The Australian Economic Review, vol. 36, no. 4, pp. 361–73

Employment Effects of Minimum Wages: Evidence from a Quasi-Experiment

Andrew Leigh*
John F. Kennedy School of Government
Harvard University

Abstract

To estimate the impact of raising the minimum wage on employment, this article uses a natural experiment, arising from six increases in the Western Australian statutory minimum wage during the period 1994–2001. Relative to the rest of Australia, the employment to population ratio in Western Australia fell following each of the six rises, twice by a statistically significant margin. Aggregating the increases, the elasticity of labour demand with respect to the Western Australian statutory minimum wage is found to be –0.13.

* Email: andrew_leigh@ksg02.harvard.edu. Thanks to Alberto Abadie, Dan Andrews, Chris Barrett, Jeff Borland, Tim Harcourt, Caroline Hoxby, Boyd Hunter, Cezary A. Kapuscinski, Graham Kierath, Bronwyn Magdulski, Paul Moss, Geoff Paddick, Christine Short, Janet Wall, Lachlan Wolfers, Mark Wooden, Tara Zeid, participants at the Kennedy School of Government social policy lunch and an anonymous referee for helpful comments and assistance with data. Alison Preston provided especially valuable feedback, and Justin Wolfers provided the original inspiration.

1. Introduction

Does raising the minimum wage cost jobs? Until the mid-1990s, there was a strong consensus across the economics profession that the answer was yes (Brown 1988). Yet following a seminal study in the United States (Card and Krueger 1994), some have begun to doubt that proposition—arguing instead that modest increases in the minimum wage might have no adverse impact on employment. In the United States, this debate has continued to rage through the 1990s and beyond.

While the question is equally pertinent in Australia, no quasi-experimental studies on the elasticity of demand with respect to minimum wages have been conducted. Rather, debate in Australia has focused around empirical estimates from other countries (Seltzer 1997; Lewis 1997; Hawke 1998; Nevile 1999; Junankar 2000; Dawkins 1997, 2002), and estimates of the overall elasticity of labour demand (for a recent summary, see Webster 2003).

The main challenge confounding researchers is that Australian minimum wages are usually set by industrial commissions, which invariably take account of the unemployment rate and economic forecasts when setting wages (Preston 2001). Studies using variation in minimum wages set by industrial commissions may therefore underestimate the elasticity of labour demand with respect to the minimum wage. Although statutory minimum wages are often also set with an eye to macroeconomic conditions, the political context sometimes produces minimum wage rises that are exogenous to the economic environment

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research
Published by Blackwell Publishing Asia Pty Ltd

(for an example in the US context, see Card 1992).

This study makes use of a natural experiment: six increases in the Western Australian statutory minimum wage during the period 1994–2001. Using differences-in-differences estimation, with the remainder of Australia as a control group, it is possible to determine whether raising the statutory minimum had an effect on the Western Australian employment rate. As will be discussed in Section 3, some of these increases appear to have been exogenous to prevailing economic conditions, making the elasticity estimates less susceptible to attenuation bias.

The use of differences-in-differences techniques is familiar in the minimum wage literature. Card and Krueger (1994) used a differences-in-differences approach to analyse the effect of an $0.80 increase in the New Jersey minimum wage on employment in the fast food industry. With neighbouring Pennsylvania as the control group, they found no loss in employment attributable to the wage rise. In response to a subsequent critique from Neumark and Wascher (2000), Card and Krueger (2000) reanalysed the change using representative payroll data, and found that these data supported their original findings.

In the absence of Australian studies on the employment effects of minimum wages, a robust debate has ensued in recent years over the degree to which Card and Krueger's quasi-experimental findings might be applicable in Australia. In its submission to the 1996–97 Safety Net Review, the Australian Council of Trade Unions relied on Card and Krueger (1994) to support its claim that minimum wages in Australia could be increased without any adverse employment effects (cited in Australian Industrial Relations Commission 1997, p. 95).

In response, the Federal Government, and Coalition State and Territory Governments ('the Joint Governments') questioned the applicability of research on US minimum wages in the Australian context. The Joint Governments cited from Card and Krueger (1995):

> the evidence at hand is relevant only for a moderate range of minimum wages, such as those that prevailed in the US labour market in the past few decades.
> [1995, p. 393]

> We also suspect that, at sufficiently high levels of the minimum wage, the predicted employment losses of the standard model will be borne out.
> [1995, p. 355]

The Joint Governments' submission noted that Australian minimum wages were higher (as a fraction of median earnings) than in some other developed countries. In 2002, the Australian federal minimum wage was 58 per cent of median weekly earnings for full-time employees.[1] By comparison, the UK Low Pay Commission (2001) reported that the UK minimum wage in 2000 was 46 per cent of the median wage for full-time workers, and the US minimum was 38 per cent.

The Joint Governments concluded their submission by arguing that the 'bite' of an increase in the Australian minimum wage would be more significant than a comparable rise in the US minimum wage (Joint Governments 1996, p. 145). Similar arguments have been made in subsequent Safety Net Reviews (for example, Joint Governments 2001, app. F), as well as in Seltzer (1997, p. 212) and Hawke (1998, pp. 84–5). By using changes in the Western Australian statutory minimum wage, this article seeks to provide new evidence in the ongoing debate over the employment effects of Australian minimum wages.

