

Changes in the Australian labour market over the economic cycle

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Interim report

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Distinguishing the effects of wages and activity on employment at the aggregate level

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1. Introduction

Submissions to Australian minimum wage setting bodies have argued that a moderate increase in minimum wages is not inconsistent with continued growth in employment. Certainly, there have been extended periods of at least moderate economic growth where this has proven to be the case. Other economic variables have been able to deliver an increase in employment independently of whether minimum wages are considered to increase, decrease or have no effect on employment at the micro level.

This paper aims to distinguish the effects of wages and activity on employment at the aggregate level by developing a model of employment which is then used for scenario analysis.

The paper is structured as follows. Section two is an overview of labour market trends since the mid-1980s, including changes in selected minimum wage rates. Section three is a brief literature review. Section four estimates a model of employment, while section five simulates the effects of different output and wage scenarios on employment.

2. General trends in the labour market since the mid-1980s

2.1. Changes in employment, wages and activity

Australia's unemployment rate reached a low of approximately 4 per cent in early 2008, the closest that the labour market has come to 'full employment' for several decades. Consumer Price Inflation reached a peak of 5 per cent in the year to the September quarter 2008. However, a general slowing in economic activity saw the unemployment rate increase by around one percentage point and employment growth slow to zero on a month-to-month basis by early 2009. These wider variations in prices, employment growth and economic activity make it more challenging to distinguish the effect of wages, and more particularly minimum wages, on employment from other factors.

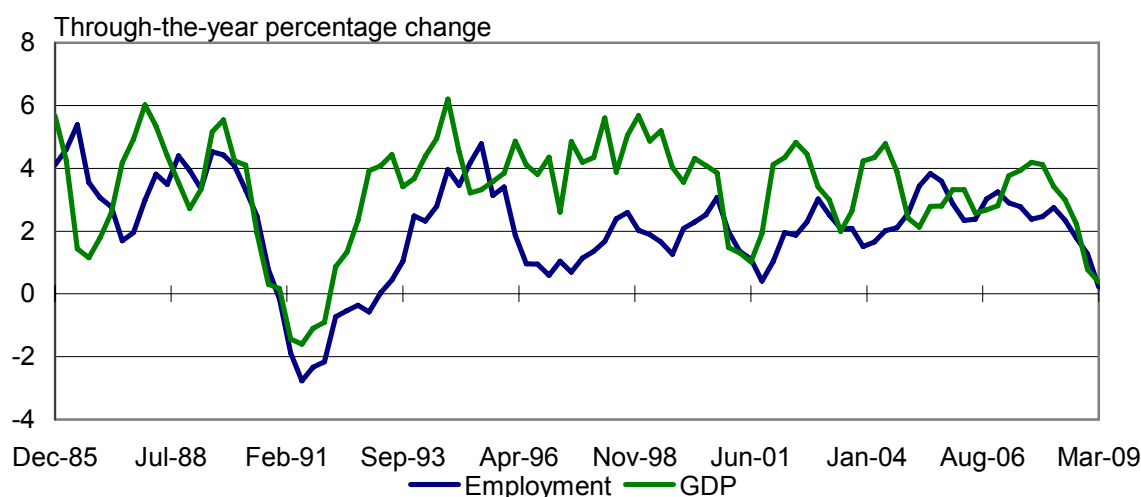
As Figure 1 illustrates, the closeness of the relationship between growth in real Gross Domestic Product (GDP) and employment has varied over time and over different stages of the economic cycle.² In the period 1989 to 1991, as the economy headed

¹ The authors thank Miranda Pointon for comments received, with responsibility for the content of the paper remaining with the authors.

² See also ABS, *Australian National Accounts: National Income, Expenditure and Product*, June 2005, 'Feature article 1: The relationship between GDP and employment', Catalogue No. 5206.0, which reports an analysis based on quarterly growth rates.

into recession, employment growth slowed at a very similar rate to GDP. However, during the early phase of the recovery in economic growth, 1991 to 1994, the recovery in employment was slower and delayed. The widest difference between growth in GDP and employment occurred in 1992-93, when the level of employment was unchanged and GDP increased by 4 per cent. Employment eventually increased quickly through 1993-94. From 1994 to 2008, a period of general but variable expansion in economic activity, the relationship between employment and GDP growth was less consistent.

Figure 1: Growth in employment and GDP, December quarter 1985 to March quarter 2009



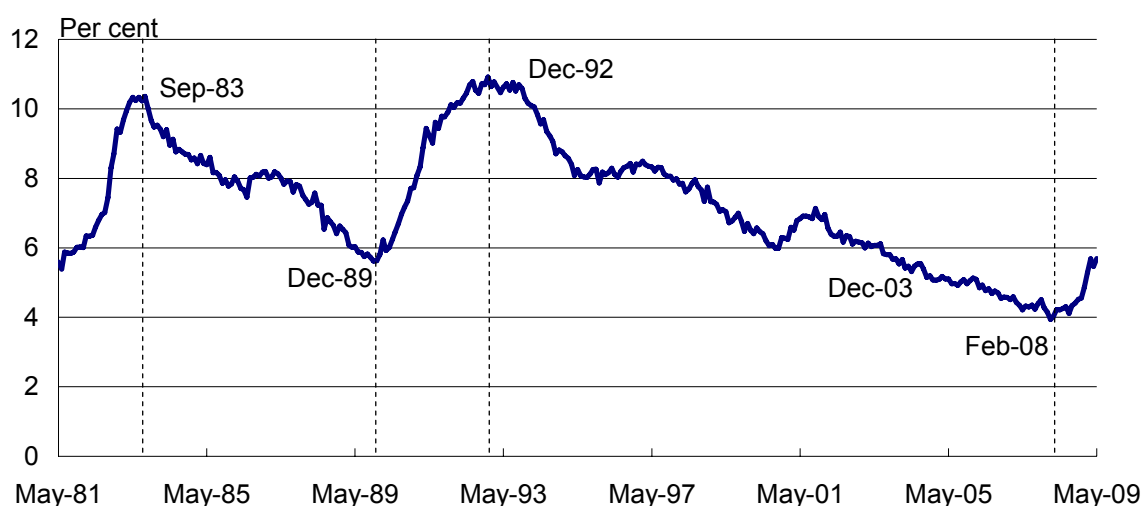
Note: Employment data are quarterly, aligning with the availability of GDP data. Employment is measured in terms of the number of people employed.

Source: ABS, *Australian National Accounts: National Income, Expenditure and Product*, March quarter 2009, Catalogue No. 5206.0; ABS, *Labour Force, Australia*, May 2009, Catalogue No. 6202.0.

There are many factors that can influence this pattern, with the gap between GDP and employment growth implicitly relating to productivity (measured in this case as output per person employed). This measure of productivity can be influenced by factors such as the labour intensity of employment growth, changes in the average number of hours worked and whether economic growth is occurring in capital-intensive industries, such as mining, or more labour-intensive industries.

The variations in employment in response to changes in economic activity, particularly the asymmetry involved, can also be read from changes in the unemployment rate over the economic cycle. Figure 2 illustrates the movements in the unemployment rate from the early 1980s to mid-2009. A rising unemployment rate implies that employment growth is less than the growth in the labour force. In December 1989, the unemployment rate reached a cyclical minimum of 5.6 per cent before rising over a period of three years to a peak of 10.9 per cent in December 1992. It then took eleven years for the unemployment rate to return to 5.7 per cent, with half of that decline achieved within three years of the peak. At the same time, the economy continued to expand.

Figure 2: Unemployment rate, May 1981 to May 2009



Note: Data are monthly. The dotted lines represent when the unemployment rate reached a cyclical peak or trough.

Source: ABS, *Labour Force, Australia*, May 2009, Catalogue No. 6202.0.

Another set of factors that could influence the GDP-employment relationship is more institutional in nature, such as the arrangements for wage-determination. Some researchers have suggested that the employment dividend from economic growth could be influenced by the extent to which those people who are already employed experience wage increases. For example, Professor Gregory observed that:

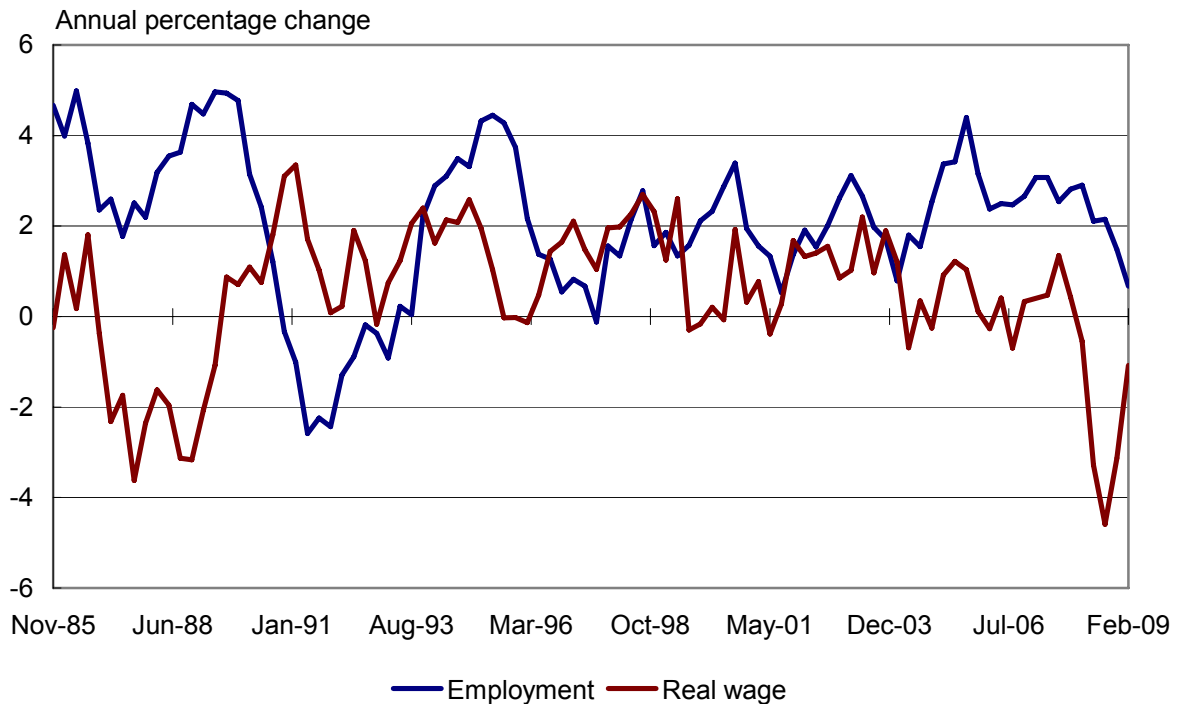
The new labour market [since the early 1990s] is delivering the gains from a faster rate of technological change to those that are employed rather than creating new jobs for the unemployed.³

That is, variations in wages may have a role in influencing the path of employment growth over time and in distributing the benefits from economic activity.

Figure 3 illustrates the change in real average wages and employment since the mid-1980s. The relationship between the two is visibly weaker than that between employment and GDP, shown in Figure 1. In some periods, such as the mid-1980s and 2008, real wages decreased on the measure shown, due largely to higher inflation rates recorded in those periods.

³ R G Gregory, 'A longer run perspective on Australian unemployment', in J Mangan (ed.), *Understanding and Reducing Unemployment: National and State Perspectives*, Brisbane, Office of Economic and Statistical Research, Queensland Treasury, 2000, p. 11.

Figure 3: Growth in employment and real average weekly earnings, November 1985 to February 2009



Note: Employment data are quarterly, aligning with the availability of Average Weekly Earnings (AWE) data. AWE deflated using the GDP price deflator.

Source: ABS, *Australian National Accounts: National Income, Expenditure and Product*, March quarter 2009, Catalogue No. 5206.0; ABS, *Labour Force, Australia*, May 2009, Catalogue No. 6202.0; ABS, *Average Weekly Earnings, Australia*, February 2009, Catalogue No. 6302.0.

The slower growth observed in real wages during the mid-1980s has been partly attributed to the Prices and Incomes Accords of the time, which broadly involved slower nominal wage growth and a higher 'social wage', including reductions in income tax.⁴ While some researchers attribute some of the higher employment growth in that time to the slower growth in real wages (and lower real unit labour costs), other researchers suggest that the relationship is ambiguous.⁵

It is worth noting that the Accords were introduced early in the period of recovery from the early 1980s recession and amended through most of the economic upswing. The Accords were also reached in a period when minimum wage reliance was higher and the degree of decentralisation of wage determination lower than at present. This leads us to now compare changes in average wages with changes in selected minimum wage rates since the mid-1980s.

2.2. Changes in selected minimum wages compared with aggregate wages

From a macroeconomic point of view, the average wage is an important variable for employment. Changes in minimum wages can affect aggregate wages to some

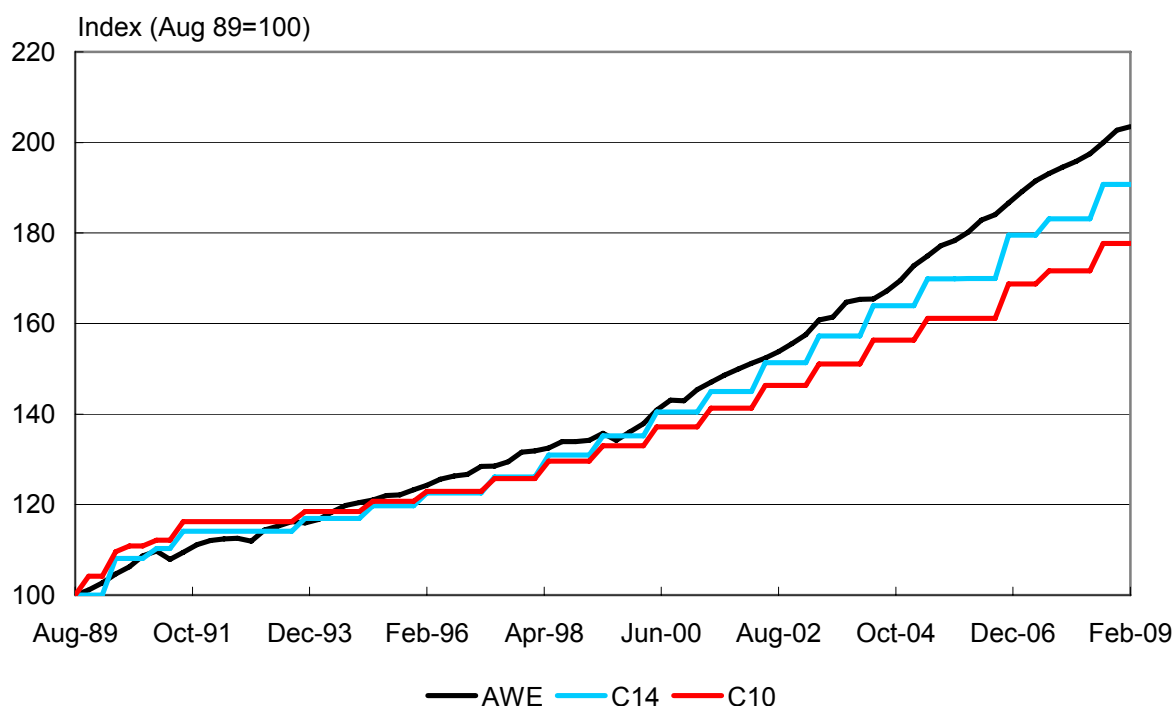
⁴ B Chapman and F Gruen, 'An analysis of the Australian consensual incomes policy: the Prices and Incomes Accord', in C de Neubord (ed.), *The Art of Full Employment*, Amsterdam, Elsevier Science Publishers, 1991, pp. 475–504; and P Dawkins, 'The Australian labour market in the 1990s', in D Gruen and S Shrestha (eds), *The Australian Economy in the 1990s*, Sydney, RBA, July 2000, p. 325.

⁵ R Green, W Mitchell and M Watts, 'The Accord, trade unions and the Australian labour market' in P Kriesler (ed.), *The Australian Economy 2*, Sydney, Allen and Unwin, 1997, pp.153–183.

degree. However, most estimates of this effect appear to be small, with a lower proportion of the labour force reliant on minimum wages than in the past.⁶

Figure 4 tracks the level of various selected minimum wage rates and average wages since August 1989, near the peak in employment in the late 1980s. Over the 1990s, AWE increased to a very similar extent as the C10 and C14 wage classifications in the Metal, Engineering and Associated Industries Award. However, the selected minimum wage rates grew at a slightly higher rate than average wages in 1989 to 1991, before slowing for most of the 1990s, whereas average wages grew at a steadier rate.

Figure 4: Average wages and selected award classifications, nominal terms, August quarter 1989 to February quarter 2009



Note: Data are quarterly. C14 and C10 are rates of pay from the Metal, Engineering and Associated Industries Award and relevant Pay Scale.
Source: ABS, *Average Weekly Earnings, Australia*, February 2009, Catalogue No. 6302.0; Metal, Engineering and Associated Industries Award 1998 and the relevant Pay Scale.

