

# **Disability and the National Minimum Wage: A Special Case?**

Tania Burchardt and Abigail McKnight

ESRC Centre for Analysis of Social Exclusion  
London School of Economics

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## **Abstract**

In the debate which preceded the introduction of a National Minimum Wage (NMW) in the UK in April 1999, concern was expressed by some disability organisations that a minimum wage could jeopardise the jobs of low paid disabled workers. This article examines whether the introduction of the NMW had an adverse effect on the employment retention of disabled workers or resulted in a reduction in the hours they worked. It applies a difference-in-difference methodology to data from 5-quarter panels from the Labour Force Survey for the period prior to the NMW and a period which spanned the introduction of the NMW. A difference-in-difference methodology allows any differential effect of the NMW between disabled and non-disabled employees to be detected despite measurement error in hourly wages. Various specifications of the estimations are tried to test the robustness of the results. The results show that employment retention rates improved for low paid disabled employees over the period of the introduction of the NMW, but that relative to others, disabled employees earning less than the NMW rate before its introduction did not enjoy the same improvement. However, when employment transitions are modelled separately for men and women, the relative fall in employment retention was not found to be statistically significant. There is also evidence that low paid disabled men changed their hours around the time of the introduction of the minimum wage (relative to other groups); more detailed analysis indicates this was more likely to be part of a long-term trend rather than a result of the NMW itself. Exempting disabled employees from the NMW could certainly not be justified on the basis of these results. The majority of disabled workers whose earnings were below the level of the NMW before its introduction retained their employment, and benefited from higher wages. A small minority may have left employment (and who would not otherwise have done so) but disabled employees would benefit more from better enforcement of the Disability Discrimination Act and/or an increase in public funding for supported employment programmes than through an exemption from the NMW.

## **Keywords**

Minimum wage; disability; employment retention; hours of work

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## Introduction

When the National Minimum Wage (NMW) was introduced in April 1999, it was agreed that the same rates would apply across the whole of the United Kingdom and all employees would be covered with the exception of those under the age of 18. A lower ‘Development Rate’ was introduced for employees aged from 18 to 21, and a lower rate, payable for six months, for employees aged 22 or over who were receiving accredited training. Although the introductory level of the NMW, at £3.60 per hour, was cautious, it was estimated that around 9% of employees (2 million) would benefit as a direct result. The exact number of individuals who would benefit was difficult to estimate because high quality wage information is difficult to obtain and because *a priori* the impact on labour demand was unknown.

Minimum wages affect some groups of workers more than others due to the unequal incidence of low pay. The second report of the Low Pay Commission (LPC, 2000) acknowledged that the impact of the NMW on disabled workers was an area of concern. Although the Commission believed that, “there are compelling arguments for treating disabled workers in the same way as other workers. To do so recognises the value of disabled workers to employers and supports a culture of social inclusion” (p.66), submissions from mental health and learning disability charities, MIND and MENCAP, highlighted the risk that jobs of employees with low levels of productivity might be jeopardised by the introduction of the minimum wage. Other submissions referred to the increase in costs to agencies and employers taking part in the Supported Employment programme, potentially resulting in a reduction in the number of workers who could be supported.

There is ample evidence that disabled people are disadvantaged in the labour market, and are therefore particularly likely to be affected by a minimum wage - for better or worse. The Disability Briefing series, based on data from the Spring 2002 Labour Force Survey, shows that six per cent of disabled people of working age are out of work but would like work and are available to start in a fortnight, compared to three per cent of non-disabled people (DRC, 2002). This gap is confirmed by more detailed survey evidence, which also suggests that disabled people are over-represented among those with no and low level educational qualifications (Meager *et al.*, 1999). Other reports have drawn attention to the lack of financial support for training and work

experience for disabled people (RADAR, 2000). Transitions into work and job retention are also more problematic for disabled people: one in three disabled people starting a new job are out of work again by the following year (Burchardt, 2000). In terms of earnings, a recent study for the former Department for Education and Employment found that the earnings differential between disabled and non-disabled men was 21 per cent, while for women it was 17 per cent, and that these differentials had grown since the late 1970s (Blackaby *et al.*, 2000).