The remainder of the article is organised as follows. Section 2 describes the legislative and judicial background of minimum wages in Western Australia and at a federal level. Section 3 outlines the specification to be employed and data to be used. Section 4 presents findings and a discussion of the results, and the final section concludes.

2. Minimum Wage Coverage

In the Harvester judgment of 1907, the Commonwealth Court of Conciliation and Arbitration (the predecessor of the Australian Industrial Relations Commission (AIRC)) established a three-tiered wage-fixing system—a

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

basic minimum wage, a secondary wage for skilled workers, and the provision for employers and employees to engage in over-award bargaining. This system endured until 1967, when the basic wage and secondary wage were replaced by the 'total wage' concept. Changes in the total wage were made in a series of national wage decisions, with minimum wages indexed to inflation during the years 1975–1981 and 1983–1986.

In 1987, a two-tiered wage system was introduced—the first tier comprising uniform national wage increases, and the second being wage increases subject to productivity growth. This represented the first step towards enterprise bargaining, under which wages and conditions were negotiated at the enterprise level. Enterprise bargaining was subsequently advanced through the AIRC's adoption of the 'Enterprise Bargaining Principle' in 1991, and the enactment of the *Industrial Relations Reform Act 1993* (Macdonald, Campbell and Burgess 2001). Further changes occurred with the enactment of the *Workplace Relations Act 1996*, which facilitated the development of enterprise bargaining, strengthened non-union bargaining, and provided greater scope for employers to use individual employment agreements (Wooden 2001).

Federal industrial jurisdiction extends to all employees in Victoria, the Australian Capital Territory and the Northern Territory (and hence all are covered by the federal minimum wage). In the remaining five States, whether an employee is within the federal jurisdiction depends upon a number of factors, including the employee's industry, and whether the employing company has operations in multiple States. Overall, 24 per cent of employees have their pay set by federally registered agreements, 14 per cent by state-registered agreements, and the remaining 62 per cent by awards only or unregistered agreements (ABS 2003). (In each case, agreements include both collective and individual agreements.)

Unlike the Federal Government, no constitutional strictures limit State Governments from legislating directly on employment matters. All have created state industrial commissions, which set minimum standards and settle industrial disputes. These state commissions—including the Western Australian Industrial Relations Commission (WAIRC)—have tended to adopt wage-fixing principles and decisions of the AIRC.

During the 1990s, two State Governments opted to also set statutory minimum wages, in addition to the minima set by state and federal industrial commissions. In 1992, Victoria instituted a statutory minimum wage for all employees—but this was repealed four years later, and wage-setting power over Victorian employees ceded to the AIRC. The more useful case for present purposes is the statutory minimum wage introduced by the Western Australian Government through the *Minimum Conditions of Employment Act 1993*. Applying to non-award, non-federal employees, the statutory minimum wage is set by the Minister via regulation, and has been increased annually, with the exception of 1999. The basic level of the statutory minimum wage applies to workers aged 21 and over. For younger workers, their minimum is reduced by 10 per cent for each year they are under 21, down to 40 per cent of the adult minimum for 16-year-olds. Thus a 5 per cent increase in the statutory minimum wage is effectively a 5 per cent increase in the minimum wage applying to 30-year-olds and 16-year-olds alike.

Until the election of a State Labor Government in 2001, the Western Australian statutory minimum wage remained below the level of the federal minimum wage. Variation in Western Australia's statutory minimum wage from 1994–2001 therefore has substantial appeal to the researcher. By comparing employment in Western Australia with employment in other States, before and after a rise in the statutory minimum, it is possible to estimate the elasticity of labour demand with respect to the minimum wage.

However, it is important to note an additional complicating factor. Like other state industrial commissions, the WAIRC incorporated increases in the federal minimum wage into state awards—so that the wage floor for employees covered by state awards was the same as for those covered by federal awards.[2] The present analysis assumes that

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

any employment effect associated with increases in the statutory minimum wage will occur via its impact on non-award employees. But one must also consider the timing of increases in the minimum wage for workers paid under state awards. If rises in the wage floor for workers on state awards were to have coincided with increases in the statutory minimum wage, any estimates of the employment effect of the statutory minimum wage could be biased.

Fortunately, in the present case, this is not a problem. Table 1 shows changes in the federal minimum wage, the point at which those changes were incorporated into state awards by the WAIRC, and increases in the statutory minimum wage. The final columns show the month of the survey for the before and after employment figures used to analyse each increase. In no instance was a federal minimum wage rise incorporated into Western Australian state awards during the period under analysis.

3. Experimental Design

3.1 Specification

This study examines minimum wage rises in 1994, 1995, 1996, 1998, 2000 and 2001, comparing the change in employment in Western Australia before and after each rise with the change in employment in the rest of Australia. 1997 is excluded because the statutory minimum wage was only increased by a trivial amount (less than 1 per cent). There was no increase in 1999.