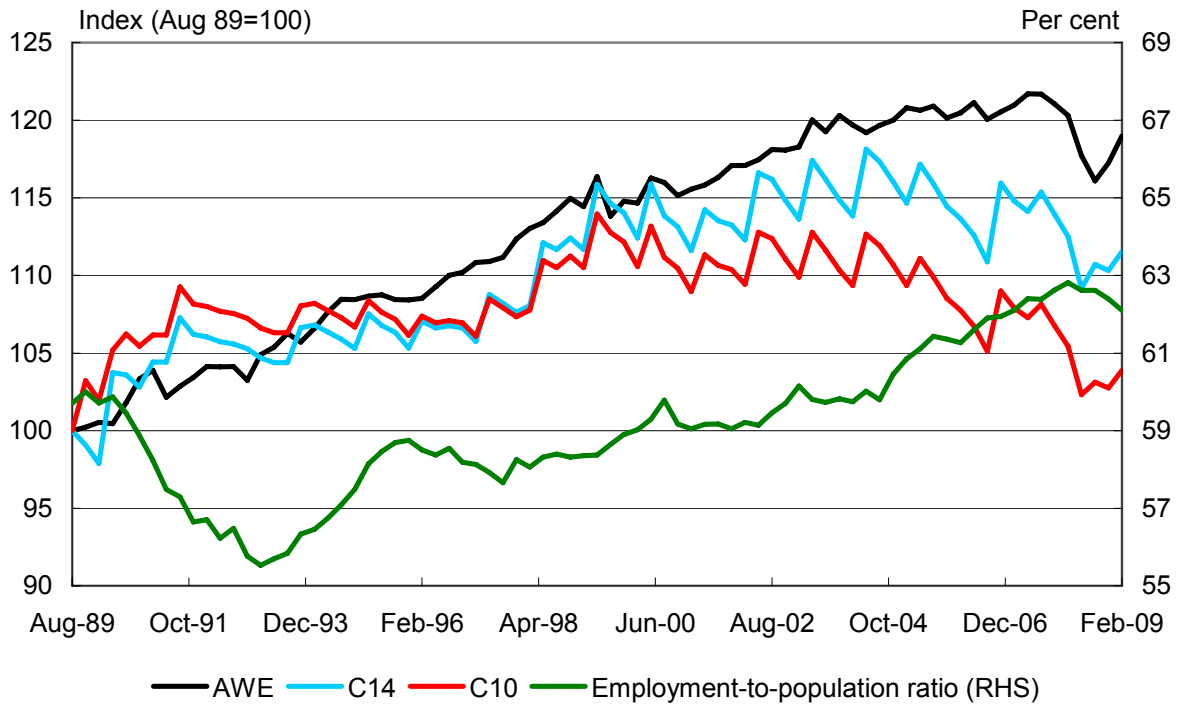
We now turn to the movements in those wage rates adjusting for price inflation (Figure 5). The main conclusion that can be drawn from the data is that minimum wages and average wages move inconsistently with each other over time. There are several interesting phases to the data:

- The first is the period 1989 to 1992, when employment was decreasing, the real minimum wages increased at a significantly higher rate than average wages – the C10 wage classification increased by 9 per cent in real terms over the two years to August 1991, while real AWE increased by 3 per cent.
- The second phase is from 1992 to 1997, over which period the minimum wage rates declined gently in real terms, while average wages increased at a steady rate and the aggregate employment-to-population ratio was generally steady.

⁶ See Centre for International Economics, *Modelling of the macroeconomic impact of the Fair Pay Commission's minimum wage decisions*, report commissioned by AFPC, 2009, forthcoming, for a brief analysis.

- The third phase is from 1998 to around 2007. Over this period, the minimum wage rates were broadly unchanged in real terms and average wages increased, but at a slower rate than in the 1990s. The employment-to-population ratio appears to have increased at a faster rate around the time that growth in average and minimum wages slowed.

Figure 5: Average wages and selected wage classifications in real terms, August 1989 to February 2009



Note: Data are quarterly. Wage measures are deflated using the GDP price deflator.

Source: ABS, *Australian National Accounts: National Income, Expenditure and Product*, March quarter 2009, Catalogue No. 5206.0; ABS, *Average Weekly Earnings, Australia*, February 2009, Catalogue No. 6302.0; Metal, Engineering and Associated Industries Award 1998 and the relevant Pay Scale; ABS, *Labour Force, Australia*, April 2009, Catalogue No. 6202.0.

In summary, a simple analysis of history reveals that aggregate employment is largely affected by changes in economic activity, particularly during a downturn; with the relationship between economic activity, wages and employment appearing more ambiguous during the expansion period. Average wages and minimum wage rates also change significantly through the economic expansion, although inconsistently with each other over time. The following section reviews the research that has been undertaken to try to quantitatively separate the wage effects on employment from other factors.

3. Review of previous research

This section reviews the Australian research on the relationship between wages and labour demand which has been directed at constructing a model of employment for use in scenario analysis.

The real wage elasticity is defined for the purposes of this paper as the change in employment associated with a change in real average wages. It is interpreted as follows: a real wage elasticity of -0.8 means that a 1 per cent increase in real average wages will result in a 0.8 per cent decrease in employment.

Australian labour demand research can be grouped into two categories — partial equilibrium and general equilibrium elasticities. Research that calculates the partial equilibrium elasticity only consider the first-round effect of changes in real wages on employment and abstract from second-round effects (for example, changes in real wages affect GDP, which then feeds back into employment). However, general equilibrium elasticities aim to incorporate the first-round and second-round effects of changes in real wages on employment. As a consequence, real wage elasticities sourced from general equilibrium models tend to be significantly higher than partial equilibrium estimates.

3.1. Partial equilibrium labour demand research

The partial equilibrium elasticities found in Australian research since 1991 have all had a negative sign, reporting estimates that range between -0.3 to -0.8 if the number of workers is used as the employment definition, and -0.4 to -0.9 if hours worked is used as the employment definition (Table 1).

Table 1: Summary of real wage elasticities in Australia

Author	Time period analysed	Employment definition used	Estimated real wage elasticity
Dixon et al. (2004)	1966-2001	Heads	-0.3
Downes and Bernie (1999)	1971-1999	Hours	-0.8
	1971-1999	Heads	-0.6
Lewis and MacDonald (2002)	1959-1998	Heads	-0.8
	1959-1998	Hours	-0.9
Debelle and Vickery (1998)	1978-1997	Hours	-0.4
	1969-1997	Hours	-0.7
Dungey and Pitchford (1998)	1984-1997	Heads	-0.4
Phipps and Sheen (1995)	1979-1993	Heads	-0.7
Russell and Tease (1988)	1969-1987	Full-time male heads	-0.6

Note: See the text for detailed references.

The variations in these estimates are due to differences in:

- econometric method;
- the time period analysed;
- control variables included;
- the definition of real wages used; and
- the definition of employment used — typically the number of workers or number of hours worked.

Russell and Tease⁷ used an ordinary least squares (OLS) regression to relate full-time male employment with output, real wages (defined as real unit labour costs) from 1969 to 1987, and to calculate the labour and output elasticities. They found that the long-run real wage elasticity was -0.6, and the long-run output elasticity was 0.65. They observed similar results when using hours worked as the dependent variable. This implies that a 1 per cent increase in output is associated with a 0.65 per cent increase in employment, while a 1 per cent increase in the real wage is associated with a 0.6 per cent fall in employment.

Phipps and Sheen⁸ also estimated the real wage elasticity using an OLS regression. However, to deal with the 'spurious regression' problem associated with OLS regression and non-stationary time series analysis, they chose to difference their dependent and independent variables. The authors analysed the relationship between real wages (real AWE) and employment (heads) over the period 1979 to 1993. They found a real wage elasticity of around -0.7 and an output elasticity of 0.75, larger estimates than those made by Russell and Tease.

The most common method used in recent literature to estimate the real wage elasticity, however, is the single-equation Error Correction Model (ECM). Debelle and Vickery⁹, Dungey and Pitchford¹⁰, Downes and Bernie¹¹, Lewis and MacDonald¹², and Dixon *et al*¹³ each used a single-equation ECM framework to estimate the real wage and output elasticities. Within that basic framework, their approaches varied in terms of the time periods analysed, real wage and employment definitions, and control variables used.

Debelle and Vickery used a single-equation ECM to analyse the relationship between real wages (real labour costs per hour) and employment (hours worked in the non-farm economy) between 1978 and 1997. Unlike other research, they also controlled for the user cost of capital. They found a long-run real wage elasticity of -0.4, which is quite different to the previous estimates of around -0.6 to -0.8. They attributed this to different sample periods and different measures of real wages and employment being used. When they re-estimated their model for the period spanning 1969 to 1997, they found a real wage elasticity of -0.7. This led them to speculate that the effect of wages on employment may have fallen in the 1980s and 1990s. They also estimated the output elasticity to be 1.0.

Also using the single-equation ECM approach, Dungey and Pitchford estimated the real wage elasticity by analysing the relationship between real earnings and employment (heads) between 1984 and 1997. As they analysed the number of people employed rather than hours worked, they also controlled for the changing

⁷ B Russell and W Tease, *Employment, output and real wages*, Reserve Bank of Australia Research Discussion Paper 8806, 1988.

⁸ A Phipps and J Sheen, 'Macroeconomic policy and employment growth in Australia', *The Australian Economic Review*, Vol. 28, No. 1, 1995, pp. 86-104.

⁹ G Debelle and J Vickery, 'The macroeconomics of Australian unemployment', in G Debelle and J Borland (eds), *Unemployment and the Australian Labour Market*, proceedings of a conference, Reserve Bank of Australia and Australian National University, 1998, pp. 235-265.

¹⁰ M Dungey and J Pitchford, 'Prospects for output and employment growth with steady inflation', in G Debelle and J Borland (eds), *Unemployment and the Australian Labour Market*, proceedings of a conference, Reserve Bank of Australia and Australian National University, 1998, pp. 208-234.

¹¹ P Downes and K Bernie, *The macroeconomics of unemployment in the Treasury Macroeconomic (TRYM) Model*, TRYM Related Paper No. 20, Commonwealth of Australia, 1999; at <<http://www.treasury.gov.au>>.

¹² P Lewis and G MacDonald, 'The elasticity of demand for labour in Australia', *The Economic Record*, Vol. 78, No. 1, 2002, pp. 18-30.

¹³ R Dixon, J Freebairn and G Lim, *An employment equation for Australia: 1966-2001*, University of Melbourne Department of Economics Research Paper Number 892, 2004.

hours worked in the economy in their specification. They estimated a real wage elasticity of -0.4, and an output elasticity of 1.3.

Downes and Bernie also estimated the real wage elasticity. While their overall research was in a macroeconomic forecasting model, they used a single-equation ECM to calculate the real wage elasticity between 1971 and 1999. Unlike previous research, they focused on the private sector and found a real wage elasticity of -0.8 when employment is defined by hours worked in the private sector, and -0.6 when employment is defined by the total number of employees.

Lewis and MacDonald examined the response of labour demand (both heads and hours worked) in 1959 to 1998 to changes in real wages (weekly wage of non-farm employees deflated by the GDP deflator) to determine the real wage elasticity. Using a single-equation ECM framework, they found that the total elasticity for labour with respect to real wages is approximately -0.45, which is lower than previous research. However, the authors contended that movements in real wages have substantial effects on output — that is, real wages decrease output and this in turn decreases employment. Thus, they argued that, assuming a unitary elasticity of real wage for output, the correct real wage elasticity was -0.8, after factoring in the effects of changes in real wages on output. Using hours worked as the dependent variable, the real wage elasticity is -0.9. They also found an output elasticity of 1.05.

The most recent research by Dixon *et al* modelled the relationship between employment (number of employed), real wages and GDP over the period 1966 to 2001. They argued that the majority of previous research either did not factor in the relationship between standard hours (total hours minus overtime) and employment (hence imposing an elasticity of zero) or it imposed negative elasticities on the relationship between standard hours and employment. The authors, however, suggested that this relationship should be positive. Hence, using a single-equation ECM model and including standard hours as an explanatory variable, they found a real wage elasticity of -0.3, and an output elasticity of 1.1. They also find that employment responds differently to changes in real wages during periods of recession compared with periods of non-recession.

In summary, the estimates of the real wage elasticity (or the effect of real wages on employment) in the partial equilibrium models were found to be consistently negative. The effects of aggregate demand on employment were estimated to be positive and, in all cases, larger in magnitude than the real wage effects.

3.2. General equilibrium labour demand research

Real wage elasticities can also be estimated using computable general equilibrium (CGE) models. As mentioned above, CGE real wage elasticities are generally larger than the partial equilibrium real wage elasticities, as they also consider the second-round effects of real wage changes on other macroeconomic variables, which then also affect employment.

Recent estimates of CGE real wage elasticities (where employment is defined as the number of workers) range between -0.9 and -1.7, and are calculated after simulating award wage increases. There are many differences between the models used, with Boxes 1 and 2 summarising the approaches taken in two of the most recent research exercises.

Box 1: Monash (ORANI) research in 2005¹⁴

Features of the model

It models employment shocks (and other macroeconomic variables) by 1-digit industry, 1-digit occupation and award/non-award categories.

Mechanics of the model

Changes in award wage rates alter employee and employer behaviour. When there is an increase in award wage rates, this influences the employer to substitute to either a non-award employee (of the same occupation), an employee in a different occupation, or capital. However, a rise in award rates also increases the incentive for the unemployed and not in the labour force individuals to seek employment. In effect, an increase in award wage rates reduces labour demand and increases labour supply.

Key assumptions

- Producers are profit maximisers.
- Minimum wage increases are fully passed on to award workers.
- Changes in award wage rates have no effect on the Consumer Price Index, as it is assumed that the RBA will adjust monetary policy to counteract any potential wage growth to inflation flow-on effects.
- Real public consumption is constantly stable, and unaffected by shocks. Real private consumption, however, is affected by shocks via changing household disposable income.
- Changes in award rates have no effect on technology or household preferences.
- Award wages are determined exogenously (ie. independent of movements in demand and supply of labour).
- Non award wages are determined endogenously, through their real after-tax wage rate. Hence, it is affected by changes in demand and supply.
- Substitution between labour and capital production is fixed, and does not vary between industries (elasticity of 0.15).
- Substitution between award and non-award is fixed, and is relatively high compared with other substitution effects (elasticity of 2).
- Substitution between labour and labour by occupation is fixed (short-run elasticity of 0.35).

Wage elasticity

The model finds that a real wage increase of 4.1 per cent in 2005 decreases aggregate employment by 3.8 per cent. Hence, the implied wage elasticity is -0.9.

¹⁴ P Dixon and M Rimmer, *The effects on the Australian economy of alternative safety net award wage histories: results from the MONASH model*, Centre of Policy Studies, Monash University, report commissioned by the Commonwealth Government, Department of Employment and Workplace Relations, Canberra, September 2005.

Box 2: Econtech research in 2006¹⁵

Features of the model

It models employment shocks (and other macroeconomic variables) by 1-digit industry and 32 regions.

Mechanics of the model

Changes in award wage rates represent a shock to all industries to varying degrees, depending on the impact to the industry's wage bill. This impact is determined by the industry's Pay Scale reliance, dependence on labour and whether it is exposed to trade (as labour costs have different effects in trade-exposed industries compared with non-trade-exposed industries). Industries react to increases in award wage rates by substituting labour to capital to maximise profit, and in turn, decrease labour demand.

Key assumptions

- Substitution between labour and capital production is fixed, and does not vary between industries (elasticity of 0.5).
- Business investment and capital stocks are kept fixed, as model refers to a medium-run equilibrium.
- Trade balance set to zero; shocks to trade affect real exchange rate.
- Private saving is constant.

Wage elasticity

The wage elasticity from Econtech's model is calculated using the following formula:

Wage elasticity = -(capital-labour elasticity of substitution/profit share)

Econtech assumes an elasticity of 0.5 for capital-labour, and the national profit share is 0.3. This implies a wage elasticity of -1.7.

3.3. Lessons from previous research

- Real wage elasticity research is split between two categories — partial and general equilibrium research.
- Real wage elasticities vary due to differences in methodology, time period analysed, control variables used, real wages definition, and employment definition. However, the estimates are in similar broad orders of magnitude.
- Output, wages and a time trend reflecting productivity are used as explanatory variables for employment in all of the labour demand studies reviewed.
- As CGE models are very detailed and complex, the partial equilibrium models offer a simple approach to running different wage and GDP scenarios.

¹⁵ Econtech, *Modelling the economic and employment impacts of various scenarios for increases in minimum wages*, report commissioned by Commonwealth Government, Department of Employment and Workplace Relations, Canberra, July 2006.

4. A partial equilibrium model of employment

Building on Sections 2 and 3, we estimate a model of employment over the period 1985 to 2008, using a single-equation Error Correction Model (ECM). Most of the recent real wage elasticity studies use an ECM framework, as it can be appropriately used for non-stationary variables, such as employment, wages and output, and it can model relationships assuming short-run and long-run trends. Real wage and output elasticities are obtained from the ECM and then used to forecast employment under a range of GDP and wage growth scenarios.

