1.7	4.0	7.3
9 Labourers and Related Workers	-11.6	-17.9	-15.5	2.9	-19.7
Difference in average growth rate between Occupations 1-3 and 7-9	*16.1*	*21.5*	*14.5*	*-6.2*	*16.6*
Total earnings					
1 Managers and Administrators	19.0	19.1	21.9	18.6	-14.1
2 Professionals	8.2	8.8	5.3	10.6	39.3
3 Associate Professionals	6.4	7.5	25.1	-4.5	48.6
4 Tradespersons and Related Workers	-8.8	-8.4	8.6	-14.2	-36.8
5 Advanced Clerical and Service Workers	-14.0	-11.7	-9.7	-31.3	-4.0
6 Intermediate Clerical, Sales and Service Workers	-4.5	-4.4	-4.9	5.5	7.7
7 Intermediate Production and Transport Workers	-9.1	-11.8	-16.6	-1.1	-15.4
8 Elementary Clerical, Sales and Service Workers	-14.5	-17.7	-0.7	3.4	1.4
9 Labourers and Related Workers	-15.0	-19.9	-20.9	-5.3	-28.0
Difference in average growth rate between Occupations 1-3 and 7-9	*24.1*	*28.3*	*30.1*	*9.3*	*38.6*
Hourly rate					
1 Managers and Administrators	5.2	4.2	17.6	30.1	15.8
2 Professionals	3.6	2.2	11.2	1.8	17.2
3 Associate Professionals	2.5	1.9	0.3	2.4	9.5
4 Tradespersons and Related Workers	0.3	2.0	-6.0	1.6	-16.1
5 Advanced Clerical and Service Workers	2.4	3.8	-3.1	-10.6	-9.3
6 Intermediate Clerical, Sales and Service Workers	-5.4	-3.8	-14.6	-9.3	-6.6
7 Intermediate Production and Transport Workers	-3.2	-3.2	-5.6	-7.1	0.8
8 Elementary Clerical, Sales and Service Workers	-8.0	-9.9	-4.3	0.3	-8.3
9 Labourers and Related Workers	-2.3	-0.5	-8.3	-7.2	-12.9
Difference in average growth rate between Occupations 1-3 and 7-9	*8.3*	*7.3*	*15.8*	*16.1*	*21.0*

Source: As for Table 11.1.

Table 11.10 Change in relative total hours worked, total earnings and hourly rate relative to the overall change in each job type, by ASCO 2nd edition skill level, 1997-2002, per cent

Total hours worked per week	Total full-time	Permanent full-time	Permanent part-time	Casual full-time	Casual part-time
Skill I	8.5	10.7	-6.8	2.3	9.4
Skill II	5.4	7.5	22.2	-5.9	31.6
Skill III	-9.1	-9.5	-2.0	-15.8	-13.4
Skill IV	-0.6	-2.0	6.6	11.5	3.5
Skill V	-9.1	-13.3	-5.4	3.3	-4.5
Average growth difference between skills I and II and IV and V	*11.8*	*16.7*	*7.1*	*-9.2*	*21.0*
Total earnings					
Skill I	11.3	11.7	6.1	13.0	32.7
Skill II	6.3	7.5	25.1	-4.5	48.6
Skill III	-9.9	-9.2	-5.3	-16.4	-21.2
Skill IV	-6.5	-7.5	-6.0	1.5	1.7
Skill V	-14.8	-18.9	-9.2	-2.6	-12.3
Average growth difference between skills I and II and IV and V	*19.4*	*22.8*	*23.2*	*4.8*	*45.9*
Hourly rate					
Skill I	4.4	3.2	14.4	12.2	16.6
Skill II	2.5	1.9	0.2	2.3	9.5
Skill III	1.4	2.9	-4.3	-4.6	-12.6
Skill IV	-4.3	-3.6	-10.6	-8.1	-3.0
Skill V	-5.1	-5.3	-6.4	-3.8	-10.8
Average growth difference between skills I and II and IV and V	*8.2*	*7.0*	*15.8*	*13.2*	*19.9*

Source: As for Table 11.1.