In order to know what effect one might expect an increase in the minimum wage to have, it is useful to identify what fraction of the Western Australian workforce earned the minimum wage. Because some workers are covered by awards, the employees affected by changes in the Western Australian statutory minimum wage are those who (i) were low-paid workers, and (ii) were not covered by federal or state awards or agreements. In the

Table 1 Western Australian and Federal Adult Minimum Wages
(date of coming into effect in parentheses)

Year	*Federal minimum wage set by AIRC*	*Minimum wage incorporated into state awards by WAIRC*	*Statutory minimum wage*		*Monthly survey before wage rise*	*Monthly survey after wage rise*
			Rate	*As a per cent of median earnings*		
1993	*	*	275.50 (3/12/93)	51.2		
1994	*	*	*301.10 (29/8/94)*	55.7	May 1994	November 1994
1995	*	*	*317.10 (29/9/95)*	58.5	June 1995	December 1995
1996	*	*	*332.00 (29/10/96)*	59.3	July 1996	January 1997
1997	359.40 (22/4/97)	359.40 (14/11/97)	335.00 (10/11/97)	58.0		
1998	373.40 (29/4/98)	373.40 (12/6/98)	*346.70 (7/12/98)*	56.4	September 1998	March 1999
1999	385.40 (29/4/99)	385.40 (1/8/99)	346.70 (no change)	53.3		
2000	400.40 (1/5/00)	400.40 (1/8/00)	*368.00 (1/3/00)*	53.3	December 1999	June 2000
2001	413.40 (2/5/01)	413.40 (1/8/01)	*400.40 (22/3/01)*	56.2	December 2000	June 2001
2002	431.40 (9/5/02)	431.40 (1/8/02)	413.40 (8/4/02)	55.1		
			431.40 (1/8/02)	57.5		

Notes: (a) An asterisk denotes that no single minimum wage prevailed across low-wage industries.
(b) Adult means a person aged over 21.
(c) For non-casual employees, simply divide by 40 to obtain the hourly wage (the only exception is July 2002 onwards, for which the divisor for the Western Australian statutory minimum wage is 38). Casual employees receive approximately 15–25 per cent more, depending on the industry.
(d) Median earnings are weekly earnings in all jobs for full-time employees aged 15 and over, from ABS, *Employee Earnings, Benefits and Trade Union Membership, Australia* (Cat. no. 6310.0) and its predecessor surveys. The survey was not conducted in 1996, so the average of the 1995 and 1997 surveys is used for that year.
(e) Italic type denotes the six Western Australian statutory minimum wage rises analysed in this article.

Sources: Orders of AIRC and WAIRC; *Western Australian Government Gazette*.

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

absence of any recent comprehensive survey of award and agreement coverage in Australia, this analysis uses unpublished tabulations from the ABS May 2002 *Employee Earnings and Hours* survey to derive an estimate of the share of employees likely to be affected by statutory minimum wage determinations. Although May 2002 is just outside the period under analysis, it is the only survey in which the ABS is able to separate award and non-award employees. In order to analyse the earnings of both full-time and part-time employees, hourly earnings for non-managerial employees are calculated from the survey's measures of weekly earnings divided by usual weekly hours (the ABS hourly rates sample did not include managerial employees, who comprised approximately 10 per cent of the workforce).

On this basis, it is estimated that in May 2002, 3.2 per cent of non-managerial employees in Western Australia were non-award workers with earnings at or below the Western Australian statutory minimum wage of $10.90 per hour (or $413.40 per week for full-time employees). An additional 1.2 per cent were non-award workers with earnings above the statutory minimum wage, but below the federal minimum wage. Since the federal minimum wage was then $0.50 per hour above the state statutory minimum wage, it seems reasonable to assume that this 1.2 per cent would be affected by a typical rise in the statutory minimum. Thus a total of 4.4 per cent of non-managerial employees would be affected by a typical rise in the Western Australian statutory minimum—or 4 per cent of all employees, assuming managerial employees are entirely unaffected. This figure accords with private calculations carried out by the Western Australian Department of Consumer and Employment Protection.[3]

3.2 Data

Employment figures are from the *Labour Force Survey*, a monthly survey of approximately 61500 Australians aged 15 or over. Due to the near-impossibility of obtaining appropriate microdata from the ABS, macrodata aggregates are used instead, with standard errors calculated from tables supplied by the ABS.

In order to make the analysis more straightforward, the data are adjusted in three ways:

- Full-time and part-time employment figures are aggregated by counting each part-time employee as 15/40ths of a full-time employee (weighting part-time employees more highly—as half of a full-time employee—makes no substantive difference to the results). This produces a total figure of 'full-time equivalent' employment.

- To account for population differences, employment is presented as a fraction of the population aged 15 and over. As Brown (1999, p. 2103) points out, the employment to population ratio is a better measure than unemployment. If a rise in the minimum wage caused workers to become discouraged and withdraw from the workforce, this would not show up in the unemployment statistics, but would be reflected in employment to population ratios.

- To allow comparisons between different months, employment rates are seasonally adjusted, based on trends over the previous three years, according to the formula:

$$E(SA)_t = \frac{E_t * 12(E_{t-12} + E_{t-24} + E_{t-36})}{(E_{t-1} + \ldots + E_{t-36})} \quad (1)$$

  where E_t is the full-time equivalent employment to population ratio in month t, and $E(SA)_t$ is the seasonally adjusted full-time equivalent employment to population ratio.