Explanatory variables chosen for this analysis are based on the variables that appear in the partial equilibrium studies referred to in the literature review — that is, real wages, GDP and time trend representing labour productivity. The model does not include further explanatory variables, as it is found that most additional variables included from previous studies are statistically insignificant. Furthermore, in order to simulate employment growth, forecasts for all explanatory variables are required and these are drawn from the Australian Government's 2009–10 Budget papers.

As noted in the literature review, there are many different definitions for the core variables of interest. Examples of these are shown below:

- Wages — unit labour costs, labour costs, average weekly earnings or average weekly ordinary time earnings;
- Deflator — Consumer Price Index, Producer Price Index or GDP price deflator; and
- Employment — Full-time employment, total employed, total employees or total hours.

For this analysis, the following definitions have been chosen for the model:¹⁶

- Wages — Average weekly earnings¹⁷;
- Deflator — GDP price deflator¹⁸; and
- Employment — total employees¹⁹.

The model used to estimate aggregate employment is similar to the specification from DeBelle and Vickery (1998), which is an unrestricted fourth-order autoregressive distributed-lag (ADL) model expressed in error-correction form:

$$\Delta \log(\text{employment}_t) = \beta_0 + \beta_1 [\log(\text{employment}_{t-1}) + \beta_2 * \log(\text{real wage}_{t-1}) + \beta_3 * \log(\text{output}_{t-1}) + \beta_4 * \text{time trend}] + \sum_{i=0}^3 \beta_{5i} * \Delta \log(\text{output}_{t-i}) + \sum_{i=0}^3 \beta_{6i} * \Delta \log(\text{real wage}_{t-i})$$

where β_1 to β_4 are the long-run coefficients, while β_{5i} to β_{6i} are the short-run coefficients. β_1 represents the speed of adjustment parameter, which indicates the speed at which the model returns to its long-run equilibrium after a deviation in real wages and/or output.

¹⁶ Seasonally adjusted data are used when available.

¹⁷ ABS, *Average Weekly Earnings, Australia*, Catalogue No. 6302.0. Average weekly earnings do not incorporate earnings from Agriculture, forestry and fishing. However, it is reasonable to assume that this adequately tracks earnings for all industries.

¹⁸ ABS, *Australian National Accounts: National Income, Expenditure and Product*, Catalogue No. 5206.0.

¹⁹ ABS, *Labour Force, Australia, Detailed, Quarterly*, Catalogue No. 6291.0.55.003, Data cube E06.

The results obtained from the aggregate model estimate the long-run real wage and output elasticity to be -0.49 and 1.11, respectively, over the period 1985 to late 2008. The magnitude of the real wage elasticity is around the mid-point of those estimated from previous partial equilibrium studies. The output elasticity is very similar to previous estimates. The linear time trend, which captures labour productivity, implies that there is an annual rate of technological progress of 1 per cent per annum. Most of the short-run elasticities are statistically insignificant (Table 2).

Table 2: Elasticities estimated from the Error Correction Model

Time period	1985Q4 to 2008Q3
	-0.43**
Speed of adjustment	(0.00)
Long-run elasticities	
Ln(Real wage)	-0.49** (0.17)
Ln(GDP)	1.11** (0.19)
Time trend	0.002* (0.0015)
Short-run elasticities	
$\Delta \ln(\text{GDP}_t)$	0.20 (0.24)
$\Delta \ln(\text{GDP}_{t-1})$	-0.35 (0.25)
$\Delta \ln(\text{GDP}_{t-2})$	0.21 (0.24)
$\Delta \ln(\text{GDP}_{t-3})$	-0.29 (0.23)
$\Delta \ln(\text{Real wage}_t)$	-0.22 (0.18)
$\Delta \ln(\text{Real wage}_{t-1})$	0.05 (0.18)
$\Delta \ln(\text{Real wage}_{t-2})$	-0.05 (0.20)
$\Delta \ln(\text{Real wage}_{t-3})$	-0.18 (0.20)
Adjusted R-squared	0.20
LM test (1) – autocorrelation (p-value)	0.00
Jacque-Bera – normality (p-value)	0.39
Bruesch-Pagan-Godfrey test – heteroscedasticity (p-value)	0.76

Note: Standard errors in parentheses. * and ** represent statistical significance at a 5 and 1 per cent level, respectively. Bewley transformation was done to determine the significance of the long-run elasticities. The speed of adjustment variable indicates that 43 per cent of a deviation is corrected for in one quarter. The significance, magnitude and correct sign of this parameter indicate that the variables are cointegrated and validate the use of an ECM model. All variables were found to be I(1) using the Augmented Dickey Fuller tests.

5. Simulations

Using the elasticities obtained from the previous section, Section 5 simulates employment under different scenarios, similar to the approach taken by Russell and Tease (1988).

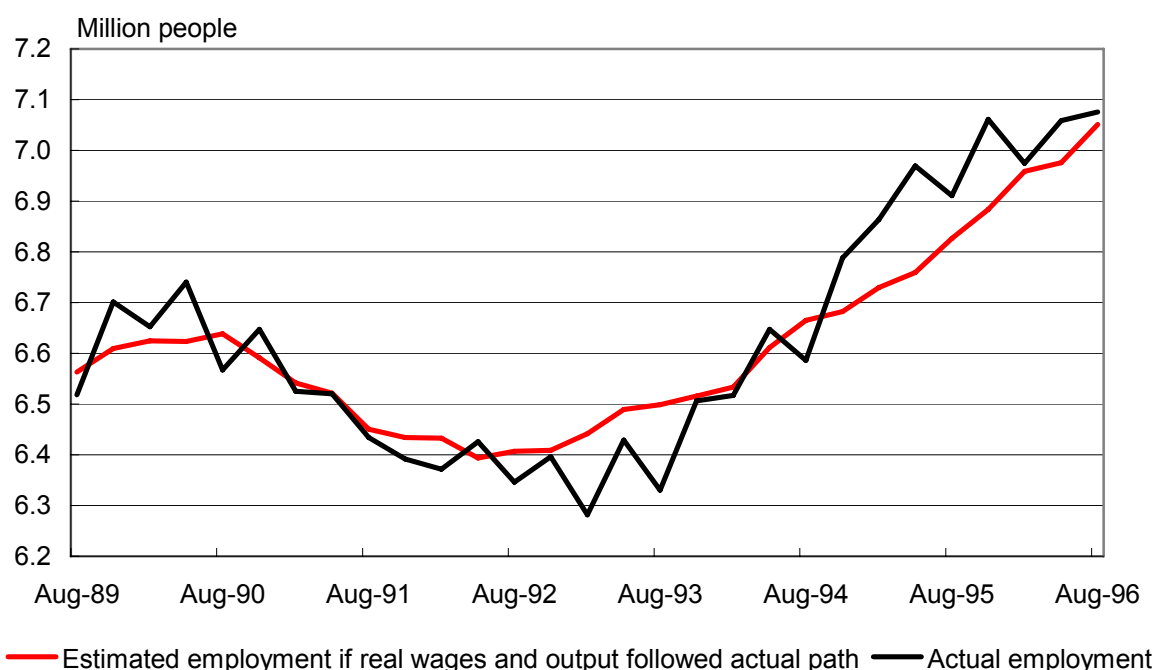
The labour demand equation estimated in Section 4 provides the base for the simulations. The coefficients in the labour demand equation are taken from Table 2, where the real wage and output elasticity are -0.49 and 1.11, respectively. For simplicity, productivity is assumed grow at a constant rate.

Simulation 1 tests the robustness of the model through the period of the early 1990s, while Simulation 2 is of employment if real wages were unchanged during the 1990s recession. Simulation 3 uses forecasts from the Australian Government's 2009-10 Budget papers for the initial assumptions on real wage and output growth, with the output assumptions then varied to observe the effects on employment.

Simulation 1: Early 1990s - robustness check of the model

First, it is important to check how accurately the model can estimate employment levels and growth. For this purpose, the model is used to estimate employment levels between August 1989 and August 1996 using actual wage and output data (Figure 6). Modelled employment closely follows actual employment levels and shows that the model can estimate employment in the first four years of the period reasonably accurately with actual real wage and output data.

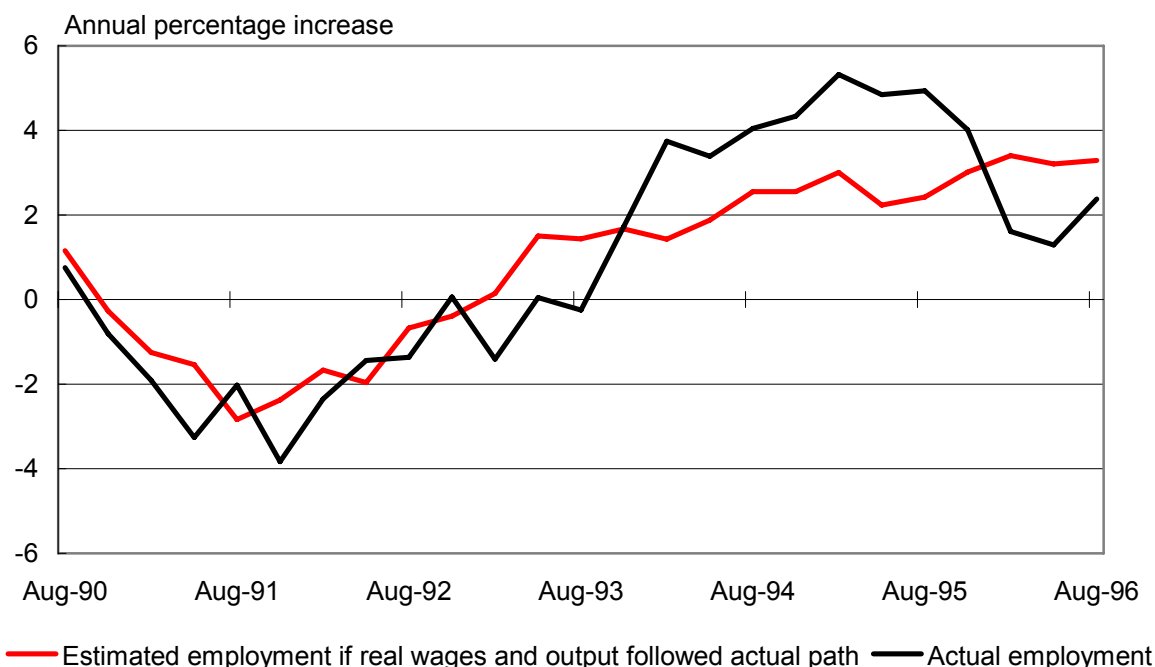
Figure 6: Simulation of employment levels during the early 1990s



Source: AFPCS modelling; ABS, *Labour Force, Australia, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

Another robustness check on the model is whether it could accurately estimate the recovery in employment growth following the 1990s recession. Figure 7 shows that the model performs reasonably well in the first few years of the estimation period..

Figure 7: Simulation of employment growth during the early 1990s



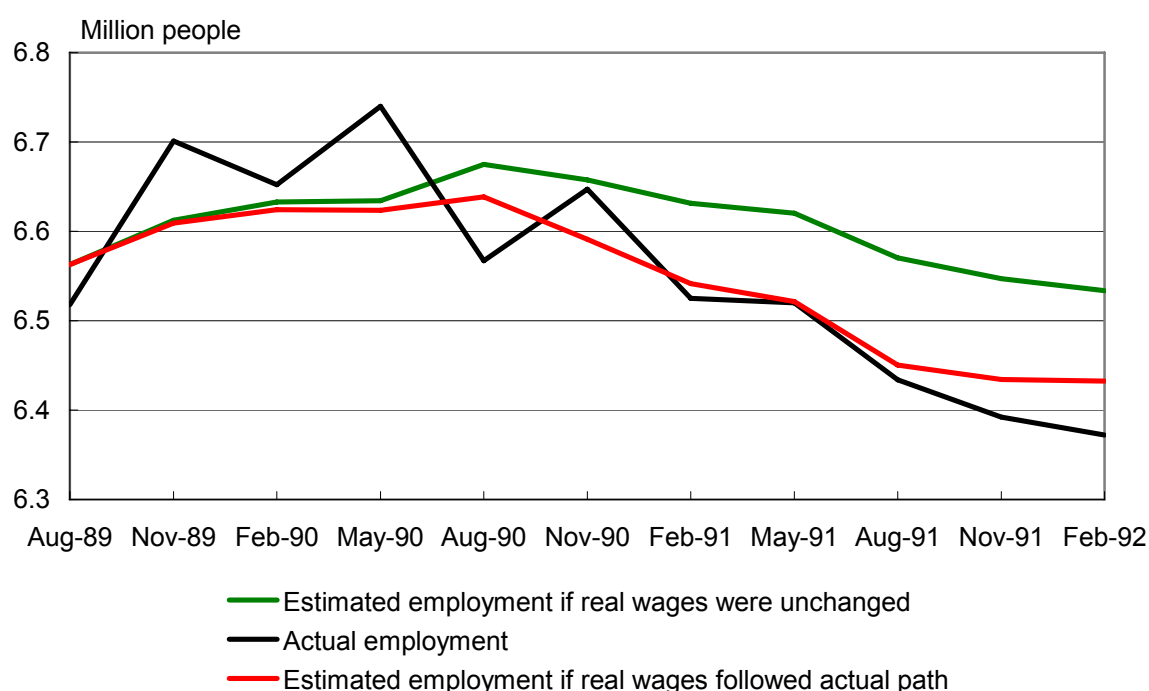
Source: AFPCS modelling; ABS, *Labour Force, Australia, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

Simulation 2: Employment levels during the 1990s recession if real wages were unchanged

The model is used to simulate the level of employment through the 1990s recession, as above, with actual rates of economic growth, but assumes that real wages were unchanged from August 1989 to February 1992. During this period, actual real wages increased by 4.1 per cent.

The model suggests that employment would have been 100 000 to 160 000 higher (depending on whether actual employment or modelled employment are used as the basis for comparison) if real wages were unchanged between August 1989 and February 1992 (Figure 8).

Figure 8: Simulation of employment levels during the 1990s recession



Source: AFPCS modelling; ABS, *Labour Force, Australia, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

Simulation 3: Employment in 2009 to 2011 if output growth decreases to early 1990s rates and the Budget forecast for real wage growth is assumed

In Simulation 3, two scenarios are presented — both of which assume real wage growth matches Budget forecasts of -1.4 per cent in 2008-09, 4.3 per cent in 2009-10 and 1.7 per cent in 2010-11.²⁰

- In the first scenario, output growth mimics the quarterly GDP growth profile experienced in the 1990s recession (between September 1989 and March 1992).
- In the second scenario, output growth matches Budget forecasts of 0 per cent in 2008-09, -0.5 per cent in 2009-10 and 2.25 per cent in 2010-11.

Table 3 and Figure 9 show the results of these two scenarios and the employment growth forecasts from the Budget. These estimates are more pessimistic than the Australian Government's forecasts for employment growth under both scenarios for output growth, although the general patterns are similar. Differences in the forecasts are likely to be due to factors such as: definition of employment; econometric methods and the range of variables included; and the estimation period.

²⁰ While the Australian Government does not publish a 'real wage' forecast per se, one is derived from the forecasts for growth in the Wage Price Index (WPI) and gross non-farm product deflator, for present purposes.

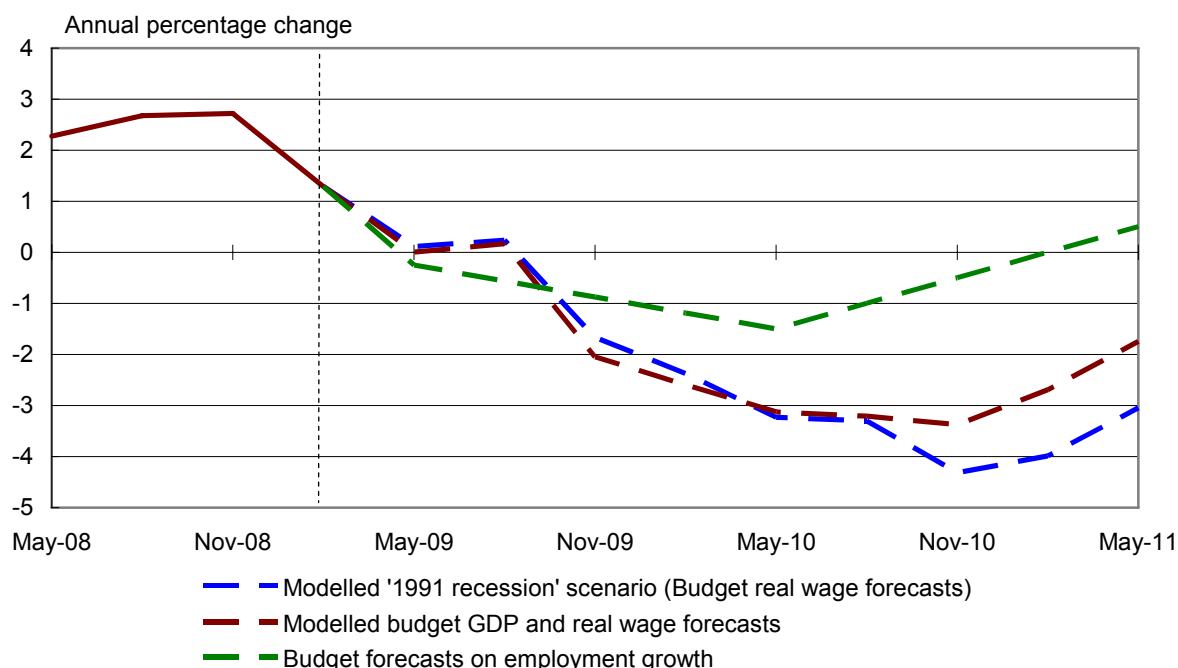
Table 3: Forecasts for employment growth under output assumptions

	Modelled '1991 recession' scenario (using Budget real wage forecasts)	Modelled Budget GDP and real wage forecasts	Budget forecasts for employment growth
		Per cent	
2008-09	0	0	-¼
2009-10	-3½	-3	-1½
2010-11	-3	-1¾	½

Note: Modelled forecasts are to the May quarter, as the model estimates growth in total employees based on when the ABS releases its detailed quarterly labour force data. Budget forecasts on employment growth are to the June quarter and based on growth in total employed.