To our knowledge there has been no large scale quantitative assessment of the impact of minimum wages on disabled people. What evidence is available on the impact of the NMW on disabled people in the UK is largely qualitative and small scale. Early evidence from the Association for Supported Employment (AfSE), based on interviews with agencies and individual disabled workers, was mixed: some disabled workers with previously low earnings had experienced an increase in income after the introduction of the NMW, while those who combined some work with receipt of Income Support had generally reduced their hours in order to minimise loss of benefit (AfSE, 2000; Schneider *et al.*, 2001). Evidence submitted to the Low Pay Commission also identified confusion among managers of employment projects for disabled people (in day centres and other venues) as to whether their clients were employees and hence covered by the NMW, and difficulties in reconciling minimum wage legislation with benefit rules and funding constraints (Hudson, 2001).

The introduction of a minimum wage in the UK in 1999 provided a good opportunity to test the impact of minimum wages on employment. In this paper we focus on the impact of the NMW on disabled people. This group of workers is chosen because a number of features make them a particularly interesting group to study. Firstly, they were disproportionately working for wages beneath the proposed NMW level prior to April 1999. Secondly, some disabled workers can have reduced productivity as a result of their impairments and therefore a minimum wage can price them out of the market. Thirdly, there is evidence that disabled workers are discriminated against in the labour market and therefore a legal minimum wage could greatly help this group by correcting a situation of underpay without any loss in employment. Finally, policy makers have considered a special exemption for disabled workers but lack evidence to support or reject such an exemption.

## Methodology

The main method used here to assess the impact of the NMW on employment is the Difference-in-Differences (Diff-in-Diffs) estimator. This estimator is often employed to assess the impact of a treatment on an outcome variable in the absence of experimental data. In simple terms, the difference in the outcome between treatment and control groups before the treatment is compared to the difference in the outcome between the same groups after the treatment. For example, the impact of an active labour market programme designed to move welfare recipients off benefit and into work can be assessed by comparing the outflow from the stock of claimants before and after the introduction of the programme compared with a group of claimants who were not eligible for the programme. From this simple example it is fairly obvious that the basic assumption underlying the Diff-in-Diffs estimator is that apart from the introduction of the treatment nothing else changed which had an unequal impact on the outcome variable for the treatment and control groups. This is often not the case and some attempt to control for other changes can be made by estimating the Diff-in-Diffs estimator in a multiple regression framework.

More formally, abstracting from other regressors, the Diff-in-Diffs estimator is defined as:

$$\hat{d}_{DID} = (\bar{Y}_{t_1}^T - \bar{Y}_{t_1}^C) - (\bar{Y}_{t_0}^T - \bar{Y}_{t_0}^C),$$

where  $\bar{Y}^T$  and  $\bar{Y}^C$  are the mean outcomes for the treatment and control groups, respectively, and  $t_0$  and  $t_1$  indicate time before and after the introduction of the treatment respectively.

For the purposes of this analysis the outcome variables of interest are the probability that an employee is employed at the beginning and end of a twelve month period and changes in weekly hours of work over the same period<sup>1</sup>. The probability of remaining in employment before the introduction of the NMW is compared with the period in

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<sup>1</sup> The impact on recruitment is another potentially important outcome which is the subject of further research.

which the NMW was introduced. Likewise changes in weekly hours of work are compared in the period before the introduction of the NMW with the period over which the NMW was introduced. The ‘treatment’ group is defined as employees initially earning below the equivalent NMW levels. One of the problems with this approach is that low paid workers have lower employment retention probabilities than higher paid workers. The Diff-in-Diff methodology is ideal in such a situation as relative employment probabilities and changes in hours of work are ‘benchmarked’ in the ‘pre-treatment’ period (i.e. before the NMW was introduced). In addition, employment transitions and changes in hours of work are compared with other low wage groups as trends over the economic cycle can be different for different groups of workers. For example, the lowest skilled workers tend to be the first to lose their jobs in economic downturns and the last to be employed in economic upturns. The outcomes for a number of groups are compared: disabled employees earning less than the equivalent NMW level with non-disabled employees with equivalent initial pay; disabled and non-disabled employees earning less than the equivalent NMW level with higher paid counterparts in different positions in the earnings distribution.