This analysis reveals a number of significant points. First, within full-time work there are major differences between permanent and casual work, with the increase in the dispersion of total earnings across occupations or skill levels being much greater in permanent than casual work. This is clearly demonstrated by Table 11.9 where the difference in the average growth rate between the top three occupations and the bottom three was 28.3 per cent for permanent full-time work, whereas for casual full-time the difference was much smaller – 9.3 per cent. At least within this period, and by this measure, a more uniform pattern of growth in earnings across occupations and skill levels in casual full-time work has somewhat evened out the sharply increasing dispersion of earnings in permanent full-time work. This difference is indeed driven by sharp differences in the pattern of growth in hours worked – in permanent full-time work, increases in hours worked have been strongly concentrated in higher

occupational or skill levels, whereas in casual full-time work, hours worked have grown most strongly in lower occupational and skill levels.

Second, the increase in the dispersion of earnings over 1997-2002 in both types of part-time work, and especially in casual part-time work, is greater than in total full-time work. In casual part-time work, for example, the average growth in earnings in skill levels I and II was 40.6 per cent while the average growth in earnings in skill levels IV and V declined by 6.9 per cent. This difference was much greater than in the case of full-time work (Table 11.10), where the average growth difference in total earnings between skill levels I and II for casual part-time work was 45.9 per cent for part-time casual work, compared with 4.8 per cent in full-time casual work and 22.8 per cent in permanent full-time work.

In the case of casual part-time work, this increased dispersion in earnings relative to full-time work is particularly due to relative changes in hourly rates. Hourly rates in the two top skill levels have increased much more rapidly, relative to those in the bottom two skill levels, in casual part-time than in total full-time work.

Other lessons could be drawn from these data in a fuller analysis. But these two points are sufficient to bring out the fact that important dimensions of the trend towards increasing earnings inequality, such as the different trends in permanent and causal full-time work and the sharp increase in the dispersion of earnings from casual work across occupations and skill levels, are disguised by the concentration on full-time earnings. These newer dimensions of earnings inequality in the Australian labour market are likely to influence the distribution of income across households, and need further study. If the growth in alternative job types is partly driven by skill-bias in the demand for labour, as was argued in the first part of this chapter may be the case, this could provide another avenue whereby skill-bias leads to increasing inequality in earnings.

11.4.3 Conclusion

This section of the chapter sought to explore whether job type creation may imply a new dimension of increasing earnings inequality in the Australian labour market. The analysis conducted was of an exploratory nature and its findings need to be treated

with caution. A reason for this is the highly aggregated nature of the data and the short term period of analysis. In spite of these caveats, the evidence from the data analysed seems to point to the notion that the increase in job type creation in Australia may be another dimension of increasing inequality, or at the very least a contributing factor in increasing inequality in the labour market. The changes reported in Tables 11.8 to 11.10 provide some evidence of another dimension of inequality. This can be seen in the change in total earnings and the hourly rate of pay being strongly biased towards high skilled occupations in all the job types examined. Within full-time employment, the data showed that the increase in the dispersion of total earnings across skill levels and occupations was of a larger magnitude in permanent full-time work than in casual full-time work – the difference being driven by a strong concentration of growth in hours worked in high skilled occupations in permanent full-time work, relative to a sharp increase in total hours worked in casual full-time occupations requiring lower skill levels. The increase in the dispersion of earnings for part-time casual and permanent work can be attributed to strong growth in the hourly rate of pay of high skilled occupations.

If this inequality growth in job types is driven by skill-bias in the demand for labour, it may be possible that this inequality is likely to impact strongly on household income inequality. Burbidge and Sheehan (2001) argued that a possible contributor to the causes of inequality in households might be the total number of hours worked by their members. If many households are dependent on these job types that provide limited hours of work per week, and their members possess low work related skills, it is likely that these job types (e.g. casual part-time employment) may be a contributing factor to increasing inequality of households. It can be also argued that job type creation may indeed be a new form or dimension of earnings inequality in the Australian labour market.