Source: AFPCS modelling; ABS, *Labour Force, Australia, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003, Commonwealth of Australia, *Budget Paper No.1: Budget Strategy and Outlook 2009-10*, Canberra, Canprint Communications, 2009.

Figure 9: Forecasts for employment growth under output assumptions

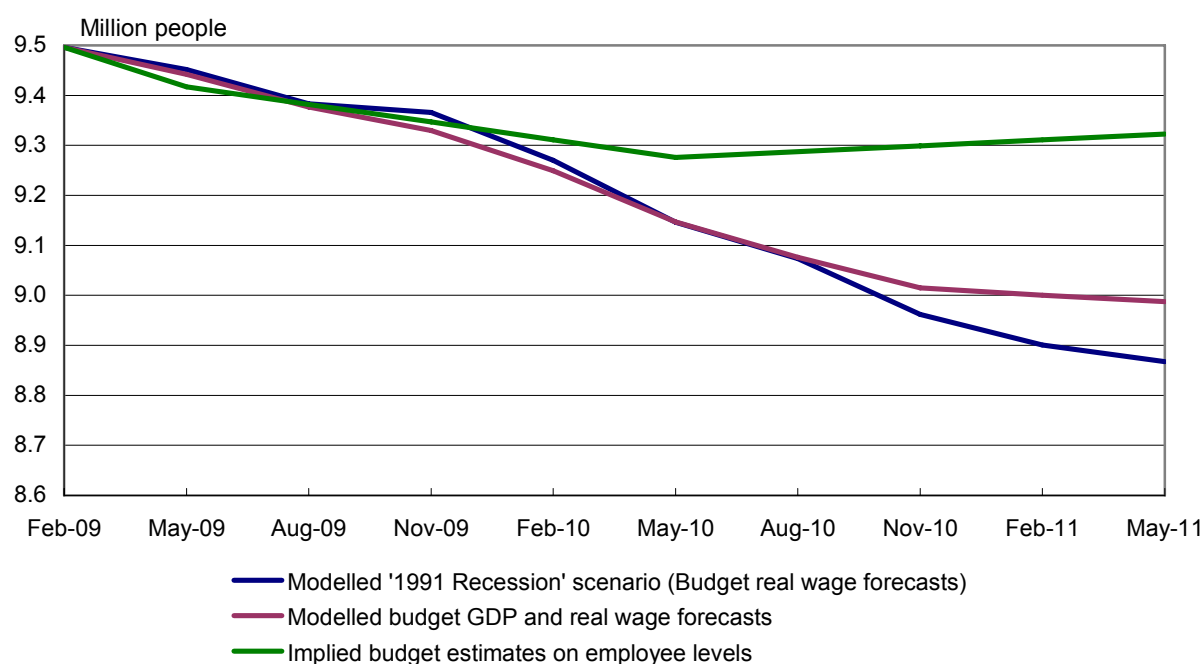


Note: Modelled forecasts are to the May quarter, as the model estimates growth in total employees based on when the ABS releases its detailed quarterly labour force data. Budget forecasts on employment growth are to the June quarter and based on growth in total employed. As Budget forecasts are only reported for annual periods, they are linearly interpolated for comparative purposes.

Source: AFPCS modelling; ABS, *Labour Force, Australia, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003, Commonwealth of Australia, *Budget Paper No.1: Budget Strategy and Outlook 2009-10*, Canberra, Canprint Communications, 2009.

In terms of employment levels, the model estimates that employment would reach a cyclical minimum at around 9 million people by 2010-11 (using real wage and output forecasts from the Budget). However, with weaker output under the '1991 recession' scenario, our model estimates that employment would continue to decline, falling to around 8.9 million by mid-2011 (Figure 10).

Figure 10: Forecasts for employment levels under output assumptions



Note: Modelled forecasts are to the May quarter as the model estimates growth in total employees based on when the ABS releases its quarterly labour force data. Budget estimates of employee levels are derived from its assumptions on employment growth.

Source: AFPCS modelling; ABS, *Labour Force, Australia, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003, Commonwealth of Australia, *Budget Paper No.1: Budget Strategy and Outlook 2009-10*, Canberra, Canprint Communications, 2009.

Limitations to the simulation results

The modelling is consistent with the approach taken and the estimates of the real wage and output elasticities of employment from earlier exercises, as reviewed in Section 3. However, as with those earlier exercises, there are limitations to the current model. Most relate to the intentionally simple structure of the model, including:

- that the effects are assumed to be linear, with a constant employment effect per dollar increase in wages. A larger change may have a larger effect and be less able to be absorbed;
- that it only considers real wage, output and labour productivity (represented by a linear time trend) as the main drivers of employment estimates. However, past literature has shown that attempts to include new variables into the labour demand equation have mostly been unsuccessful; and
- that it does not take into account indirect and feedback effects from a change in wages, such as adjustments to real wages occurring without affecting the growth assumptions.

However, the model usefully illustrates that a wage effect on employment can be distinguished from the effect of other changes, such as in the amount of economic activity, and that the level of employment may be different if wages had grown by a slightly different rate.

6. Concluding remarks

This paper has applied an employment model to gauge the current relationship between employment, real wage and output. The model has two purposes:

- to find elasticity estimates for real wage and output on employment; and
- using these elasticities, to simulate employment under different scenarios for wage and output growth.

Results from the model confirm the results from past studies, with the elasticity of employment with respect to output estimated to be 1.1. The real wage elasticity estimated from the model is -0.5, which is around the mid-point of elasticities estimated in past literature. The analysis confirms that both wages and aggregate demand have statistically significant effects on employment outcomes to be considered in different economic scenarios.

Changes in the industrial and skill composition of employment

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Australian Fair Pay Commission Secretariat¹

1. Introduction

With the downturn in economic and employment growth over 2008 and 2009, it is useful to review how employment patterns have changed at the industry level in different phases of the economic cycle in the past.

During the early 1990s recession, the total number of people employed declined by over 3 per cent from peak to trough. However, the change in employment varied widely at the industry level, in terms of their extent and timing. Different employment outcomes across industries were also evident during the recovery period following the recession, while total employment increased by over 40 per cent to peak in late 2008. Changes in industry employment by low-skilled and higher-skilled employment are also analysed to help determine the patterns of employment over the business cycle.

In the late 1990s, Borland and Kennedy summarised the industrial changes in employment at different times before and after the early 1990s recession.² This paper extends that analysis by examining the industry and skill dimensions jointly and reviewing the patterns of change up until early 2009.

Section two explains the data used in the report. Section three reviews the broad structural change in employment since 1990, while Section four segments that period to examine patterns of change in employment by industry and skill level during different phases of the economic cycle. Section five then discusses the industrial changes in employment since the peak in employment in early 2008, with section six offering some concluding remarks.

2. Data sources

This report uses the detailed Labour Force Survey data that are released on a quarterly basis by the Australian Bureau of Statistics.³ Data on employment by industry and occupation are collected in February, May, August and November of each year.

¹ The authors thank colleagues from the Secretariat for comments at an earlier seminar on the analysis. The contents of the paper remain the authors' responsibility.

² J Borland and S Kennedy, 'Dimension, Structures and History of Australian Unemployment', in G DeBelle and J Borland (eds), *Unemployment and the Australian Labour Market*, Proceedings of a Conference, H C Coombs Centre for Financial Studies, Kirribilli, 9-10 June 1998, RBA & Centre for Economic Policy Research, ANU, Canberra, Alken Press Pty Ltd, 1998, pp. 68-100.

³ Australian Bureau of Statistics (ABS), *Labour Force, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

For most of the present analysis, industries are classified using the Australian and New Zealand Standard Industrial Classification 2006 (ANZSIC06). Employment data using these classifications was first released with the February 2009 quarterly Labour Force Survey and replaces the previous ANZSIC93 classifications. For occupational skill level, we use the Australian Standard Classification of Occupations (ASCO) Second Edition. There is no data at this stage that combines ANZSIC06 with ASCO Second Edition prior to 1996 and, therefore, the previous industry classification, ANZSIC93, is used for consistency in the industry analysis by skill level.

3. Changes to the shares of total employment

The composition of economic activity and employment changes over time, with different parts of the economy growing at different rates to each other.⁴ This structural change has been occurring in response to a wide range of factors and influences, such as changing prices, demographics, productivity growth, technological changes and shifts in comparative advantages. However, particularly large changes in the composition of an economy have been found to occur during or as a result of recession.⁵

Although structural change occurs during expansionary periods, recessions appear to accelerate the change. Rather than most industries growing but at different rates during a general expansion, it appears more likely that during a downturn and initial recovery employment will be decreasing in some industries and being created in others. Some element to this change in employment by industry is cyclical, with another dimension being structural.

If we look over the longer term since the mid 1980s, the level of employment has almost tripled in Professional, scientific and technical services, Administration and support services and Arts and recreation services (from a low base). Employment levels have more than doubled in Rental, hiring and real estate services (from a low base), Accommodation and food services, Health care and social assistance and Construction. While there are other factors that have contributed, this employment growth is consistent with a general expansion of the population and a shift in economic activity towards services and leisure.

In contrast, employment has declined substantially in industries such as Agriculture, forestry and fishing and Manufacturing. Factors such as increased international trade, lower levels of industry protection, greater domestic competition, technological change and a general push towards higher productivity have resulted in a decline in the demand for labour in those industries.

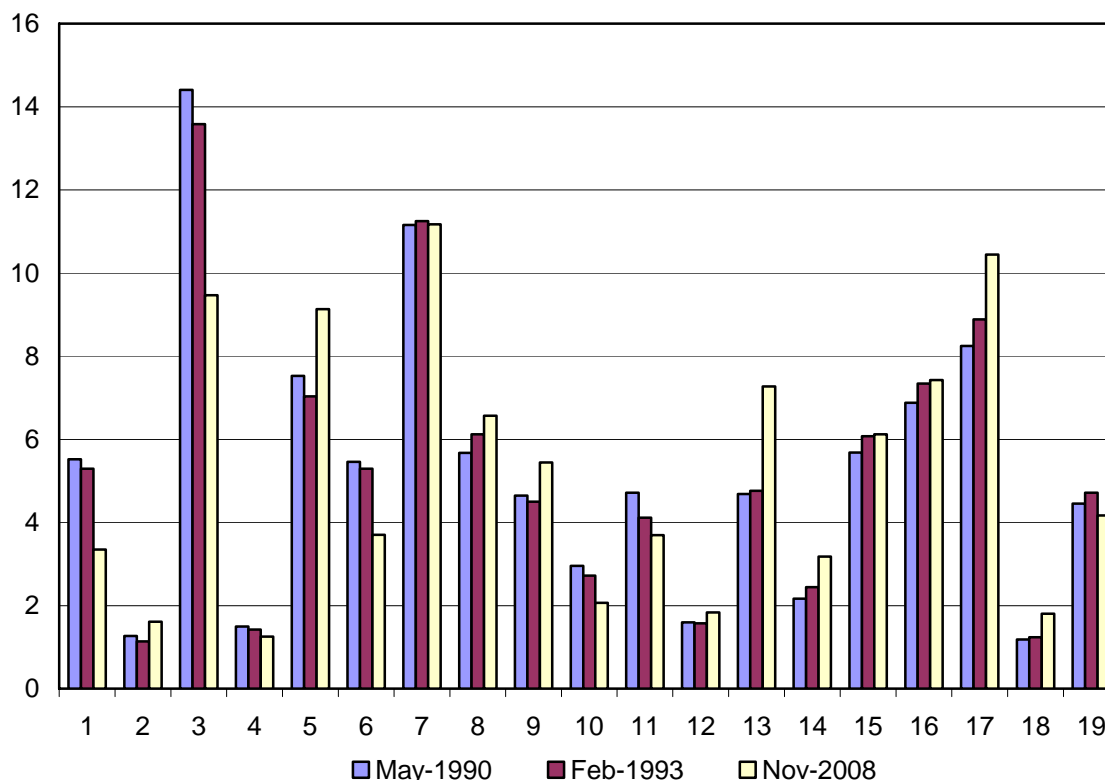
The composition of employment by industry in Australia has shifted over time. To illustrate the change in composition, as opposed to the levels, of employment by industry, we report the shares of total employment by industry at selected points in time since 1990 (Figure 1). The dates were chosen based on the peak and trough of the employment cycle. Total employment reached a peak in May 1990 and reached its lowest point in the cycle in February 1993. Employment then increased almost continually until the end of 2008.

⁴ P Downes and A Stoeckel, *Drivers of structural change in the Australian economy*, Centre for International Economics, Canberra, December 2006.

⁵ For example, J Fahrer and A Heath, *The evolution of employment and unemployment in Australia*, Research Discussion Paper 9215, Reserve Bank of Australia, December 1992.

During the early 1990s, when total employment declined, most of the decline in the shares of employment occurred in Manufacturing and Financial and insurance services. At the same time, employment shares of Education and training and Health care and social assistance continued to increase.

Figure 1: Share of total employment by industry, May 1990, February 1993 and November 2008



Note: ANZSIC 06 classifications. The industries are enumerated as follows:

- | | |
|--|--|
| 1 Agriculture, forestry, and fishing | 11 Financial and insurance services |
| 2 Mining | 12 Rental, hiring and real estate services |
| 3 Manufacturing | 13 Professional, scientific and technical services |
| 4 Electricity, gas, water and waste services | 14 Administrative and support services |
| 5 Construction | 15 Public administration and safety |
| 6 Wholesale trade | 16 Education and training |
| 7 Retail trade | 17 Health care and social assistance |
| 8 Accommodation and food services | 18 Arts and recreational services |
| 9 Transport, postal and warehousing | 19 Other services |
| 10 Information media and telecommunications | |

Source: ABS, *Labour Force, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

Over the long expansion to 2008, the share of employment decreased to the greatest extent in Manufacturing, Agriculture, forestry and fishing and Wholesale trade. In contrast, the employment share increased significantly in Construction, Professional, scientific and technical services and Health care and social assistance.

Among the industries with higher levels of minimum wage reliance⁶, the share of employment in Retail trade was maintained through both the recession and long

⁶ ABS, *Employee Earnings and Hours, Australia*, August 2008, Catalogue No. 6306.0.

expansion (at around 11 per cent of total employment), while the share of employment in Accommodation and food services as well as Administrative and support services increased through both periods.

4. Employment growth by industry since the mid 1980s

4.1. Changes in the level of employment by industry

Within this broader picture, employment has varied between industries according to different stages of the business cycle. This is reported in Table 1, which shows employment growth by industry for different periods of time since the mid 1980s. The lengths of the time periods were chosen to be comparable with the recession period of the early 1990s.

Patterns of employment during the recession (1990 to 1993)

Changes in employment tend to lag changes in Gross Domestic Product (GDP), as changes to economic activity need to work their way through the economy. GDP reached a cyclical peak in the March quarter 1990 and declined or was largely unchanged for seven consecutive quarters from the June quarter 1990 to the December quarter 1991.⁷ Employment reached a cyclical peak in May 1990 and declined or was unchanged in all but one quarter up to February 1993, when it reached a cyclical minimum.

Employment in some industries began to decline before others. Employment in Manufacturing, Construction, Mining and Transport, postal and warehousing reached their peak earlier than other industries. Overall, the industries in which most of the decline in employment occurred were Manufacturing, Construction and Financial and insurance services. Employment in Financial and insurance services fell for twelve consecutive quarters from February 1991.

Among the industries with higher levels of minimum wage reliance, employment in Retail trade declined at around the same rate as total employment. Employment in Accommodation and food services, Health care and social assistance and Administrative and support services grew strongly during the quarters when total employment fell by its largest percentages. Employment in those industries only began to fall once GDP had begun to recover, though total employment was still weak. These were three of the least affected industries by employment during the downturn.