## **Data**

The estimation of the impact of the NMW on disabled people requires a data source which contains detailed information on individuals’ disability status and details of their pay for a sufficiently long period covering the introduction of the NMW. The Labour Force Survey (LFS) has a number of advantages. It is a large representative survey of households in the UK, earnings information has been collected from a sample of LFS respondents since Winter 1992/93 and a consistent measure of disability is available from Spring 1997. The LFS is a quarterly survey but consists of a rotating panel: households remain in the survey for five quarters before they are replaced; one-fifth of households are replaced each quarter. It is therefore possible to link the records of respondents over five quarters to create a longitudinal dataset. Since Spring 1997, earnings information has been collected from working age employees in their first and final interviews giving two earnings data points approximately one year apart (prior to this earnings were collected in the final interview only).

However, there are some disadvantages to the LFS. The main disadvantage in the context of this investigation is the quality of the wage information. Wages are derived from information collected on earnings and hours of work which can lead to two sources of measurement error. Although there have been improvements in the wage data in the LFS, such as the collection of actual hourly rates of pay for some employees, these did not take effect until Spring 1999 and therefore cannot be used for pre and post NMW analysis of hours and employment. A number of methodological approaches are employed to deal with this problem. If measurement error results in a higher proportion of employees in the low wage groups than in the true population then as long as this affects disabled and non-disabled workers alike and/or does not change over time, then the error will be 'differenced out' in the estimation. Because of the problems with the wage data we do not attempt to provide point estimates of the impact of the NMW but concentrate on estimating the impact of the NMW on disabled employees relative to non-disabled employees.

The LFS contains questions which approximate the 1995 Disability Discrimination Act definition<sup>2</sup> of current disability, that is, a physical or mental impairment which substantially limits day-to-day activities and has lasted, or is expected to last, at least a year. This definition of disability does not coincide with the definitions used within the tax and benefits systems (which are variously based on 'incapacity' for work, mobility, and previous benefit status), nor with the 'social model' definition advocated by organisations of disabled people (which emphasises the disabling nature of the physical, social and economic environment). However, using the DDA definition of disability has the advantage that it is in line with current legislation and can be applied to individuals both in and out of work. It is also available on a consistent basis in the LFS since Spring 1997. For those who are disabled, the LFS asks respondents to specify the types of health problem or impairments which they have, and to identify which they regard as the main problem. Unfortunately, no measure of severity of impairment is available in the dataset.

The following analysis makes use of the full quarterly surveys from Spring 1997 to Winter 2001 and nine panels selected from the period Summer 1997 to Winter 2001.

## Description of the data and sample selection

The sample is restricted to working age individuals within the scope of the NMW (i.e. aged 18 years or over and under 65 years if male or under 60 years if female). The panel sample is further restricted to employees who were not at school, on a sandwich course, at university or college on a full time basis or training for nursing etc. This further restriction is applied in an attempt to remove employees who may qualify for the 'development' NMW rate or who are both more likely to be in low paid jobs and experience employment transitions that are not associated with the introduction with the NMW.

The analysis of the panel data concentrates on three time periods: a Pre NMW period, a period spanning the introduction of the NMW and, in some cases, a Post NMW period. Table 1 gives details of the periods covered in this study. In each of these periods three five wave panels are merged to maximise the sample size. As the NMW was introduced in the middle of the LFS Spring quarter (March to May) in 1999 this quarter cannot be included in the analysis as some of the individuals will have been interviewed before the NMW was introduced as some after it was introduced. Summer, Autumn and Winter quarters<sup>3</sup> are combined in each period to provide 'seasonally balanced' panels (i.e. the Spring quarter is excluded from all of the panels to equalise the seasonal composition of the panels). We make use of the five-wave panels constructed by the Office for National Statistics (ONS). These panels include only those individuals who respond at all five waves of the survey. In principle, for the purposes of this analysis, we could also include those who respond at wave 1 and wave 5 but not at the intervening waves. However, this would be unlikely to add greatly to the sample size, and would mean that the weights constructed by ONS for the five-wave panels could not be applied. To check for attrition, data from all wave 1 respondents in the Spring 1999 quarterly dataset were compared with data from the sub-set of respondents included in wave 1 of the Spring 1999-Spring 2000 panel. This showed that 59 per cent of all wave 1 respondents of working age respond at all subsequent waves, and hence are included in the panel. Those who drop out are