These three procedures create the measure that will be used in this article: seasonally adjusted, full-time equivalent, employment to population ratios. For the sake of simplicity, this is merely referred to as the employment to population ratio, or the employment rate.

To assess the effect of increases in the statutory minimum wage, the employment rate in the survey three months after the minimum wage rise is subtracted from the employment rate in the survey three months prior to the

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

minimum wage rise. This interval is selected to minimise the risk that employers anticipated the rise in the minimum wage, and to recognise that any effect will probably only have occurred after a delay.

3.3 Controls

Employment rates in the five other States and two Territories (referred to as the 'Rest of Australia') are used as a control group. Perhaps because of Western Australia's particular industrial mix, no single State or Territory consistently outperformed the Rest of Australia as a control (as measured by the sum of the absolute values of the difference-in-difference estimator in the pre-experimental period). One possible explanation is that Western Australia combines proximity to South Australia and the Northern Territory with a significant agricultural sector (similar to Queensland), significant mining and tourism sectors, and a somewhat smaller manufacturing sector than the eastern States. Creating a 'synthetic Western Australia', analogous to the technique found in Abadie and Gardeazabal (2003), did not materially affect the results.

One might also be concerned about the validity of the Rest of Australia as a control if other State-level policy changes occurred coincident with increases in the Western Australian statutory minimum wage. While it is not possible to rule out all options, the two most likely suspects—minimum wage rates in other States and changes in the payroll tax rates—do not confound the analysis. During the period under analysis, no other State had a statutory minimum wage. With regard to payroll taxes, the main change in Western Australia over the period 1994–2001 was the shift on 1 July 1998 from a marginal tax rate of 5.2 per cent on wage bills between $675 000 and $2 700 000 to a marginal tax rate that rose from 0 per cent to 4.9 per cent over this range. However, since this took place five months prior to the 1998 increase in the Western Australian minimum wage, its effects are unlikely to have been felt in the labour market at the same time as the minimum wage rise. A variety of payroll tax changes took place in other States and Territories over the period 1994–2001, but their timing and magnitude does not cast any doubt on the validity of the Rest of Australia as a control for changes in Western Australian employment over this period.[4]

3.4 Possible Endogeneity Issues

The final methodological issue is the extent to which increases in the statutory minimum wage were exogenous to the state of the economy. Two factors are relevant: Was the timing of the decision exogenous to labour market conditions? And was the magnitude of the increase exogenous to labour market conditions?

Under the *Minimum Conditions of Employment Act 1993*, the Minister can only increase the minimum wage 12 months or more after a prior increase. To a large extent, this explains the timing. Of the six increases analysed here, four occurred 12–13 months after the preceding rise (of the other two, the 1994 increase was the first, and therefore not bound by the 12-month rule, while the 2000 rise occurred 15 months after the preceding rise). However, because there remains a risk that the magnitude was endogenous with respect to economic conditions, it is therefore worth briefly analysing each in turn.

1994 and 1995: The 1994 rise was the first increase in the statutory minimum to have taken effect, and thus both its magnitude and timing could potentially have been endogenous to economic conditions. The 1995 increase occurred precisely 13 months after the 1994 increase, so its timing is more likely to have been exogenous, though there is still the potential that the magnitude was endogenous.

1996: Both size and timing appear to have been exogenous. The Minister commissioned a report (Plowman, Taplin and Henstridge 1996), which recommended that the minimum wage be set at the level of the average real expenditure of an unskilled worker with no dependants (based on data from the 1993–94 Household Expenditure Survey). One week after receipt, the Minister implemented the report's precise recommendation (Kierath 1996).

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

1998: Since it is unclear what factors were taken into account, there is some risk of endogeneity. In announcing the rise, the Minister stated only that: 'The Government's decision to increase the minimum wage will help stimulate spending and in turn create employment opportunities' (Edwardes 1998).

2000: As with 1998, there are potential endogeneity concerns. A media release announcing the decision stated that the Government 'took into account indicators such as CPI, household expenditure and average earnings to determine the new rate. It also examined submissions from industry, State Treasury and trade union sources' (Edwardes 2000).

2001: The timing of this rise was exogenous, since it was effectively determined by the date of the Western Australian state election (which was held in February, and was not an early election). Shortly after winning, the new State Labor Government increased the Western Australian statutory minimum to the level of the federal minimum, as it had promised to do during the election campaign. Although the level at which the AIRC had set the federal minimum wage in May 2000 was endogenous to economic conditions then prevailing, it seems reasonable to assume it was exogenous to economic conditions prevailing in March 2001, when it was applied in Western Australia.

Of the six increases, prevailing economic conditions seem to have had a minimal impact on the 1996 and 2001 decisions. In the case of the other four decisions, it is conceivable that the Western Australian Government correctly predicted that labour market conditions after the statutory minimum wage increase would be better than average. However, this would only affect the experiment if the Western Australian economy outperformed the Rest of Australia during that period.