Patterns of employment during the expansion (1993 to 2008)

Total employment began to increase from May 1993 and was growing at an annual rate of over 4 per cent by the middle of 1995. Around this time, employment growth in Administrative and support services and Transport, postal and warehousing was over 20 per cent and many other industries were growing at rates not seen since the late 1980s. Other industries that experienced strong employment growth were Arts and recreational services, Professional, scientific and technical services and Accommodation and food services.

⁷ ABS, *Australian National Accounts: National Income, Expenditure and Product*, March 2009, Catalogue No. 5206.0.

As the expansion continued, total employment growth slowed by the end of the 1990s and into the early 2000s. This was the case for most industries that had strong employment growth during the mid 1990s (for example, Professional, scientific and technical services and Administrative and support services), while there were some other industries that had stronger growth over this period (Rental, hiring and real estate services and Information, media and telecommunications). Employment in industries with higher minimum wage reliance such as Retail trade, Accommodation and food services and Health care and social assistance also grew strongly during this period.

As the economic expansion entered the 'boom' phase in the 2000s, total employment grew at its highest rate over the expansion, although still below growth rates of the late 1980s. Although the strongest growth rates occurred in the relatively smaller industries (Mining and Electricity, gas, water and waste services), other larger industries were also growing relatively strongly (Construction and Professional, scientific and technical services). These are mainly higher-paid industries, and the demand for workers in these industries increased as the boom period continued and unemployment decreased. Employment in relatively low-paid industries such as Retail trade and Accommodation and food services grew at below average rates, when in the previous two periods in Table 1 they had above average growth rates.

Employment by hours worked

Another way to measure employment is to analyse the number of hours worked in an economy. This is a broader measure of labour demand and abstracts from changes in the full-time and part-time composition of employment. Part-time employment has become more significant in the labour market over time and has tended to continue growing while full-time employment decreased during a general downturn. In 1990, part-time employment comprised around 21 per cent of total employment, while in 2008 it comprised around 28 per cent.⁸

In broad terms, the use of an hours-based measure of employment does not give very different results for employment trends during the 1990s recession or the recovery. The same table using data for hours worked shows similar trends to that of employment. This is in part due to the length of the time periods used. Although hours may bear more of the adjustment in the short term, the changes in employment are more consistent between the two measures of employment over a longer period.

⁸ Average proportion of total employment over the year.

Table 1: Total employment by industry, average annual growth rates in selected periods since 1984

Industry	Nov 84 – Nov 89	Nov 89 – Nov 93	Nov 93 – Nov 98	Nov 98 – Nov 03	Nov 03 – Nov 08
Agriculture, forestry and fishing	1.0	-0.9	0.3	-2.1	-0.5
Mining	2.6	-4.0	-2.0	2.6	13.4
Manufacturing	1.0	-2.7	0.1	-0.5	0.1
Electricity, gas, water and waste services	-2.3	-3.2	-5.9	2.8	8.3
Construction	5.5	-2.3	2.4	4.1	5.2
Wholesale trade	4.1	0.0	-0.4	-2.0	1.1
Retail trade	4.9	-0.3	2.6	2.3	1.8
Accommodation and food services	6.0	2.2	4.3	2.2	1.5
Transport, postal and warehousing	2.3	-2.1	5.4	1.3	4.2
Information media and telecommunications	1.4	-1.3	-3.1	3.0	0.6
Financial and insurance services	6.2	-2.7	0.6	1.2	2.8
Rental, hiring and real estate services	9.7	-2.7	2.0	7.0	2.2
Professional, scientific and technical services	7.4	0.8	8.0	2.4	4.4
Administrative and support services	6.6	3.1	9.7	3.1	-0.4
Public administration and safety	1.8	2.7	-0.2	4.8	2.6
Education and training	3.3	1.8	1.8	2.9	2.3
Health care and social assistance	3.3	2.5	3.0	2.9	3.7
Arts and recreation services	7.2	1.2	4.7	2.9	5.0
Other services	5.3	0.3	2.9	0.6	1.2
Total employment	3.6	-0.2	2.2	1.9	2.5

Note: ABS trend data is used to calculate the annual growth rates. Employment is the total number of people employed in the industry. Total employment is the total number of people employed across the economy and is not the sum of industry employment.

Note: The orange cells show employment growth that is more than one percentage point below the Total employment average for the period, while the green cells show employment growth that is more than one percentage point higher than the Total employment average for the period.

Source: ABS, *Labour Force, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

4.2. Employment growth in low-skilled and higher-skilled occupations by industry

Tables 2 and 3 show how the patterns of employment growth by industry differed between their low-skilled and higher-skilled segments. Data for occupational skill levels prior to 1996 are not available by ANZSIC 2006 and for this section ANZSIC 1993 industry classifications are used. This affects some industry classifications more than others, most notably the combining of some industries to form Property and business services.

Table 2: Low-skilled employment, average annual growth rates over the period

Industry	Nov 86 – Nov 89	Nov 89 – Nov 93	Nov 93 – May 96	Aug 96 – Nov 98	Nov 98 – Nov 03	Nov 03 – Nov 08
Agriculture, forestry, and fishing	5.2	-3.2	6.1	-0.6	-2.5	-1.0
Mining	0.0	-10.8	1.5	-8.0	6.3	19.2
Manufacturing	4.1	-2.8	2.0	1.0	-2.1	-0.1
Electricity, gas and water	-11.8	-13.9	-3.8	-18.7	-1.0	10.6
Construction	7.4	-5.6	1.1	6.8	7.6	4.1
Wholesale trade	4.1	1.3	0.9	-5.2	-6.8	2.8
Retail trade	4.6	0.0	6.8	1.9	2.6	-0.3
Accommodation, cafes and restaurants	8.3	3.3	3.6	1.6	1.5	3.2
Transport and storage	-0.6	-4.1	7.6	-2.8	-1.2	3.4
Communication services	4.2	-2.3	26.1	1.0	-3.4	4.1
Finance and insurance	3.6	-1.1	1.8	1.7	-15.5	8.2
Property and business services	8.3	2.3	9.1	9.1	3.0	-1.3
Government administration and defence	-0.5	2.3	-3.0	-18.3	8.4	-10.2
Education	2.1	0.8	1.1	-5.3	-1.3	-2.1
Health and community services	4.1	2.1	6.2	0.7	-4.2	5.1
Cultural and recreational services	6.6	1.9	8.0	-0.2	-1.5	0.7
Personal and other services	9.3	0.8	5.7	5.5	-0.4	-6.1
Total low-skilled	4.6	-0.3	5.0	1.3	0.9	0.3

Notes and sources follow Table 3.

Table 3: Higher-skilled employment, average annual growth rates over the period

Industry	Nov 86 – Nov 89	Nov 89 – Nov 93	Nov 93 – May 96	Aug 96 – Nov 98	Nov 98 – Nov 03	Nov 03 – Nov 08
Agriculture, forestry, and fishing	-2.1	0.2	-0.7	-0.8	-1.4	-0.1
Mining	3.6	-1.3	-5.3	-4.2	2.5	13.8
Manufacturing	2.2	-2.5	0.2	-1.9	-0.4	0.7
Electricity, gas and water	-5.8	-1.9	-10.3	0.8	2.1	9.4
Construction	7.1	-1.7	3.2	1.4	3.5	5.3
Wholesale trade	6.9	-1.0	-3.7	0.8	-1.5	-0.3
Retail trade	4.2	-0.3	1.8	0.7	2.0	2.7
Accommodation, cafes and restaurants	6.8	3.0	2.0	2.7	3.4	1.5
Transport and storage	0.3	-1.3	2.7	1.6	1.8	3.9
Communication services	-0.1	-2.3	7.7	-5.5	5.1	2.1
Finance and insurance	5.8	-2.5	-2.0	2.3	1.2	1.9
Property and business services	7.8	0.0	11.2	7.0	4.0	3.2
Government administration and defence	0.6	1.8	1.2	-2.6	5.5	3.0
Education	2.7	2.2	2.0	1.5	3.2	2.2
Health and community services	2.7	2.4	1.9	2.2	3.9	3.5
Cultural and recreational services	8.7	-0.8	2.3	4.6	2.1	5.3
Personal and other services	3.8	1.7	3.4	6.5	0.8	4.2
Total higher-skilled	3.4	-0.3	1.8	1.5	2.2	2.9

Note: Data are seasonally adjusted by AFPCS. Changes in occupation classifications in 1996 mean that the definitions for the two segments prior to and after 1996 are not strictly comparable. Prior to 1996, low-skilled was defined as Salespersons and personal service workers and Labourers and related workers under ASCO First Edition. From 1996, low-skilled was defined as Elementary clerical, sales and service workers and Labourers and related workers under ASCO Second Edition.

Note: The orange cells show employment growth being more than one percentage point less than the Total average for the period, while the green cells show employment growth being more than one percentage point higher than the All industries average for the period.

Source: ABS, *Labour Force, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

Patterns of employment during the recession (1990 to 1993)

It is unclear as to whether employment began to fall initially in low- or higher-skilled occupations. However, employment for both of the broad skill categories declined by a similar degree during the early 1990s downturn (Tables 2 and 3).

Some industries continued to deliver moderate rates of employment growth in low-skilled jobs during the recession. Some of those industries include Accommodation, cafes and restaurants and Property and business services (Table 2). Low-skilled employment in Retail trade was broadly unchanged. Higher-skilled employment grew in similar industries to low-skilled employment during this period.

Patterns of employment during the expansion (1993 to 2008)

In the early phase of the recovery, low-skilled employment grew at a higher rate than higher-skilled employment. However, growth in low-skilled employment slowed as the economy expanded, while higher-skilled employment growth strengthened to be higher than low-skilled employment by the end of the expansion.

The industries delivering the strongest growth in low-skilled employment during the initial recovery period were the service industries, including Retail trade and Property and business services. This was also the case for higher-skilled employment.

Based on this data, low-skilled employment growth in the service industries and in many of the more minimum wage reliant industries was not as weak during the recession as other industries and was an important part of the recovery during the early 1990s. However, over the longer term, through the late 1990s and to 2008, the growth in low-skilled employment declined across a broader range of industries, and employment growth switched towards higher-skilled occupations generally.

Mobility of labour between industries and occupations

Another dimension of these changes in low-skilled and higher-skilled employment over time is the characteristics of those people who are employed in those occupations. Murtough and Waite found that retrenched workers who find a new job often experience a change in the nature of their work, such as occupation and industry.⁹ Many higher-skilled people found themselves in lower-skilled occupations and in other industries. For example, some people retrenched from the Manufacturing industry found employment in service industries. Murtough and Waite, as well as other researchers, also found that low-skilled people were less likely to regain employment and had an increased likelihood of leaving the labour force.¹⁰ So while low-skilled employment on an industry basis fared well in the initial recovery period, a larger proportion of those jobs may have been filled by higher-skilled people. However, as the expansion strengthened, higher-skilled people are likely to have 'moved back' into higher-skilled jobs.

⁹ G Murtough and M Waite, *Unemployment and re-employment of displaced workers*, Productivity Commission Staff Research Paper, Canberra, AusInfo, 2000, pp. x-xi.

¹⁰ P Frijters and R Gregory, 'From golden age to golden age: Australia's 'Great Leap Forward'?', *The Economic Record*, Vol. 82, No. 257, June 2006, pp. 207-224.

5. Recent employment growth by industry

Turning to the more recent data, Figure 2 reports the change in employment by industry over the year to the February quarter 2009. Over that time, changes to employment have been mixed across industries.

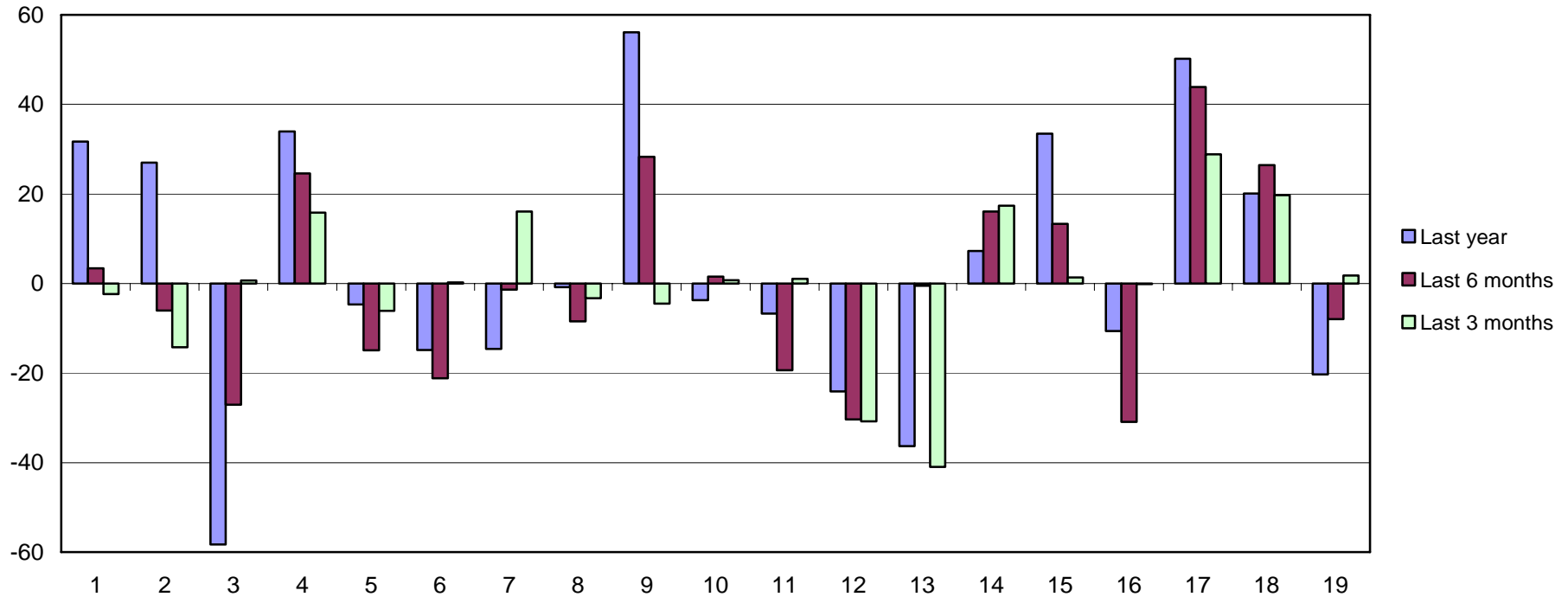
Similar to the downturn in the early 1990s, employment in Manufacturing, Financial and insurance services have declined over the year to February 2009. Employment in Manufacturing has declined by nearly 60,000 people, though most of that decline appears to have occurred in 2008, with the level of employment remaining relatively flat in February 2009. In the six months to February 2009, employment in Financial and insurance services fell by nearly 20,000 people.

Other industries to experience a relatively large fall in employment over the year to February 2009 are Professional, scientific and technical services and Rental, hiring and real estate services. The recent falls in employment in Accommodation and food services have been relatively small.

Employment has increased both over the year and in the three months to February 2009 in Health care and social assistance, Arts and recreation services and Electricity, gas, water and waste services.

Total hours worked has reduced by over 1 per cent over the year to February 2009. There is some evidence of hours having reduced more than employment in many industries over this period. So, at this stage, there appear to be some common as well as different features of the changing composition of the labour market between the early 1990s and the downturn since early 2008.

Figure 2: Change in employment by industry, February 2008 to February 2009



Note: ABS seasonally adjusted data is used to determine short-term movements. The industries were enumerated as follows:

- | | | |
|--|--|--------------------------------------|
| 1 Agriculture, forestry and fishing | 8 Accommodation and food services | 15 Public administration and safety |
| 2 Mining | 9 Transport, postal and warehousing | 16 Education and training |
| 3 Manufacturing | 10 Information media and telecommunications | 17 Health care and social assistance |
| 4 Electricity, gas, water and waste services | 11 Financial and insurance services | 18 Arts and recreation services |
| 5 Construction | 12 Rental, hiring and real estate services | 19 Other services |
| 6 Wholesale trade | 13 Professional, scientific and technical services | |
| 7 Retail trade | 14 Administrative and support services | |

Source: ABS, *Labour Force, Detailed, Quarterly*, February 2009, Catalogue No. 6291.0.55.003.

6. Concluding remarks

The data on changes in employment during the 1990s recession and subsequent recovery offer some variations by industry and skill level. During the recession of the early 1990s, most of the decline in shares of employment occurred in Manufacturing, Construction and Financial and insurance services. The shares of employment were maintained or slightly increased in some of the more low-paid industries throughout the recession and long expansion. While employment fell across all industries during the recession period, this was more temporary in some industries than others.

Total employment in low-skilled and higher-skilled occupations declined to the same extent during the recession. In the early phase of the recovery, low-skilled employment grew at a higher rate than higher-skilled employment. The industries delivering the strongest growth in low-skilled employment during the initial recovery period were the service industries, including Retail trade and Property and business services. However, the growth in low-skilled employment slowed as the expansion continued, while higher-skilled employment growth strengthened.