Appendices

Appendix A

Skills Taxonomy

Basic Skills

Content Skills: Background structures needed to work with and acquire more specific skills in a variety of different domains.

B01	B01IM00M	B01LV00M	Reading and comprehension.
B02	B02IM00M	B02LV00M	Active listening.
B03	B03IM00M	B03LV00M	Writing.
B04	B04IM00M	B04LV00M	Speaking.
B05	B05IM00M	B05LV00M	Mathematics.
B06	B06IM00M	B06LV00M	Science.

Process Skills: Procedures that contribute to the more rapid acquisition of knowledge and skills across a variety of domains.

B07	B07IM00M	B07LV00M	Critical thinking.
B08	B08IM00M	B08LV00M	Active learning.
B09	B09IM00M	B09LV00M	Learning strategies.
B10	B10IM00M	B10LV00M	Monitoring.

Cross-Functional Skills

Social Skills: Developed capacities used to work with people to achieve goals.

C01	C01IM00M	C01LV00M	Social perceptiveness.
C02	C02IM00M	C02LV00M	Coordination.
C03	C03IM00M	C03LV00M	Persuasion.
C04	C04IM00M	C04LV00M	Negotiation.
C05	C05IM00M	C05LV00M	Instructing.
C06	C06IM00M	C06LV00M	Service orientation.

Complex Problem Solving Skills: Developed capacities used to solve novel, ill-defined problems in complex, real-world settings.

C07	C07IM00M	C07LV00M	Problem identification.
C08	C08IM00M	C08LV00M	Information gathering.
C09	C09IM00M	C09LV00M	Information organisation.
C10	C10IM00M	C10LV00M	Synthesis/Reorganisation.
C11	C11IM00M	C11LV00M	Idea generation.
C12	C12IM00M	C12LV00M	Idea evaluation.
C13	C13IM00M	C13LV00M	Implementation planning.
C14	C14IM00M	C14LV00M	Solution appraisal.

Technical Skills: Developed capacities used to design, set up, operate, and correct malfunctions involving application of machines or technological systems.

C15	C15IM00M	C15LV00M	Operations analysis.
C16	C16IM00M	C16LV00M	Technology design.
C17	C17IM00M	C17LV00M	Equipment selection.
C18	C18IM00M	C18LV00M	Installation.
C19	C19IM00M	C19LV00M	Programming.
C20	C20IM00M	C20LV00M	Testing.
C21	C21IM00M	C21LV00M	Operation monitoring.

C22	C22IM00M	C22LV00M	Operation and control.
C23	C23IM00M	C23LV00M	Product inspection.
C24	C24IM00M	C24LV00M	Equipment maintenance.
C25	C25IM00M	C25LV00M	Troubleshooting.
C26	C26IM00M	C26LV00M	Repairing.

Systems Skills: Developed capacities used to understand, monitor, and improve socio-technical systems.

C27	C27IM00M	C27LV00M	Visioning.
C28	C28IM00M	C28LV00M	Systems perception.
C29	C29IM00M	C29LV00M	Identifying downstream consequences.
C30	C30IM00M	C30LV00M	Identification of key causes.
C31	C31IM00M	C31LV00M	Judgement and decision making.
C32	C32IM00M	C32LV00M	Systems evaluation.

Resource Management Skills: Developed capacities used to allocate resources efficiently

C33	C33IM00M	C33LV00M	Time management.
C34	C34IM00M	C34LV00M	Management of financial resources.
C35	C35IM00M	C35LV00M	Management of material resources.
C36	C36IM00M	C36LV00M	Management of personnel resources.

Explanatory Notes

1. 'I' in IMOOM refers to the skill importance indicator. For a particular skill descriptor this denotes how important this particular area of skill is to the performance of the job in question.
2. 'L' in LVOOM refers to the level indicator. For a skill descriptor this refers to the degree or quality of skill required to perform that specific job.