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<sup>2</sup> The Disability Discrimination Act was passed in 1995 and the employment provisions came into effect at the end of 1996.

<sup>3</sup> For example, Summer 1997 covers June 1997, July 1997 and August 1997; Autumn 1997 covers September 1997, October 1997 and November 1997; and Winter 1997 covers December 1997, January 1998 and February 1998.

slightly more likely to be male, younger, a member of an ethnic minority, disabled, unemployed or inactive, and, if an employee, to have lower hourly pay. The loss of representativeness is regrettable. However, since the methods we employ depend on *differences* between groups over time, provided the nature of attrition has not itself changed over time, the impact on our estimates of differences will be small. The advantage of using the ONS constructed panels is that we are able to make use of ONS weights that have been computed to adjust for attrition and sampling design<sup>4</sup>. Both weighted and unweighted analyses are shown below. Sample sizes vary slightly for different panels but there is information for around 16,000 employees in each of the three periods.

Period	LFS quarters	sample size
Pre NMW	Summer 1997-Summer 1998	5,939
	Autumn 1997-Autumn 1998	6,077
	Winter 1997-Winter 1998	5,408
Span NMW	Summer 1998-Summer 1999	5,829
	Autumn 1998-Autumn 1999	5,780
	Winter 1998-Winter 1999	5,088
Post NMW	Summer 1999-Summer 2000	5,372
	Autumn 1999-Autumn 2000	5,237
	Winter 1999-Winter 2000	4,625

The share of disabled persons in the working age population has followed an upward trend in recent years (Burchardt, 2000). Figure 1 shows the share of disabled persons in the working age population from Spring 1997 to Autumn 2001 by gender. Over this time period the share of working age disabled persons increased from just over 12 per cent to around 17 per cent. This increase is potentially important because it may have been accompanied by changes in the composition of the disabled population. Men and women have similar rates of disability over this time period.

<sup>4</sup> The ONS weights combine counteracting attrition and sample design bias with grossing to population levels. We divide these weights by a constant to avoid inflating the apparent sample size, while maintaining the relative weights of different individuals in the sample.

Figure 1 Trends in incidence of disability in the working age population by gender – Spring 1997 to Autumn 2001