4. Findings and Discussion

Table 2 shows the difference-in-difference results from the six minimum wage rises. In all cases, the employment to population ratio in Western Australia fell more than in the Rest of Australia. In 1998, this drop is significant at the 10 per cent level, and in 2001, it is significant at the 1 per cent level. For the other minimum wage rises, the difference-in-difference estimate is not statistically significant.

In each instance, it is possible to derive the elasticity of labour demand with respect to changes in the statutory minimum wage. This is done by dividing the difference-in-difference estimate by the percentage increase in the minimum wage. There is substantial variation across estimates of the elasticity—between –0.037 and –0.41.

However, to merely consider the six minimum wage 'experiments' in isolation is to ignore the extra information that can be learned from aggregating them. A crude way of doing this would be to average the elasticity estimates, and calculate significance by estimating the probability that the Western Australian employment to population ratio would fall relative to the Rest of Australia in six out of six instances: $(1/2)^6 = 1/64$.

But a more sophisticated way of aggregating the data is to compare the estimates in Table 2 (each of which looks at the relative employment change over a particular seven-month period), with every seven-month 'difference in difference' estimate between Western Australia and the Rest of Australia over the period 1981–2002.[5] In essence, we are seeking to resolve the following question: *If you were to look at a table showing how much Western Australia's employment to population ratio changed, relative to the Rest of Australia, over 1981–2002, would the six estimates in Table 2 stand out?*

In order to answer this question, the following regression is estimated for the 247 seven-month changes over the period 1981–2002:

$$[E_{WA(t+3)} - E_{WA(t-3)}] - [E_{RA(t+3)} - E_{RA(t-3)}] = \alpha + \beta R_t + \varepsilon_t \quad (2)$$

where E_{WAt} is the employment to population ratio in Western Australia in month t; E_{RAt} is the employment to population ratio in the Rest of Australia in month t; and R_t is a variable equal to the percentage increase in the minimum wage rise in the six particular months when the Western Australian minimum wage increased, and 0 in all other cases.

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

Table 2 Employment to Population Ratios before and after Minimum Wage Rises

	Western Australia		*Rest of Australia*		*Difference-in-Difference*	
August 1994 wage rise (9.29 per cent increase)						
Before	0.773	(0.005)	0.767	(0.001)		
After	0.780	(0.005)	0.777	(0.001)		
Difference	0.006	(0.007)	0.010	(0.002)	–0.003	(0.007)
Implied elasticity (difference-in-difference estimate divided by 9.29 per cent)					–0.037	(0.085)
September 1995 wage rise (5.31 per cent increase)						
Before	0.777	(0.005)	0.775	(0.001)		
After	0.774	(0.005)	0.777	(0.001)		
Difference	–0.003	(0.007)	0.001	(0.002)	–0.005	(0.007)
Implied elasticity (difference-in-difference estimate divided by 5.31 per cent)					–0.097	(0.149)
October 1996 wage rise (4.69 per cent increase)						
Before	0.783	(0.005)	0.782	(0.001)		
After	0.762	(0.005)	0.767	(0.001)		
Difference	–0.020	(0.007)	–0.014	(0.002)	–0.006	(0.007)
Implied elasticity (difference-in-difference estimate divided by 4.69 per cent)					–0.140	(0.169)
December 1998 wage rise (3.49 per cent increase)						
Before	0.769	(0.005)	0.768	(0.001)		
After	0.753	(0.005)	0.766	(0.001)		
Difference	–0.015	(0.007)	–0.001	(0.002)	–0.014*	(0.007)
Implied elasticity (difference-in-difference estimate divided by 3.49 per cent)					–0.410	(0.224)
March 2000 wage rise (6.14 per cent increase)						
Before	0.780	(0.005)	0.784	(0.001)		
After	0.771	(0.005)	0.780	(0.001)		
Difference	–0.008	(0.007)	–0.004	(0.002)	–0.003	(0.007)
Implied elasticity (difference-in-difference estimate divided by 6.14 per cent)					–0.063	(0.129)
March 2001 wage rise (8.80 per cent increase)						
Before	0.784	(0.005)	0.784	(0.001)		
After	0.751	(0.005)	0.770	(0.001)		
Difference	–0.032	(0.007)	–0.014	(0.002)	–0.0181***	(0.007)
Implied elasticity (difference-in-difference estimate divided by 8.80 per cent)					–0.206	(0.089)

Notes: (a) Estimates are for full-time equivalent, seasonally adjusted, employment to population ratios.
(b) Standard errors are in parentheses. Standard errors for estimates are calculated from ABS Cat. no. 6203.0, Table A. Standard errors for differences (and differences-in-differences) are then derived from these estimates using the usual formula for the standard error of a difference.
(c) ***, ** and * denote significance at the 1 per cent, 5 per cent and 10 per cent levels respectively.

Source: ABS, *Labour Force Survey*, Cat. no. 6203.0.