Source: US Department of Labor (1998a).

APPENDIX B

Knowledges Taxonomy

Business and Management
Knowledge of principles and facts related to business administration and accounting, human and material resource management in organisations, sales and marketing, economics, and office information and organising systems.

K01	K01IMOOM	K01LVOOM	Administration and management.
K02	K02IMOOM	K02LVOOM	Clerical.
K03	K03IMOOM	K03LVOOM	Economics and accounting.
K04	K04IMOOM	K04LVOOM	Sales and marketing.
K05	K05IMOOM	K05LVOOM	Customer and personal service.
K06	K06IMOOM	K06LVOOM	Personnel and HR.

Manufacturing and Production Skills
Knowledge of principles and facts related to the production, processing, storage and distribution of manufactured and agricultural goods.

K07	K07IMOOM	K07LVOMM	Production and processing.
K08	K08IMOOM	K08LVOOM	Food production.

Engineering and Technology
Knowledge and design, development, and application of technology for specific purposes.

K09	K09IMOOM	K09LVOOM	Computers and electronics.
K10	K10IMOOM	K10LVOOM	Engineering and technology.
K11	K11IMOOM	K11LVOOM	Design.
K12	K12IMOOM	K12LVOOM	Building and construction.
K13	K13IMOOM	K13LVOOM	Mechanical.

Mathematics and Science
This includes knowledge of the history, theories, methods, and applications of physics, biology, mathematics and geography for specific work purposes.

K14	K14IMOOM	K14LVOOM	Mathematics.
K15	K15IMOOM	K15LVOOM	Physics.
K16	K16IMOOM	K16LVOOM	Chemistry.
K17	K17IMOOM	K17LVOOM	Biology.
K18	K18IMOOM	K18LVOOM	Psychology.
K19	K19IMOOM	K19LVOOM	Sociology and anthropology.
K20	K20IMOOM	K20LVOOM	Geography.

Health Services
Knowledge of principles and facts regarding diagnosing, curing and preventing disease, and proving and preserving physical and mental health and well-being.

K21	K21IMOOM	K21LVOOM	Medicine and dentistry.
K22	K22IMOOM	K22LVOOM	Therapy and counselling.

Education and Training
Knowledge of instructional methods and training techniques including curriculum design principles, learning theory, group or individual teaching techniques, design of individual development plans, and test design principles.

K23	K23IMOOM	K23LVOOM	Education and training.

Arts and Humanities

Knowledge of facts and principles related to the branches of learning concerned with human thought, language, and the arts.

K24	K24IMOOM	K24LVOOM	English language.
K25	K25IMOOM	K25LVOOM	Foreign language.
K26	K26IMOOM	K26LVOOM	Fine arts.
K27	K27IMOOM	K27LVOOM	History and archaeology.
K28	K28IMOOM	K28LVOOM	Philosophy and theology.

Law and Public Safety

Knowledge of regulations and methods for maintaining people and property free from danger, injury or damage; the rules of public conduct established and enforced by legislation; and the political process establishing such rules.

K29	K29IMOOM	K29LVOOM	Public safety and security.
K30	K30IMOOM	K50LVOOM	Law, government and jurisprudence.

Communications

Knowledge of the science and art of delivering information.

K31	K31IMOOM	K31LVOOM	Telecommunications.
K32	K32IMOOM	K32LVOOM	Communications and media.

Transportation

Knowledge of principles and methods for moving people, or goods by air, rail, sea, or road, including their relative costs, advantages, and limitations.

K33	K33IMOOM	K33LVOOM	Transportation.

Explanatory Notes

1. 'I' in IMOOM refers to the importance indicator. For a particular knowledge descriptor this denotes how important this particular area of knowledge is to the performance of the job in question.
2. 'L' in LVOOM refers to the level indicator. For a knowledge descriptor this refers to the degree or quality of knowledge required to perform that specific job.