Over the year to February 2009, employment declined across a number of industries, particularly Manufacturing. While the growth in total employment growth slowed over this period, employment in some industries continued to increase.

This analysis allows us to use the experiences of employment during Australia's previous recession to help understand what might occur during the current economic downturn. However, as there has been considerable structural change in the labour market since the early 1990s on many dimensions, the patterns of change going forward may be different.

Labour market outcomes for low-skilled people in Australia

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1. Introduction

The aim of this report is to review the labour market outcomes of low-skilled people in Australia. This includes how their outcomes have compared with those of higher-skilled people and trends over the past decade. The report will also discuss the possible factors that have affected low-skilled employment and, based upon the available evidence, attempt to determine their relative significance.

Although the Commission's objectives refer to particular groups of low-skilled people (for example, the unemployed and employees to whom training arrangements apply), this report is primarily concerned with low-skilled people as one group rather than particular types. For example, even though the labour market outcomes of low-skilled people as a whole are to a significant degree determined by the labour market outcomes of junior workers (as juniors form a major component of the low-skilled workforce), this report is not specifically concerned about workers who earn junior rates. To the extent that the report does focus on particular groups of people, it does so based on a given skill measure (for instance, people who have not completed Year 12).

The report is divided into two broad parts. The first part considers how to define what types of people are 'low-skilled'. This part will review the various ways in which the 'low-skilled' have been defined, and arrive at its own definitions based on which types of people are also 'low-paid'.

Using these definitions, the second part of the report looks at the labour market outcomes of low-skilled people, and discusses the possible reasons for those outcomes. It compares recent trends in employment and unemployment across skill groups, and considers what factors have been driving those trends, including minimum wages.

2. Defining the low-skilled

2.1. Definitions of skill

There is no set definition of which people should be considered as 'low-skilled'.² One view is that the term 'skill' refers to a person's ability to perform tasks, with the 'higher-skilled' people being those who are able to perform more effectively. Another

¹ The author would like to thank colleagues in the Secretariat, particularly Miranda Pointon and Nick Mowbray, for comments on this paper. Responsibility for the analysis remains with the author.

² See A Esposto, 'Skill: An Elusive and Ambiguous Concept in Labour Market Studies', *Australian Bulletin of Labour*, Vol. 34, No. 1 2008, pp. 100-124 for a more detailed discussion around the problems of defining and measuring skill.

view is that 'skill' is intrinsic to a job itself, with the 'higher-skilled' people being those employed in jobs that are more complex and which require greater knowledge and experience.

From an economic point of view, skill could be defined in terms of productivity – that is, 'high-skilled' people are more productive than 'low-skilled' people. This in turn raises the problem of how to measure a person's productivity level. In practice, researchers have used worker characteristics that are likely to be correlated with productivity (for example, educational attainment).

The following discusses a number of possible ways in which 'low-skilled' people could be defined.

Level of education

Higher-educated people would be expected to have a broader and/or more complex set of skills than lower-educated people. A common method for separating out high-skilled and low-skilled people is on the basis of whether or not that person has completed a non-school qualification. However, the gradation in the quality of learning between people with and without a non-school qualification is not clear-cut. There are some cases in which the Australian Bureau of Statistics (ABS) considers completion of Year 10 or above as a higher level of educational attainment than completion of a non-school qualification.

Educational attainment is only a partial measure of skill. People may be able to competently perform the tasks required of a particular job without having the necessary formal qualifications due to, among other things, relevant job experience. Also, differences in courses and educational institutions mean that people with the same level of educational attainment may differ considerably in terms of their skill levels.

Occupation

Alternatively, a person's skill level can be defined in terms of the job he or she performs. The Australian and New Zealand Standard Classification of Occupations (ANZSCO) classifies occupations according to skill level and skill specialisation. In ANZSCO, skill level is measured in terms of formal education and training, previous experience in related occupations, and on-the-job training. There are five skill levels, with occupations in the lowest skill category typically requiring a level of skill commensurate with compulsory secondary education (see Appendix A). This paper will tend to use the precursor to ANZSCO, the Australian Standard Classification of Occupations (ASCO), as it allows the use of a longer time series.

Esposito³ argues that the measures that ANZSCO uses to define skill level are too broad to adequately capture the skill composition of Australian jobs.⁴ For the purposes of the current paper, however, the more salient problem with using a person's occupation to define his or her skill level is that people who are not employed often can not be classified.

There have been a number of studies, both in Australia and abroad, that have looked at the discrepancies between the level of education that is required for a particular occupation and the actual level of education of people employed in that occupation. These studies have found a high incidence of both 'overeducation' and

³ A Esposito, 'Skill: An Elusive and Ambiguous Concept in Labour Market Studies', *Australian Bulletin of Labour*, Vol. 34, No. 1 2008, pp. 100-124.

⁴ He proposes the adoption of the Occupational Information Network (O*NET) to analyse skill in Australia.

'undereducation'. For example, Linsley⁵ found that, for wage and salary earners aged 18 to 54 years, 27 per cent of workers reported that they had a level of education that was greater than typically required for their job and 19 per cent of workers reported that they had a level of education that was lower than typically required for their job.⁶

Length of work experience

A person's length of work experience is considered a proxy for the 'on-the-job' skills that he or she has acquired. However, a person's time in the workforce may not be a good measure of the *quality* of his or her skills, in particular the skills acquired through education.

Earnings

In a competitive market, a person's wage rate would be expected to reflect his or her productivity. Therefore, a person's skill level could be defined in terms of his or her position within the earnings distribution. However, as noted by Vickery⁷, there are a number of problems with this approach. First, an employee's remuneration may not reflect his or her productivity. Second, as with the occupation approach, a person's skill level can only be directly measured if he or she is employed, although it is possible to impute the skill level of non-employed people by comparing their personal characteristics to workers at different points in the wage distribution. Third, since this approach measures each person's skill level relative to the rest of the workforce it can not capture changes in the skill level of the workforce as a whole.

Reilly, Milne and Zhao⁸ have constructed a measure of the quality of labour in which a person's skill level is equivalent to his or her *expected* hourly wage rate given that person's level of educational attainment and years of potential work experience.⁹ This measure of skill would appear to be superior to any of the measures given above, since it relates a person's skill level to the value placed on *both* that person's qualifications and work experience. However, it is difficult to construct, particularly over time, since it requires the use of ABS unit record data.

Summary

In this report, a person's skill level will be defined both in terms of his or her occupation and highest level of educational attainment. Relevant data for both of these measures are readily available from the various ABS labour force surveys. Both measures have an advantage over a length of work experience measure in that they are better at capturing the quality of a person's skills. They are also preferable to an earnings measure since they will allow us to discuss changes in the skill level of the workforce as a whole.

Relative to each other, the occupation measure of skill and the educational attainment measure of skill both have strengths and weaknesses. An occupational measure of skill takes into account that relevant work experience may substitute for formal

⁵ I Linsley, 'Causes of Overeducation in the Australian Labour Market', *Australian Journal of Labour Economics*, Vol. 8, No. 2, 2005, pp. 121-44.

⁶ These estimates were based on the 1997 wave of the Negotiating the Life Course survey.

⁷ J Vickery, *Unemployment and Skills in Australia*, Reserve Bank of Australia, Research Discussion Paper 1999-12, December 1999.

⁸ R Reilly, W Milne and S Zhao, *Quality-adjusted Labour Inputs*, Australian Bureau of Statistics, Catalogue No. 1351.0.55.010, November 2005.

⁹ A person's occupation is not included as an explanatory variable for his or her wage rate as occupational differences in wages are believed to be highly correlated with education.

qualifications. On the other hand, some of the people that are actually working in a particular occupation may have higher or lower skills than are typically required for that job. Therefore, it is also worth examining the educational attainment data to see what it indicates about the skill level of the workforce.

The next step is to define what levels of educational attainment and occupations should be regarded as low-skilled. From the perspective of the Commission's wage-setting function, it is preferable that the groups of people that are collectively defined to comprise the low-skilled also capture a significant proportion of the low-paid. The next section uses earnings data to provide clearer definition with regard to which groups of people should be classified as low-skilled.

2.2. Relationship between low skill and low pay

As mentioned above, a given individual's wage may not be indicative of his or her actual productivity. However, on average, given a substantial degree of market competitiveness, we would still expect low-skilled people to earn lower wage rates than high-skilled people. This section looks at which occupations and levels of educational attainment low-paid workers are concentrated in. All data used in this section are from Wave 6 of the Household, Income and Labour Dynamics in Australia (HILDA) Survey.

Pay by educational attainment

As expected, people without a non-school qualification tend to earn lower hourly wage rates than people with a non-school qualification (Table 1). However, the hourly wage rate distribution for people whose highest level of educational attainment is a Certificate I or Certificate II qualification is similar to that for people who have not completed secondary education. Therefore, although these people have a non-school qualification, it seems reasonable to also consider them as 'low-skilled'.

Table 1: Hourly wage rate in main job by highest level of educational attainment, 2006

Highest level of educational attainment	Percentile		
	25%	50%	75%
Postgraduate - masters/doctorate	22.62	30.53	40.86
Graduate diploma/certificate	23.25	29.40	36.82
Bachelor degree	18.42	25.00	33.33
Advanced diploma/Diploma	15.79	21.18	29.07
Certificate III/IV	15.40	19.92	26.32
Certificate I/II	11.84	14.41	20.00
Year 12	13.18	16.90	22.36
Year 11 and below	11.54	15.83	20.53

Note: Hourly wage rate in main job defined as current weekly gross wages and salary in main job divided by hours per week usually worked in all jobs. Casual employees are assumed to receive a loading of 20 per cent.

Source: HILDA (2006).

As Table 1 indicates, there is a considerable overlap in the wage rates of people with high and low levels of educational attainment. A substantial proportion of people who may be considered as low-paid may not necessarily be considered as low-skilled. For example, of the employees that earned \$15 per hour or less as of 2006, around one-third are estimated to have completed a Certificate III/IV qualification or above.¹⁰

¹⁰ As of late 2006, a full-time worker that earned \$15 per hour would have received about two-thirds of average weekly earnings over the course of a week.

Conversely, a substantial proportion of people who may be considered as low-skilled may not be considered as low-paid. For example, as of 2006, 50 per cent of employees whose highest level of educational attainment was Year 12 earned a wage rate of \$16.90 per hour or above.

Pay by occupation

In terms of major occupational groups, Elementary clerical, sales and service workers and Labourers and related workers, both of which are Skill Level 5, tend to earn by far the lowest wages (Table 2). However, the hourly wage distributions for the two major occupation groups from Skill Level 4 – Intermediate clerical, sales and service workers and Intermediate production and transport workers – are similar to the one for people who have only completed Year 12. Therefore, there is a case for also defining these occupational groups as ‘low-skilled’. Of the employees that earned \$15 per hour or less as of 2006, around two-thirds are estimated to be within these four occupational groups. The Tradespersons and related workers group also contains a significant number of low-paid employees, as it includes apprentices and trainees.

Table 2: Hourly wage rate in main job by major occupational group, 2006

Occupation (ASCO major group)	Skill Level	Percentile		
		25%	50%	75%
Managers and administrators	1	20.85	30.46	41.35
Professionals	1	20.83	27.08	34.52
Associate professionals	2	16.67	22.33	29.17
Tradespersons and related workers	3	14.25	19.94	26.79
Advanced clerical and service workers	3	16.25	20.68	27.60
Intermediate clerical, sales and service workers	4	13.89	17.36	21.23
Intermediate production and transport workers	4	14.63	18.12	22.71
Elementary clerical, sales and service workers	5	10.00	13.89	17.00
Labourers and related workers	5	10.76	14.34	17.53

Note: Hourly wage rate in main job defined as current weekly gross wages and salary in main job divided by hours per week usually worked in all jobs. Casual employees are assumed to receive a loading of 20 per cent.

Source: HILDA (2006).

In summary, given a preference to capture the majority of low-paid employees, the following categories could be defined as ‘low-skilled’:

Table 3: Categories of low-skilled people by level of educational attainment and major occupational group

By level of educational attainment	Percentage of people aged 15-64 (as at May 2007)	By major occupational group (ASCO)	Percentage of employed people (as at May 2008)
Certificate I/II	5.2	Intermediate clerical, sales and service workers	16.7
Certificate not further defined	1.5	Intermediate production and transport workers	8.6
Year 12	17.8	Elementary clerical, sales and service workers	9.0
Year 11 or below	29.5	Labourers and related workers	8.5
Total	54.1		42.8

Based on the 2006 HILDA Survey, around 63 per cent of employees that would be classified as having a low-skilled level of educational attainment would be classified as being employed in a low-skilled occupation. Conversely, around 64 per cent of employees that would be classified as being employed in a low-skilled occupation would be classified as having a low-skilled level of educational attainment.

Under the ANZSCO classification system, the major occupational groups are assigned to more than one skill level. Based on our methodology for the ASCO classification system, Labourers (Skill Levels 4 and 5), and Machinery operators and drivers (Skill Level 4) would be considered low-skilled occupational groups (see Appendix A). Managers (Skill Levels 1 and 2), Professionals (Skill Level 2), and Technicians and Trades Workers (Skill Levels 2 and 3) would not be considered low-skilled occupational groups. The other major occupational groups, Community and Personal Service Workers, Clerical and Administrative Workers, and Sales Workers would be considered predominantly low-skilled (Table 4).

Table 4: Estimated percentage of people in major ANZSCO occupational groups employed in low-skilled occupations, May 2008

Major Occupational Group	Percentage employed in low-skilled occupations
Community and Personal Service Workers	74.5
Clerical and Administrative Workers	74.0
Sales Workers	90.5

Note: Low-skilled occupations include all unit (4-digit ANZSCO) occupational groups that are predominantly Skill Level 4 and/or 5.

Source: ABS, ANZSCO – Australian and New Zealand Standard Classification of Occupations, 2006, Catalogue No. 1220.0; ABS, Labour Force, Australia, Detailed, Quarterly, November 2009, Catalogue No. 6291.0.55.003.

3. Labour market outcomes for low-skilled people

Part 2 set out two different systems for defining the low-skilled, one of which was based on a person's highest level of educational attainment, and the other of which was based on a person's occupation. Using these definitions, this section presents data on the labour market outcomes for low-skilled people in Australia, and compares them with those of high-skilled people. It then discusses the possible reasons for why the outcomes of low-skilled and high-skilled people are noticeably different. Next it compares recent trends in employment and unemployment by skill level, focusing in particular on the decreasing percentage of low-skilled people in the labour force. Finally, it considers what factors have been driving those trends, including any potential effect from past increases in minimum wages.

3.1 Labour market outcomes

Labour market outcomes by level of educational attainment

People with high levels of educational attainment tend to have lower unemployment rates and higher participation rates than people with low levels of educational attainment (Table 5). Overall, as of May 2008:

- People with a 'high level' of educational attainment (as defined in Section 1) had an unemployment rate of 2.6 per cent, compared to 6.4 per cent for people with a 'low level' of educational attainment;

- People with a 'high level' of educational attainment had a participation rate of 86.6 per cent, compared to 70.2 per cent for people with a 'low level' of educational attainment;
- People with a 'high level' of educational attainment are considerably more likely to be employed full-time than people with a 'low level' of educational attainment, and somewhat less likely to be employed part-time.

Some of the differences in labour market outcomes by educational attainment are due to factors other than educational levels. For example, people who have not completed school will tend to have less job market experience and are more likely to be studying than people who have. Therefore, even aside from their lower educational level, people who have not completed school would be expected to have a lower chance of employment.

To account for such effects, a logit model was estimated (using unit record data from the ABS' 2007 *Education and Work* survey) in which a person's probability of employment is considered to be dependent upon his or her highest level of educational attainment, gender, location, marital status, place of birth, age, current educational attendance, and relationship in household (e.g. lone parent). After adjusting for these effects, people with high levels of educational attainment are still estimated to have (all other things being equal) a significantly higher probability of employment than people with low levels of educational attainment, but the differences are not as great as in the raw data (Table 6, see Appendix B for the full results). In particular, accounting for factors such as age and educational attendance reduces the estimated difference in the probability of employment for people who have not completed school relative to those who have.