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

Table 3 Combining the Difference-in-Difference Estimates:
(dependent variable is all seven-month difference-in-difference estimates between Western Australia and the Rest of Australia between 1981 and 2002)

Panel A: Aggregating all six minimum wage increases							
Elasticity of labour demand (coefficient on minimum wage increase)	–0.126*** (0.041)						
N	247						
R^2	0.03						
Panel B: Sensitivity check							
Year excluded	1994	1995	1996	1998	2000	2001	
Elasticity of labour demand (coefficient on minimum wage increase)	–0.169*** (0.035)	–0.129*** (0.046)	–0.124*** (0.045)	–0.112*** (0.040)	–0.136*** (0.048)	–0.092*** (0.034)	
N	246	246	246	246	246	246	
R^2	0.03	0.03	0.03	0.02	0.03	0.01	

Notes: (a) Of the 247 difference-in-difference estimates, six are the difference-in-difference estimates shown in Table 2. In these cases, the variable 'minimum wage increase' is the percentage rise in the minimum wage, and in all other cases, the variable 'minimum wage increase' is set to zero. The estimated coefficient on 'minimum wage increase' is therefore the estimated elasticity of employment with respect to the minimum wage.
(b) The dataset is all $[(T + 3) – (T – 3)]$ difference-in-difference estimates over the period February 1981 to February 2002.
(c) Robust standard errors are in parentheses. ***, ** and * denote significance at the 1 per cent, 5 per cent and 10 per cent levels respectively.

Source: ABS, *Labour Force Survey*, Cat. no. 6203.0.

Table 4 Elasticity of Labour Demand for Age–Sex Sub-Groups
(dependent variable is all seven-month difference-in-difference estimates between Western Australia and the Rest of Australia between 1981 and 2002)

Age	*15–24*	*25–34*	*35–44*	*45–54*
Panel A: Persons				
Elasticity of labour demand (coefficient on minimum wage increase)	–0.389*** (0.138)	–0.139* (0.071)	–0.008 (0.044)	0.007 (0.084)
N	247	247	247	247
R^2	0.04	0.01	0.0001	0.0001
Panel B: Females				
Elasticity of labour demand (coefficient on minimum wage increase)	–0.471* (0.274)	–0.150 (0.205)	–0.066 (0.090)	–0.024 (0.078)
N	247	247	247	247
R^2	0.03	0.01	0.001	0.0001
Panel C: Males				
Elasticity of labour demand (coefficient on minimum wage increase)	–0.366** (0.180)	–0.098 (0.068)	0.011 (0.058)	0.075 (0.145)
N	247	247	247	247
R^2	0.02	0.004	0.0001	0.002

Notes: (a) Of the 247 difference-in-difference estimates, six are the difference-in-difference estimates shown in Table 2. In these cases, the variable 'minimum wage increase' is the percentage rise in the minimum wage, and in all other cases, the variable 'minimum wage increase' is set to zero. The estimated coefficient on 'minimum wage increase' is therefore the estimated elasticity of employment with respect to the minimum wage.
(b) The dataset is all $[(T + 3) – (T – 3)]$ difference-in-difference estimates over the period February 1981 to February 2002.
(c) Robust standard errors are in parentheses. ***, ** and * denote significance at the 1 per cent, 5 per cent and 10 per cent levels respectively.

Source: ABS, *Labour Force Survey*, Cat. no. 6203.0.

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

Panel A of Table 3 shows the results from this regression. Because R_t is the percentage increase in the Western Australian minimum wage (rather than a simple dummy variable), the estimated value of β is the elasticity of labour demand with respect to the Western Australian statutory minimum wage. This is estimated to be –0.13, which is statistically significant at the 1 per cent level. As a sensitivity check, Panel B excludes each of the minimum wage increases in turn. The estimated elasticity varies from –0.09 to –0.17, but remains statistically significant at the 1 per cent level.

As another robustness check, I confine the sample to particular population sub-groups. Table 4 shows the results from estimating equation (2) for different age–sex groups. Panel A breaks the workforce down into four 10-year age groups: those aged 15–24, 25–34, 35–44 and 45–54 (note that although the statutory minimum wage is lower for those aged under 21, the percentage increase is the same). Panels B and C repeat this exercise for females in each age group, and then for males in each age group. In each case, the employment impact of increases in the minimum wage appears to be concentrated on those aged 15–24. For young workers, the elasticity of labour demand is estimated at –0.39, which lies between the results reported in two earlier studies (Daley et al. 1998; Mangan and Johnston 1999). For older cohorts, the estimates tend to be smaller and statistically insignificant. When the sample is broken down by sex, the impact for females is larger in magnitude than for males, but less precisely estimated.

An additional robustness check might be to break the workforce down by industry. However, jurisdictional coverage (and hence the application of the Western Australian statutory minimum wage) varies substantially across industries,[6] as well as being imprecisely measured.[7] Because the impact of the statutory minimum wage on an industry depends both upon its fraction of low-wage workers and the fraction of workers whose employment is affected by the minimum wage, it is difficult to know which industries would be likely to be most affected by changes in the minimum wage. Given these problems, the employment impact is not broken down by industry.

How does the estimated elasticity of labour demand with respect to the minimum wage compare to similar US estimates? In Subsection 3.1, it was estimated that 4.4 per cent of the Western Australian workforce would be affected by a typical rise in the statutory minimum wage. This is comparable to the proportion of the US workforce that earns the US federal minimum wage, which the National Center for Policy Analysis (1996) estimates to be 3.7 per cent, and Card and Krueger (1995, pp. 5–6) estimate to be 5 per cent.