Source: US Department of Labor (1998a).

APPENDIX C

Generalised Work Activities Taxonomy

Information Input

Where and how are information and data gained that are needed to perform this job?

Looking for/Receiving Job Related Information

G01	G01IM00M	G01LV00M	Getting information needed to do the job.
G03	G03IM00M	G03LV00M	Monitor processes, material, surroundings.

Identify/Evaluating Job Related Information

G02	G02IM00M	G02LV00M	Identifying objects, actions and events.
G04	G04IM00M	G04LV00M	Inspecting equipment, structures, material.
G05	G05IM00M	G05LV00M	Estimating needed characteristics.

Mental Processes

What processing, planning, problem-solving, decision making, and innovating activities are performed with job-relevant information?

Information/Data Processing

G06	G06IM00M	G06LV00M	Judging quality of things, service, people.
G07	G07IM00M	G07LV00M	Evaluating information against standards.
G08	G08IM00M	G08LV00M	Processing information.
G09	G09IM00M	G09LV00M	Analysing data or information.

Reasoning/Decision Making

G10	G10IM00M	G10LV00M	Making decisions and solving problems.
G11	G11IM00M	G11LV00M	Thinking creatively.
G12	G12IM00M	G12LV00M	Updating and using job related knowledge.
G13	G13IM00M	G13LV00M	Developing objectives and strategies.
G14	G14IM00M	G14LV00M	Scheduling work activities.
G15	G15IM00M	G15LV00M	Organising, planning and prioritising.

Work Output

What physical activities are performed, what equipment and vehicles are operated/controlled, and what complex/technical activities are accomplished as job outputs?

Performing Physical and Manual Work Activities

G16	G16IM00M	G16LV00M	Performing general physical activities.
G17	G17IM00M	G17LV00M	Handling and moving objects.
G18	G18IM00M	G18LV00M	Controlling machines and processes.
G20	G20IM00M	G20LV00M	Operating vehicles or equipment.

Performing Complex Technical Activities

G19	G19IM00M	G19LV00M	Interacting with computers.
G21	G21IM00M	G21LV00M	Drafting and specifying technical devices, etc.
G22	G22IM00M	G22LV00M	Implementing ideas, programs, etc.
G23	G23IM00M	G23LV00M	Repairing and maintaining mechanical equipment.
G24	G24IM00M	G24LV00M	Repairing and maintaining electrical equipment.
G25	G25IM00M	G25LV00M	Documenting/Recording information.

Interacting with Others

What interactions with other persons or supervisory activities occur while performing this job?

Communicating with Others

G26	G26IM00M	G26LV00M	Interpreting meaning of information to others.
G27	G27IM00M	G27LV00M	Communicating with other workers.
G28	G28IM00M	G28LV00M	Communicating with persons outside organisations.
G29	G29IM00M	G29LV00M	Establishing and maintaining relationships.
G30	G30IM00M	G30LV00M	Assisting and caring for others.
G31	G31IM00M	G31LV00M	Selling or influencing others.
G32	G32IM00M	G32LV00M	Resolving conflicts, negotiating with others.
G33	G33IM00M	G33LV00M	Performing for/working with public.

Coordinating/Developing/Managing/Advising

G34	G34IM00M	G34LV00M	Coordinating work and activities for others.
G35	G35IM00M	G35LV00M	Developing and building teams.
G36	G36IM00M	G36LV00M	Teaching others.
G37	G37IM00M	G37LV00M	Guiding, directing and motivating subordinates.
G38	G38IM00M	G38LV00M	Coaching and developing others.
G39	G39IM00M	G39LV00M	Provide consultation and advice to others.

Administering

G40	G40IM00M	G40LV00M	Performing administrative activities.
G41	G41IM00M	G41LV00M	Staffing organisational units.
G42	G42IM00M	G42LV00M	Monitoring and controlling resources.

Source: US Department of Labor (1998a).

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