Table 5: Labour market outcomes by level of educational attainment, May 2008

	Employed Full-Time	Employed Part-Time	Employed Total	Percentage Unemployed	Labour Force (Participation Rate)	Not In Labour Force	Total	Unemployment Rate
Persons with a non-school qualification, highest level of non-school qualification completed								
Postgraduate degree	72.5	14.7	87.2	2.2	89.4	10.6	100.0	2.5
Graduate Diploma/ Graduate Certificate	64.8	22.0	86.8	1.7	88.5	11.5	100.0	2.0
Bachelor Degree	64.9	19.3	84.2	1.7	85.9	14.1	100.0	2.0
Advanced Diploma/Diploma	57.6	22.2	79.9	2.9	82.7	17.3	100.0	3.5
Certificate III/IV	69.4	16.7	86.1	2.5	88.6	11.4	100.0	2.8
Certificate I/II	48.0	25.4	73.4	5.2	78.5	21.5	100.0	6.6
Certificate n.f.d.	55.6	22.5	78.1	3.8	81.9	18.1	100.0	4.6
Level not determined	61.1	20.0	81.1	2.9	84.0	16.0	100.0	3.4
Persons without a non-school qualification, highest level of school completed								
Year 12	47.5	26.3	73.8	3.7	77.5	22.5	100.0	4.8
Year 11	38.7	26.3	65.0	4.2	69.2	30.8	100.0	6.0
Year 10 or below	37.2	20.3	57.5	5.1	62.6	37.4	100.0	8.2
Total with a non-school qualification	63.9	19.4	83.3	2.5	85.8	14.2	100.0	2.9
Total without a non-school qualification	41.2	23.3	64.5	4.5	69.0	31.0	100.0	6.5
High level of educational attainment	65.6	18.7	84.3	2.2	86.6	13.4	100.0	2.6
Low level of educational attainment	42.2	23.5	65.7	4.5	70.2	29.8	100.0	6.4
Total	53.5	21.2	74.7	3.4	78.1	21.9	100.0	4.4

Note: People with a low level of educational attainment include people whose highest level of educational attainment is a Certificate I/II qualification or a Certificate not further defined, and people without a non-school qualification. All other people are considered to have a high level of educational attainment.

Source: ABS, *Education and Work, Australia*, May 2008, Catalogue No. 6227.0.

Table 6: Probability of employment by highest level of educational attainment, May 2007

Highest level of educational attainment	Percentage increase in probability of employment relative to Year 10 or below	
	Adjusted	Unadjusted
Bachelor degree or above	18.4	29.0
Advanced Diploma/Diploma or Certificate III/IV	15.4	27.3
Year 12	11.2	17.0
Year 11	5.7	7.8
Certificate I/II or Certificate not further defined	2.6	17.4

Source: ABS, *Education and Work, Australia, May 2007*, Catalogue No. 6227.0; ABS, *Survey of Education and Work – Confidentialised Unit Record File, May 2007*, Catalogue No. 6227.0.30.001.

Labour market outcomes by occupation

Occupational data also indicate that low-skilled workers have a higher probability of unemployment than high-skilled workers. The ABS publishes data each quarter on unemployment by occupation of last job for those people who have worked for two weeks or more and last worked within the past two years. Combining this data with the employment data by occupation creates a proxy for the unemployment rate for each occupation (Table 7).

The average unemployment rate over the four quarters to the May quarter 2008 of people in low-skilled occupational groups (Skill Levels 4 and 5) is around 2½ times greater than that of people in other occupational groups. This is similar to the difference in unemployment rates between low-skilled and high-skilled workers as indicated by the educational attainment data.

Table 7: Unemployment rate by major occupational group

	Skill Level	Average over four quarters to May quarter 2008
Managers and administrators	1	1.1
Professionals	1	1.2
Associate professionals	2	1.5
Tradespersons and related workers	3	2.2
Advanced clerical and service workers	3	1.2
Intermediate clerical, sales and service workers	4	2.6
Intermediate production and transport workers	4	3.3
Elementary clerical, sales and service workers	5	4.1
Labourers and related workers	5	6.4
High-skilled (Skill Levels 1 to 3)		1.5
Low-skilled (Skill Levels 4 to 5)		3.8

Note: Includes people who were last employed within that occupation, and that have been employed: a) for more than two weeks, and b) within the last two years.

Source: ABS, *Labour Force, Detailed, Quarterly, May 2008*, Catalogue No. 6291.0.55.003.

3.2. Explanations for labour markets outcomes by skill

As shown in Vickery as well as Barnes and Kennard¹¹, high-skilled workers have consistently had a higher probability of employment (and a lower probability of unemployment) than low-skilled workers, both in Australia and overseas. Vickery considers several explanations for why this is so. He does not consider any of them to be a full explanation for the higher unemployment rate for low-skilled workers, and concludes that it is unclear which of them is the most important.

The first explanation is consistent with Vickery's finding that low-skilled workers have a much higher probability of exiting from employment, both into unemployment and to outside the labour force. The other three explanations are consistent with his finding that low-skilled people have a lower probability of moving into employment (i.e. have a lower 'job matching' rate).

- 1) If low-skilled workers, in general, have less firm-specific human capital than high-skilled workers, then firms are more likely to let them go. However, if this explanation held true, one would expect low-skilled unemployment to be more volatile than high-skilled unemployment (since firms are less reluctant to shed low-skilled workers during a downturn). Vickery finds that, in Australia, this is true of male employees, but not of female employees.
- 2) High-skilled people who are unable to obtain employment in their area of specialisation may be 'crowding out' low-skilled workers, since they can perform low-skilled jobs while continuing to search for high-skilled positions. As discussed in Part 1 of this report, there are a substantial proportion of workers that have a higher level of qualification than what is required for their job, although this has also been found to happen in reverse.
- 3) Low-skilled people may have a lower incentive to work as their replacement ratios are higher – that is, their unemployment benefits are higher relative to the wages they would expect to earn if employed. Evidence for this effect has been found in relation to female youth in Australia, but not for the population as a whole.
- 4) Low-skilled workers may be 'overpaid' relative to high-skilled workers given what they produce, either due to institutional factors (such as Australia's system of minimum wage rates) or non-institutional factors. Vickery concludes that it seems unlikely that any country-specific institutional factors are the main explanation for the higher rate of low-skilled unemployment in Australia, since low-skilled unemployment is comparatively high across a range of countries with very different institutional factors. More specifically, Kennedy¹² notes that unemployment rates for low-skilled people are similar in Australia and the US, even though Australia has a relatively high minimum wage.¹³ As Kennedy points out, this does not mean that such factors do not have an effect on low-skilled unemployment, only that their effects may be relatively small.

So far, this part of the report has focused upon the *structure* of labour market outcomes across different skill groups. The remainder of the report will focus upon changes in

¹¹ P Barnes and S Kennard, *Skill and Australia's Productivity Surge*, Productivity Commission, October 2002.

¹² S Kennedy, *Full Employment in Australia and the Implications for Policy*, Speech to the NSW Economic Society, December 2007.

¹³ This is based on official labour force statistics. P Saunders, *What Are Low Ability Workers To Do When Unskilled Jobs Disappear?, Part 2: Expanding Low-skilled Employment*, Issue Analysis No. 93, The Centre for Independent Studies, February 2008, argues that the actual employment level of low-skilled workers in the US is likely to be significantly higher than it is in Australia since official statistics exclude the US' comparatively large 'informal economy' (i.e. illegal immigrants).

the skill profile of the workforce over the past decade, and how these have affected the relative employment and unemployment rates of low-skilled workers.

3.3. Trends in employment and unemployment across different skill groups

Trends by level of educational attainment

Data on educational attainment indicate that the workforce has become more highly skilled over time. For all of the main labour force status categories, the percentage of people in that category with a non-school qualification increased considerably from 1994 to 2008 (Table 8).¹⁴ For most categories, the majority of the increase was due to people with a Bachelor degree or higher qualification, although the percentage of people in each category whose highest level of non-school qualification was an Advanced Diploma or Diploma also increased.

While people without a non-school qualification make up a smaller share of employment compared with a decade ago, their unemployment rate relative to people with a non-school qualification has not changed substantially. For both people with and without a non-school qualification, the unemployment rates as of May 2008 were almost half their values as of May 1994.

¹⁴ The ABS Classification of Qualifications system was introduced in 1993. Data before this period also show a trend increase in the percentage of workers with non-school qualifications.

Table 8: Labour force status of people with and without a non-school qualification, May 1994 and May 2008

	Percentage							
	With a non-school qualification		Bachelor degree or above		Advanced Diploma/Diploma		Without a non-school qualification	
	1994	2008	1994	2008	1994	2008	1994	2008
Working-age population	38.8	53.9	11.5	21.9	27.3	30.8	61.2	46.1
Not in the Labour Force	21.2	34.9	5.1	13.2	16.0	20.9	78.8	65.1
Labour Force	45.2	59.3	13.8	24.4	31.4	33.6	54.8	40.7
Unemployment	27.8	39.9	6.6	11.5	21.2	27.4	72.2	60.1
Employment	47.1	60.2	14.6	25.0	32.5	33.9	52.9	39.8
Employed full-time	50.7	64.5	15.7	27.2	34.9	36.0	49.3	35.5
Employed part-time	35.9	49.3	11.0	19.4	24.8	28.8	64.1	50.7
Unemployment rate	6.1	2.9	4.7	2.1	6.7	3.6	13.0	6.5
Participation rate	85.5	85.8	88.1	86.8	84.4	85.2	65.8	69.0
Employment to population ratio	80.3	83.3	84.0	85.0	78.8	82.1	57.3	64.5

Note: In May 2008, percentages for Bachelor degree or above and Advanced Diploma/Diploma do not add up to percentages for people with a non-school qualification as some people do not supply their highest level of non-school qualification.

Source: ABS, *Transition From Education to Work*, May 1994, Catalogue No. 6227.0; ABS, *Education and Work, Australia*, May 2008, Catalogue No. 6227.0.

Barnes and Kennard show that, since 1980, the ratio of the unemployment rate of workers with non-school qualifications to that of workers without non-school qualifications has remained reasonably stable from year to year, at around one-half. This is consistent with the finding in Vickery that changes in unemployment rates for different skill groups are mainly determined in the short run by the state of the business cycle.

Trends by occupation

Occupational data also show a trend towards higher-skilled employment, although the trend is not as pronounced as it is for the educational attainment data. From August 1996 to November 2008, the highest-skilled occupational groups (Managers and administrators, Professionals, and Associate Professionals) have recorded by far the largest employment growth (Table 9).¹⁵ Collectively, the occupational groups assigned to the lowest skill level (Elementary clerical, sales and service workers, and Labourers and related workers) recorded the smallest employment growth, with little growth in full-time employment. However, the occupational groups assigned to the next lowest skill level (Intermediate clerical, sales and service workers and Intermediate production and transport workers) recorded comparatively solid employment growth, particularly in part-time employment.

Table 9: Percentage growth in employment and hours worked by major occupational group, August 1996 to November 2008

	Skill Level	Percentage growth			Hours Worked
		Full-time	Part-time	Total	
Managers and administrators	1	39.9	71.4	42.8	33.9
Professionals	1	47.0	79.7	53.6	42.9
Associate professionals	2	44.4	125.1	54.1	39.1
Tradespersons and related workers	3	17.2	68.4	21.1	18.3
Advanced clerical and service workers	3	-12.0	4.7	-5.3	-9.8
Intermediate clerical, sales and service workers	4	13.0	53.3	26.5	19.3
Intermediate production and transport workers	4	10.9	73.7	19.5	15.9
Elementary clerical, sales and service workers	5	-5.4	27.6	13.0	4.1
Labourers and related workers	5	8.9	7.9	8.5	10.6
Total		23.3	44.3	28.6	23.9
Skill Levels 1 and 2		44.5	89.3	51.4	39.5
Skill Level 3		11.8	26.9	14.2	12.4
Skill Level 4		12.1	57.1	24.0	17.9
Skill Level 5		2.7	19.5	10.8	7.5

Source: ABS, *Labour Force, Detailed, Quarterly*, November 2008, Catalogue No. 6291.0.55.003.

While the highest-skilled occupational groups have recorded the highest growth in employment in recent years, they have not recorded the largest falls in unemployment (Table 10). For both high-skilled occupations as a whole and low-skilled occupations

¹⁵ The ASCO Second Edition occupational classifications were introduced to the Labour Force Survey in August 1996. In the period from August 1986 to May 1996, employment in low-skilled occupational groups grew by more than employment in high-skilled occupational groups, driven in large part by strong employment growth for Salespersons and personal service workers.

as a whole the average unemployment rates over the four quarters to May 2008 were about 60 per cent of what they were over the four quarters to February 2001.¹⁶

In summary, both the data by level of educational attainment and by occupation show a trend towards higher-skilled employment over the past decade. However, the unemployment and participation rates of low-skilled workers relative to those of high-skilled workers have remained reasonably stable, with unemployment rates falling and participation rates rising for both sets of workers.

The fact that the employment of high-skilled labour has increased relative to low-skilled labour, but that the relative unemployment rates have been stable suggests that, in recent years, the demand for low-skilled workers relative to high-skilled workers has broadly tracked the relative supply of low-skilled workers. As shown above, while the percentage of employed people who are low-skilled has increased over the past decade, so has the percentage of the working population who are low-skilled. The next section further examines these shifts in demand and supply.

Table 10: Unemployment by major occupational group

	Skill Level	Average over four quarters to February 2001 (1)	Average over four quarters to November 2008 (2)	(2)/(1)
Managers and administrators	1	1.4	1.2	0.86
Professionals	1	2.2	1.3	0.60
Associate professionals	2	2.2	1.7	0.79
Tradespersons and related workers	3	4.4	2.3	0.53
Advanced clerical and service workers	3	1.9	1.2	0.67
Intermediate clerical, sales and service workers	4	4.2	2.5	0.60
Intermediate production and transport workers	4	5.9	3.2	0.53
Elementary clerical, sales and service workers	5	6.5	4.1	0.63
Labourers and related workers	5	10.1	6.2	0.62
High-skilled (Skill Levels 1 to 3)		2.6	1.6	0.63
Low-skilled (Skill Levels 4 to 5)		6.3	3.7	0.59

Note: Includes people who were last employed within that occupation, and that have been employed: a) for more than two weeks, and b) within the last two years.

Source: ABS, *Labour Force, Detailed, Quarterly*, November 2008, Catalogue No. 6291.0.55.003.

4. Trends in relative demand for and supply of low-skilled workers

4.1. Wage developments

Under the assumption that wages are flexible, if changes in labour supply across skill groups have broadly kept pace with changes in labour demand, then wage relativities across skill groups should have remained fairly constant. Over the past decade, the average weekly earnings of full-time employees in high-skilled occupations have, in general, grown faster than those of full-time employees in low-skilled occupations; however, in most cases the differences are not large (Table 11). Data by occupation

¹⁶ Unemployment data by occupation before May 2001 referred to full-time workers only.

from the Wage Price Index release, which more closely capture movements in basic hourly wage rates, show a slightly stronger correlation between skill and earnings growth.

Table 11: Wages for Full-time Employees by Occupation

	Mean Weekly Earnings in Main Job for Full-Time Employees Annualised			Total hourly rates of pay excluding bonuses (Wage Price Index)
	Relative to earnings of professionals 1997	2007	growth from Aug 1997 to Aug 2007	Annualised growth from Sep qtr 1997 to Jun qtr 2008
Managers and administrators	119	129	5.3	3.7
Professionals	100	100	4.5	3.9
Associate professionals	85	86	4.5	3.5
Tradespersons and related workers	71	70	4.4	3.6
Advanced clerical and service workers	67	73	5.4	3.4
Intermediate clerical, sales and service workers	66	64	4.1	3.3
Intermediate production and transport workers	74	73	4.3	3.4
Elementary clerical, sales and service workers	59	56	3.9	3.1
Labourers and related workers	59	59	4.6	3.3

Source: ABS, *Employee Earnings, Benefits and Trade Union Membership*, August 2007, Catalogue No. 6310.0; ABS, *Labour Price Index*, June 2008, Catalogue No. 6345.0.

A more formal approach for examining how movements in the relative demand and relative supply of low-skilled labour have translated into movements in relative wages and unemployment is the one used by Barnes and Kennard, and developed by Nickell and Layard^{17, 18}. Essentially, the Nickell and Layard model can be written as:

$$\text{shift in relative demand for high-skilled workers} - \text{shift in relative supply for high-skilled workers} = \text{relative wage movement} + \text{relative unemployment movement}$$

The left-hand side of the equation shows the extent to which there has been a shift in the excess demand for high-skilled workers relative to low-skilled workers. The right-hand side shows how the shift in relative excess demand can be divided between a) changes in the wages of high-skilled workers relative to low-skilled workers; and b) changes in the unemployment rate of high-skilled workers relative to low-skilled workers.

Under this framework, if labour markets are rigid, then a rise in excess demand for high-skilled workers relative to low-skilled workers would predominantly lead to a fall in unemployment for high-skilled workers relative to low-skilled workers. On the other hand, if labour markets are flexible, then this would predominantly lead to a rise in relative wages for high-skilled workers.

Recent movements in the demand for and supply of low-skilled workers relative to high-skilled workers are estimated using earnings data by occupation from the annual *Employee Earnings, Benefits and Trade Union Membership* survey, and employment

¹⁷ S Nickell and R Layard, *Labour Market Institutions and Economic Performance*, Centre for Economic Performance Discussion Paper 0407, September 1998.