Given that coverage rates seem to be roughly similar, the above estimate of the elasticity of labour demand with respect to the Western Australian statutory minimum wage can be compared with the US estimate of the same parameter. The two figures appear to be in the same ballpark. A 1996 survey of labour economists at leading US universities found that the median respondent believed that an increase in the minimum wage would reduce teenage employment (Fuchs, Krueger and Poterba 1998). And those US labour economists who believe in a negative elasticity of labour demand with respect to the minimum wage tend to estimate it at around –0.1 to –0.25 (Brown, Gilroy and Kohen 1982; Neumark and Wascher 1992). Naturally, as James, Wooden and Dawkins (2001) have pointed out, it is important not to confuse these estimates with the elasticity of labour demand with respect to the minimum wage *for minimum wage workers*, which will undoubtedly be higher—as is indicated by the fact that the elasticity is found to be larger in magnitude for younger workers.

5. Conclusion

On six occasions between 1994 and 2001, the Western Australian minimum wage was increased, by between 3.49 per cent and 9.29 per cent. After each of these increases, the employment to population ratio in Western Australia fell, relative to the Rest of Australia. Aggregating these six changes, the elasticity of labour demand with respect to the Western Australian statutory minimum wage is estimated to be

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

–0.13. The employment impact is most substantial among younger employees, with the elasticity of labour demand for workers aged 15–24 estimated at –0.39. The elasticity of the Western Australian statutory minimum wage appears similar to that of US minimum wages. Australian minimum wages do 'bite', but it is not clear that they bite more fiercely than in America.

Naturally, this study has focused only on the employment effect of raising the minimum wage. But this is of course only half the story. Policy makers must weigh the employment cost of minimum wage increases against the higher earnings that accrue to low-wage workers and their families. This involves learning more about those workers who hold minimum wage jobs, and how minimum wage increases affect household incomes—issues about which we currently know surprisingly little.[8]

First version received March 2003; final version accepted August 2003 (Eds).

Endnotes

1. This figure is based on the minimum wage of $431.40 (which applied from May 2002), and median weekly earnings of $750.00, from the Australian Bureau of Statistics' (ABS) *Employee Earnings, Benefits and Trade Union Membership, Australia, August 2002* (Cat. no. 6310.0). Using an alternative measure of median weekly earnings for full-time employees, from ABS, *Employee Earnings and Hours, May 2002* (Cat. no. 6306.0), makes little difference to the result (using this survey, the minimum wage is 56 per cent of median weekly earnings). Since the former survey is conducted as part of the ABS Labour Force Survey, it is probably most readily comparable with median earnings figures from the US Current Population Survey and the UK Labour Force Survey.

2. In so doing, the WAIRC rejected an argument from the Minister that the existence of the statutory minimum wage meant that it should not adjust state awards based on increases in the federal minimum wage: *re A Review of the National Wage Case Decision* [1997] WAIRComm 230.

3. The Department believes that the figure is around 4 per cent (personal email communications with Paul Moss and Tara Zeid, Western Australian Department of Consumer and Employment Protection, 2002 and 2003).

4. See the *Australian Tax Handbook* (Deutsch 1995–2002).

5. The period 1981–2002 is used for reasons of convenience. The Labour Force Survey dataset contained employment figures from February 1978, but in order to seasonally adjust with the previous three years data, it was necessary to drop three years—hence the first difference-in-difference estimate takes February 1981 as its starting point.

6. Among the factors that can influence jurisdiction are whether the industry is a 'national' industry, and whether the relevant award extends to the entire industry (Kenner 1999, p. 10).

7. For example, an unpublished breakdown of the method of setting pay in Western Australia from ABS, *Employee Earnings and Hours, May 2000* (Cat. no. 6306.0), indicates substantial variation in coverage rates between the two lowest paid industries—retail trade and accommodation, cafes and restaurants.

8. For notable exceptions, see Australian Centre for Industrial Relations Research and Teaching (1996) and Richardson (1998).

References

Abadie, A. and Gardeazabal, J. 2003, 'The economic costs of conflict: A case study of the Basque Country', *American Economic Review*, vol. 93, pp. 113–32.

Australian Bureau of Statistics 2003, *Employee Earnings and Hours, May 2002*, Cat. no. 6306.0, ABS, Canberra.

Australian Centre for Industrial Relations Research and Teaching 1996, *A Profile of Low Wage Employees*, ACIRRT, Sydney.

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

Australian Industrial Relations Commission 1997, *Safety Net Review*, 71 IR 1.

Brown, C. 1988, 'Minimum wage laws: Are they overrated?', *Journal of Economic Perspectives*, vol. 2, no. 3, pp. 133–47.

Brown, C. 1999, 'Minimum wages, employment, and the distribution of income', in *Handbook of Labor Economics*, vol. 3B, eds O. Ashenfelter and D. Card, Elsevier, Amsterdam.

Brown, C., Gilroy, C. and Kohen, A. 1982, 'The effect of the minimum wage on employment and unemployment', *Journal of Economic Literature*, vol. 20, pp. 487–528.

Card, D. 1992, 'Do minimum wages reduce employment? A case study of California, 1987–1989', *Industrial and Labor Relations Review*, vol. 46, pp. 38–54.

Card, D. and Krueger, A. 1994, 'Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania', *American Economic Review*, vol. 84, pp. 772–93.

Card, D. and Krueger, A. 1995, *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press, Princeton, New Jersey.

Card, D. and Krueger, A. 2000, 'Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: Reply', *American Economic Review*, vol. 90, pp. 1397–420.

Daley, A., Nguyen-Hong, D., Eldridge, D., Gabbitas, O. and McCalman, P. 1998, *Youth Wages and Employment*, Productivity Commission Staff Research Paper, AusInfo, Canberra.

Dawkins, P. 1997, 'The minimum wage debate and policy developments in Australia, the UK and the US: An introductory overview', *Australian Economic Review*, vol. 30, pp. 187–93.

Dawkins, P. 2002, 'The "five economists plan": The original idea and further developments', *Australian Journal of Labour Economics*, vol. 5, pp. 203–30.

Deutsch, R. (various years), *Australian Tax Handbook*, Australian Tax Practice, Sydney.

Edwardes, C. 1998, *Media Release*, 20 November.

Edwardes, C. 2000, *Minimum Wage Boost for WA Workers*, media release, 1 March.

Fuchs, V., Krueger, A. and Poterba, J. 1998, 'Economists' views about parameters, values, and policies: Survey results in labor and public economics', *Journal of Economic Literature*, vol. 36, pp. 1387–425.

Hawke, A. 1998, 'A minimum wage: Are we returning to Justice Higgins?', *Australian Bulletin of Labour*, vol. 24, pp. 79–93.

James, M., Wooden, M. and Dawkins, P. 2001, 'Minimum wages and the fallacy of the inflated denominator', *Economic Papers*, vol. 20, no. 3, pp. 59–70.

Joint Governments 1996, *The 1996–97 Safety Net Review*, Department of Employment and Workplace Relations, Canberra, <http://www.workplace.gov.au/publications>.

Joint Governments 2001, *The 2000–01 Safety Net Review*. Department of Employment and Workplace Relations, Canberra, <http://www.workplace.gov.au/publications>.

Junankar, P. N. 2000, 'Are wage cuts the answer? Theory and evidence', in *The Unemployment Crisis in Australia: Which Way Out?*, ed. S Bell, Cambridge University Press, Melbourne.

Kenner, S. J. 1999, 'The continued state/federal industrial relations dichotomy and its implications', Discussion Paper, Western Australian Industrial Relations Commission.

Kierath, G. D. 1996, *Media Release*, 26 October.

Lewis, P. 1997, 'The economics of the minimum wage', *Australian Economic Review*, vol. 30, pp. 204–7.

Low Pay Commission 2001, *The National Minimum Wage: Making a Difference, Third Report of the Low Pay Commission, Volume One*, Cm 5075, The Stationery Office, London.

Macdonald, D., Campbell, I. and Burgess, J. 2001, 'Ten years of enterprise bargaining in Australia: An introduction', *Labour and Industry*, vol. 12, no. 1, pp. 1–25.

Mangan, J. and Johnston, J. 1999, 'Minimum wages, training wages and youth employment', *International Journal of Social Economics*, vol. 26, pp. 415–29.

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research

National Center for Policy Analysis 1996, *Why the Minimum Wage Law Causes Unemployment*, <http://www.ncpa.org/studies/s190/s190.html>.

Neumark, D. and Wascher, W. 1992, 'Employment effects of minimum wages and subminimum wages: Panel data on state minimum wage laws', *Industrial and Labor Relations Review*, vol. 46, pp. 55–81.

Neumark, D. and Wascher, W. 2000, 'Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: Comment', *American Economic Review*, vol. 90, pp. 1362–96.

Nevile, J. W. 1999, 'Evidence or assumptions? The basis of the five economists' case for real wage cuts', Discussion Paper 2001–1, Center for Applied Economic Research, University of New South Wales.

Plowman, D., Taplin, J. and Henstridge, J. 1996, *Determining the Minimum Wage: A Household Expenditure Approach*, Report to the Minister for Labour Relations, Western Australia, Graduate School of Management, University of Western Australia, Nedlands, Western Australia.

Preston, A. 2001, *The Structure and Determinants of Wage Relativities: Evidence from Australia*, Ashgate, Burlington, Vermont.

Richardson, S. 1998, 'Who gets minimum wages?', *Journal of Industrial Relations*, vol. 40, pp. 554–79.

Seltzer, A. 1997, 'An evaluation of the international evidence on the employment effects of minimum wage legislation', *Australian Economic Review*, vol. 30, pp. 208–14.

Webster, E. 2003, 'The effects of wages on aggregate employment: A brief summary of empirical studies', *Australian Economic Review*, vol. 36, pp. 134–42.

Wooden, M. 2001, 'Industrial relations reform in Australia: Causes, consequences and prospects', *Australian Economic Review*, vol. 34, pp. 243–62.

© 2003 The University of Melbourne, Melbourne Institute of Applied Economic and Social Research