¹⁸ Another method for examining changes in relative demand and supply by skill level is the methodology in L Katz and KM Murphy, 'Changes in Relative Wages, 1963-1987: Supply and Demand Factors', *Quarterly Journal of Economics*, Vol. 107, No.1, 1992, pp. 35-78. This is applied to Australian data in J Borland, Education and the Structure of Earnings in Australia, *The Economic Record*, Vol. 72, No. 219, 1996, pp. 370-80.

and unemployment data by occupation from the Labour Force Survey. (Further details on the methodology are provided in Appendix D.) The results are as follows:

- If relative demand and supply are defined in terms of employment, then estimates show that the relative supply of high-skilled workers has increased by more than the relative demand of high-skilled workers over the period August 2001 to August 2007 (Table 12). This has led to a fall in the wages of high-skilled workers relative to low-skilled workers, and an increase in the unemployment of high-skilled workers relative to low-skilled workers.
- In contrast, if relative demand and supply are defined in terms of hours worked, then estimates show that the relative supply of high-skilled workers has increased by less than the relative demand of high-skilled workers over this period.¹⁹ This has led to a rise in the wages of high-skilled workers relative to low-skilled workers, but also an increase in the unemployment of high-skilled workers relative to low-skilled workers.

In either case, however, the estimates are of a similar magnitude to those of Barnes and Kennard. They concluded that, taking account of the small size of the changes, data limitations and the possibility of measurement error, the most appropriate interpretation of their estimates was probably that movements in the relative demand for low-skilled workers during the 1980s and 1990s had been broadly in line with movements in the relative supply of low-skilled workers. This appears to be true of recent years as well.

Table 12: Average percentage changes per year in the demand for and supply of high-skilled workers relative to low-skilled workers, August 2001 to August 2007

	Change in relative demand (1)	Change in relative supply (2)	Relative wage movement (3)	Relative unemployment movement (4)	Net change (1-2 = 3+4)
Employment	1.15	1.48	-0.11	-0.21	-0.32
Hours worked	1.15	0.98	0.45	-0.28	0.17

Note: Assumes an elasticity of substitution between high-skilled and low-skilled labour of 1.

Source: ABS, *Employee Earnings, Benefits and Trade Union Membership*, August 2007, Catalogue No. 6310.0; ABS, *Labour Force, Detailed, Quarterly*, May 2008, Catalogue No. 6291.0.55.003.

So far, this report has shown that the workforce has become more highly skilled over time, but has not addressed the question of why this has happened. The next section considers some possible explanations.

4.2. Explanations for the changing skill profile of employment

Demand-side factors

There are two main explanations for the increase in demand for high-skilled labour relative to low-skilled labour. The first is that *technological change* has increased the productivity of high-skilled workers relative to low-skilled workers. This explanation is known as skill-biased technological/technical change (SBTC). The second is that *international trade* has reduced the relative demand for low-skilled labour in developed

¹⁹ Changes in the share of high-skilled workers in the workforce are not as great when measured in terms of hours worked, as the average hours worked by high-skilled workers fell over this period.

countries, as the industries in which low-skilled workers are concentrated are competing with imports from developing countries.

So far the evidence favours the SBTC explanation, both in Australia and overseas. The percentage of workers who are high-skilled has increased across a range of industries, in both the traded and non-traded sectors. If the trade explanation were the dominant one, then we would not expect to see this pattern. This is because low-skilled workers would be released from the import-competing industries, therefore reducing low-skilled wages and encouraging low-skilled employment in other sectors.

Laplagne, Marshall and Stone²⁰ used general equilibrium analysis to examine the impact of various factors on the relative employment of high-skilled and low-skilled labour in Australia over the period 1987 to 1994. They found evidence to indicate that technological change had increased the relative use of high-skilled labour across a range of industries, and that technological change was the most important factor driving the change in the relative employment of high-skilled labour. In contrast, trade was found to have little effect on the change in the relative employment of high-skilled workers.

Supply-side factors

Growth in participation in education can be explained in terms of increased returns to investing in education or reduced costs of investing in education. The Economic Planning Advisory Commission²¹ listed several reasons why the cost of investing in education in Australia has fallen over recent decades. These include:

- 1) Increased part-time employment among students has decreased the amount of income lost through undertaking full-time education. On the other hand, there is the possibility that increased part-time employment opportunities may reduce the likelihood of students extending their education.
- 2) The decrease in full-time opportunities for young people has reduced the opportunity cost of undertaking education.
- 3) There has been an increase in the range and level of subsidies available to students from low income families who wish to continue their education. (However, there was also the introduction of payment for university study through the Higher Education Contribution Scheme.)

There have been a number of studies that have indicated that the rate of return of investing in education has been increasing in recent decades, most recently Daly, Fleming and Lewis²². This may be linked to the rising demand for high-skilled workers.

The role of minimum wages

Changes in minimum wages may also have played a role in the decline of low-skilled employment relative to high-skilled employment. To test this, we estimate an error correction model in which changes in the gap between employment for high-skilled occupations and employment for low-skilled occupations is dependent upon the

²⁰ P Laplagne, P Marshall and S Stone, *The Role of Technology in Determining Skilled Employment: An Economywide Approach*, Productivity Commission, August 2001.

²¹ Economic Planning Advisory Commission, *The Changing Australian Labour Market*, Commission Paper No. 11, 1996.

²² A Daly, D Fleming and P Lewis, 'A Cohort Analysis of the Private Rate of Return to Higher Education in Australia', *Australian Journal of Labour Economics*, Vol. 9, No. 3, 2006.

Federal Minimum Wage (C14), the strength of economic activity (as measured by Gross Domestic Product), and a trend decline in the gap to capture the effects of technological change.

According to our model, changes in minimum wages have had a statistically significant²³ effect over the past decade on changes in low-skilled employment relative to high-skilled employment. (See Appendix D for the full results.) It is estimated that, over that period:

- a 1 per cent increase in the average ratio over the past year of the full-time adult minimum wage to full-time adult average weekly ordinary-time earnings reduced low-skilled employment by about 1.4 per cent relative to high-skilled employment in the case where low-skilled employment includes all employed people in occupations assigned to one of the two lowest skill levels (Skill Levels 4 and 5); and
- a 1 per cent increase in the average ratio over the past year of the full-time adult minimum wage to full-time adult average weekly ordinary-time earnings reduced low-skilled employment by about 1.6 per cent relative to high-skilled employment in the case where low-skilled employment includes all employed people in occupations assigned to the lowest skill level (Skill Level 5).

Note that recent changes in minimum wages are only estimated to have a statistically significant effect on changes in high-skilled employment *relative* to low-skilled employment. The evidence suggests that they are unlikely to have had a large effect on the *absolute* demand for low-skilled labour. Instead, recent changes in the demand for low-skilled labour appear to be best explained by a trend shift towards high-skilled labour due to technological change along with an increase in demand for all types of labour due to the economic expansion.

5. Concluding remarks

This report reviewed the labour market outcomes of low-skilled people in Australia, including how they compare with those of higher-skilled people and trends over the past decade. A person's skill level was defined in terms of his or her occupation, or alternatively his or her highest level of educational attainment, with both definitions having strengths and weaknesses. The occupations and levels of educational attainment that were classified as low-skilled were those which captured the majority of low-paid workers.

High-skilled people have considerably better labour market outcomes than low-skilled people, both in terms of having higher rates of employment and lower rates of unemployment. Vickery offered a few explanations for why this occurs, including differences in human capital, high-skilled workers taking low-skilled positions, differences in replacement rates, and low-skilled workers being 'overpaid' relative to their productivity. However, he concluded that none of these was a full explanation.

The workforce has become more highly skilled over time, with a greater percentage of employed persons having a high level of educational attainment and working in high-skilled occupations. However, the ratio of the unemployment rate for low-skilled workers to that of high-skilled workers has remained reasonably steady from year to year, which is consistent with the view that changes in unemployment rates for different

²³ That changes in minimum wages have had a statistically significant effect means that there is statistical evidence that changes in minimum wages have made a *difference* to changes in low-skilled employment relative to high-skilled employment. It does not necessarily mean that this difference is significant in the common sense of the word.

skill groups are mainly determined in the short run by the state of the business cycle. It is also consistent with the view that the relative supply of low-skilled labour has broadly kept pace with the relative demand for low-skilled labour.

Previous evidence has supported the view that technological change is the main explanation for the shift in demand towards high-skilled employment, with the percentage of workers who are high-skilled increasing across a range of industries. Minimum wages are found to have had a statistically significant effect on the employment of low-skilled workers *relative* to high-skilled workers, but they are unlikely to have had a large effect on the overall employment of low-skilled workers.

Appendix A

Major occupational groups by skill level

Skill level	Commensurate level of education (based on AQF classifications)	ASCO major occupational groups assigned to skill level	ANZSCO major occupational groups assigned to skill level
1	Bachelor degree or higher (at least five years of relevant experience may substitute for formal qualification)	Managers and administrators Professionals	Managers (some) Professionals
2	Advanced Diploma or Diploma (at least three years of relevant experience may substitute for formal qualification)	Associate professionals	Managers (some) Technicians and Trades Workers (some) Community and personal service workers (some) Clerical and administrative workers (some) Sales workers (some)
3	Certificate IV, or Certificate III with at least two years of on-the-job training (at least three years of relevant experience may substitute for formal qualification)	Tradespersons and related workers Advanced clerical and service workers	Technicians and Trades Workers (some) Community and personal service workers (some) Clerical and administrative workers (some) Sales workers (some)
4	Certificate II or III (at least one year of relevant experience may substitute for formal qualification)	Intermediate clerical, sales and service workers Intermediate production and transport workers	Community and personal service workers (some) Clerical and administrative workers (some) Sales workers (some) Machinery operators and drivers Labourers (some)
5	Certificate I or compulsory secondary education (short period of relevant experience may substitute for formal qualification)	Elementary clerical, sales and service workers Labourers and related workers	Community and personal service workers (some) Clerical and administrative workers (some) Sales workers (some) Labourers (some)

Source: ABS, ANZSCO – *Australian and New Zealand Standard Classification of Occupations*, 2006, Catalogue No. 1220.0.

Appendix B

Marginal effect on probability of employment, May 2007

Variable	Marginal effect	Standard error
Probability of employment for base individual	0.7807	
<i>Highest level of educational attainment – relative to Year 10 or below</i>		
Bachelor degree or above	0.1838*	0.0040
Advanced Diploma/Diploma or Certificate III/IV	0.1544*	0.0043
Certificate I/II or Certificate not further defined	0.0261	0.0168
Year 12 or below	0.1124*	0.0045
Year 11 or below	0.0567*	0.0062
Level not determined	0.0962*	0.0151
Female	-0.1306*	0.0041
Living outside capital city	-0.0085**	0.0044
Not married	-0.0108**	0.0055
Born outside Main English Speaking Countries	-0.1286*	0.0066
<i>Age – relative to 15-19</i>		
20-24	0.0503*	0.0085
25-34	-0.0106	0.0111
35-44	0.0411*	0.0101
45-54	0.0652*	0.0096
55-59	-0.0687*	0.0135
60-64	-0.2674*	0.0167
Living in 'non-resource state'	-0.0249*	0.0041
Attending full-time study	-0.3012*	0.0172
<i>Relationship in household</i>		
Lone parent	-0.1128*	0.0113
Dependent child	0.0402*	0.0114
Relationship not determined	-0.0599*	0.0123

Source: ABS, *Survey of Education and Work – Confidentialised Unit Record File*, May 2007, Catalogue No. 6227.0.30.001.

Note: Results estimated using logit model. * denotes variable is significant at 1 per cent level; ** denotes variable is significant at 10 per cent level.

'Non-resource states' include New South Wales, Victoria and South Australia.

Appendix C

Methodology for supply and demand analysis

The methodology used to translate movements in the demand for and supply of low-skilled workers relative to high-skilled workers into relative wage and unemployment movements is based on Nickell and Layard (1998). Under this framework, employers distinguish between workers in different skill groups – that is, they are not perfect substitutes. Assuming a constant elasticity of substitution between high-skilled and low-skilled workers, the production function can be written as:

$$Y = F(K, [\delta N_1^{-\rho} + (1 - \delta) N_2^{-\rho}]^{-1/\rho})$$

where Y = output, K = capital, N_1 = high-skilled workers, N_2 = low-skilled workers, δ = the relative factor share of high-skilled workers, and ρ is the substitution parameter, which determines the value of the constant elasticity of substitution.

If firms aim to minimise costs, then the ratio of the wage for high-skilled workers to the wage for low-skilled workers is equal to the technical rate of substitution (the rate at which the firm can substitute one input for another and still produce the same level of output) as follows:

$$\frac{W_1}{W_2} = \frac{\delta}{1 - \delta} \left[\frac{N_2}{N_1} \right]^{1/\sigma}$$

where W_1 and W_2 are the high-skilled and low-skilled wage rates; and $\sigma = (1 + \rho)^{-1}$ is the elasticity of substitution between high-skilled and low-skilled labour.

It can be shown from this equation that²⁴:

$$\sigma \Delta \ln(W_1 / W_2) + \Delta \ln[(1 - u_1) / (1 - u_2)] = \sigma \Delta \ln(\delta / (1 - \delta)) - \Delta \ln(s / (1 - s))$$

or [Relative wage movement + Relative unemployment movement] = [Shift in relative demand for high-skilled workers – Shift in relative supply for high-skilled workers]

where

δ = the adjusted share of high-skilled labour in total labour cost;

u_1 and u_2 = high-skilled and low-skilled unemployment rates;

W_1 and W_2 = high-skilled and low-skilled wage rates;

s = share of high-skilled workers in the labour force; and

σ = the elasticity of substitution between high-skilled and low-skilled labour.

²⁴ See P Barnes and S Kennard, *Skill and Australia's Productivity Surge*, Productivity Commission, October 2002, for the full derivation.

δ in turn can be expressed as:

$$\delta = W_1 N_1^{1/\sigma} \left[W_1 N_1^{1/\sigma} + W_2 N_2^{1/\sigma} \right]^{-1}$$

where δ , W_1 , W_2 , N_1 , N_2 , and σ are as defined above.

Both Nickell and Layard (1998) and Barnes and Kennard (2002) define skill in terms of educational attainment. Due to data availability, skill is defined here in terms of occupation. Consistent with the definitions set out in Section 1, occupations assigned to skill levels 4 and 5 are classified as low-skilled and all other occupations are classified as high-skilled. The details of the data used for each part of the demand/supply equation are given below.

Employment and unemployment (N , U)

Employment and unemployment data by occupation is taken from the quarterly Labour Force survey. The unemployment data is based on the person's last occupation and excludes people that last worked more than two years ago and that have never worked for two weeks or more. Since the supply term in the equation is expressed in terms of the *share* of high-skilled workers, it is implicitly assumed that the unemployed people not captured by the data are distributed across the occupations in the same way as the rest of the labour force.

In calculating supply using the hours worked approach, it is assumed that, for employed people within each occupation, the number of actual hours worked is equal to the number of desired hours. For unemployed people, it is assumed that, for each occupation, those people looking for a full-time job and those people looking for a part-time job are willing to work the same average hours as their employed counterparts.

As noted by Barnes and Kennard (2002), this approach does not account for underemployment (people working shorter hours than they would choose) and discouraged jobseekers (people who would be willing to work but are discouraged from actively looking for employment).

Wage ratio (W_1/W_2)

Wages for high-skilled and low-skilled workers are calculated using data on mean weekly earnings in main job by occupation from the Employee Earnings Benefits and Trade Union Membership (EEBTUM). In the numbers employed approach, the wage ratio is calculated using weekly earnings. In the hours worked approach, the wage ratio is calculated using hourly earnings, using data on weekly earnings from the EEBTUM survey and data on average hours worked per week from the Labour Force survey.

Share of labour costs (δ)

The share of labour costs is calculated using data on mean weekly earnings in main job by occupation from the EEBTUM survey and employment data from the Labour Force survey.

Elasticity of substitution (σ)

In the absence of a clear indication of what the appropriate elasticity of substitution may be, σ is set equal to 1.

Appendix D

Effect of minimum wage 'bite' on change in gap between low-skilled employment and high-skilled employment

Variable	Low-skilled – Occupations assigned to Skill Levels 4 and 5		Low-skilled – Occupations assigned to Skill Level 5	
	Coefficient	Standard error	Coefficient	Standard error
Constant	-2.448	2.558	-2.142	3.900
<i>Error correction term</i>	-0.583*	0.121	-0.460*	0.129
Low-skilled employment less high-skilled employment (lag 1)	1		1	
Gross domestic product (lag 1)	0.798**	0.438	0.821	0.751
Minimum wage 'bite' – average ratio of minimum wage to full- time adult average weekly ordinary-time earnings over past four quarters (lag 1)	-1.411*	0.514	-1.681***	0.913
Trend (lag 1)	-0.014*	0.004	-0.015*	0.007
Change in gross domestic product (lag 1)	-1.025**	0.308		
Adjusted R-squared	0.372		0.167	

Note: Results estimated using ordinary least squares. All variables are expressed in log terms. * denotes variable is significant at 1 per cent level; ** denotes variable is significant at 5 per cent level, *** denotes variable is significant at 10 per cent level.

Source: ABS, *Labour Force, Detailed, Quarterly*, November 2008, Catalogue No. 6291.0.55.003; ABS, *Australian National Accounts: National Income, Expenditure and Product*, December 2008, Catalogue No. 5206.0; ABS, *Average Weekly Earnings*, November 2008, Catalogue No. 6302.0.