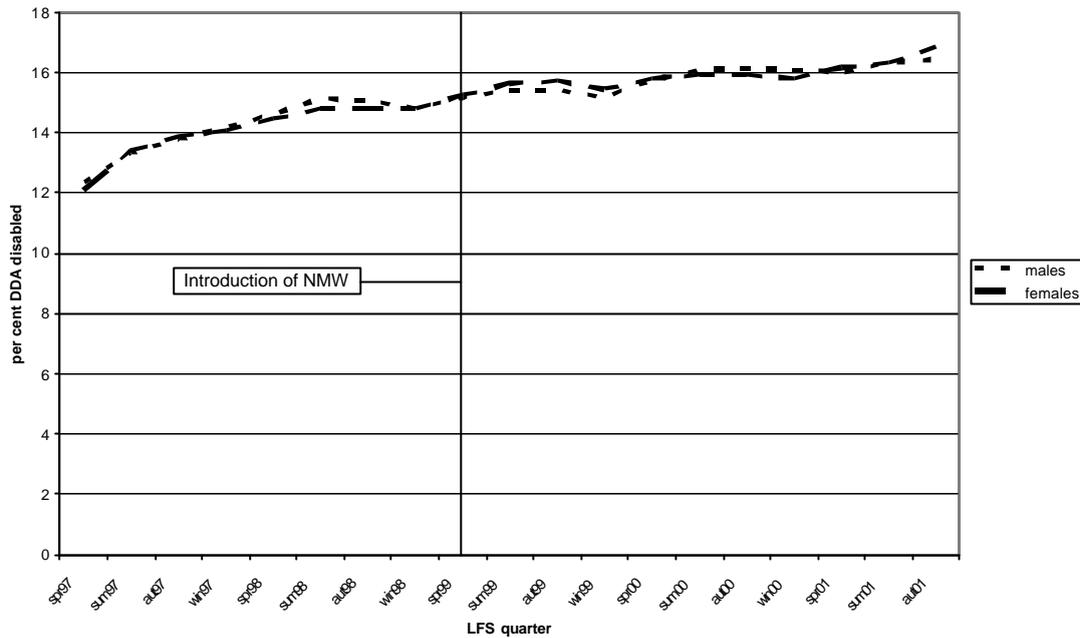


Table 2 Types of impairment among DDA disabled employees in the Pre NMW period (per cent reporting impairment)

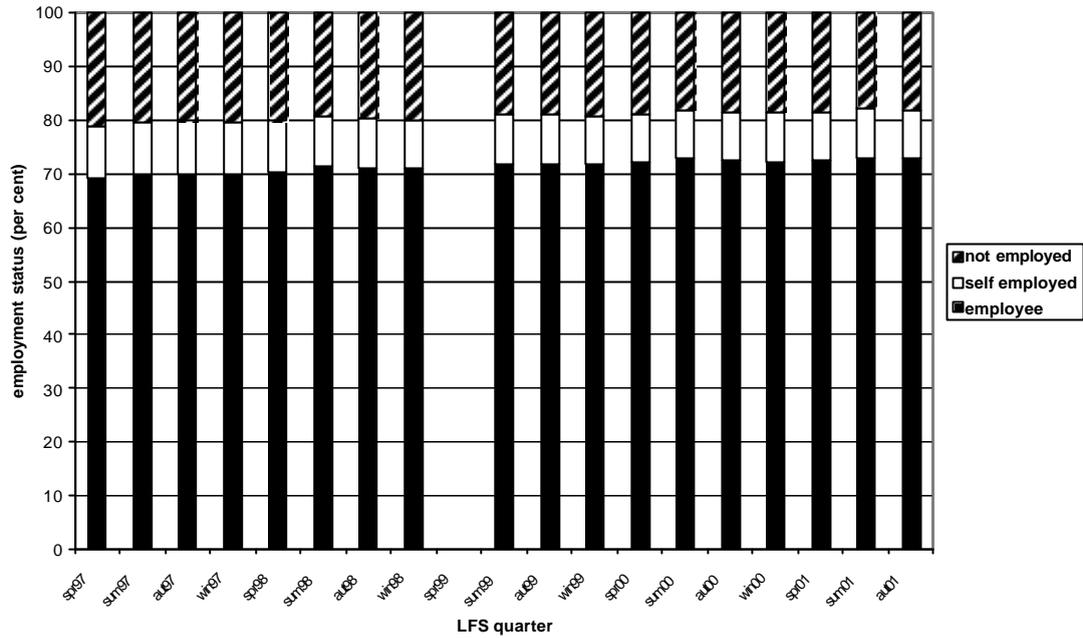
Type of impairment	Men	Women	All
Musculoskeletal problems	39.9	45.2	43.8
Circulation or digestive problems	35.2	30.1	34.3
Chest/breathing problems or allergies	30.5	31.5	28.3
Mental health problems	5.1	9.1	7.1
Sensory problems	9.6	4.0	7.0
Learning difficulties	1.1	0.4	0.7
Any other	17.8	24.4	21.1

Source: Quarterly Labour Force Surveys

A comparison between disabled employees earning at least twice the NMW rate and those earning less than this rate in the Pre NMW period reveals that lower paid disabled employees are more likely to have musculoskeletal problems (46 per cent compared with 40 per cent) and mental health problems (9 per cent compared with 5 per cent), but are less likely to have any circulation or digestion problems (33 per cent compared with 36 per cent).

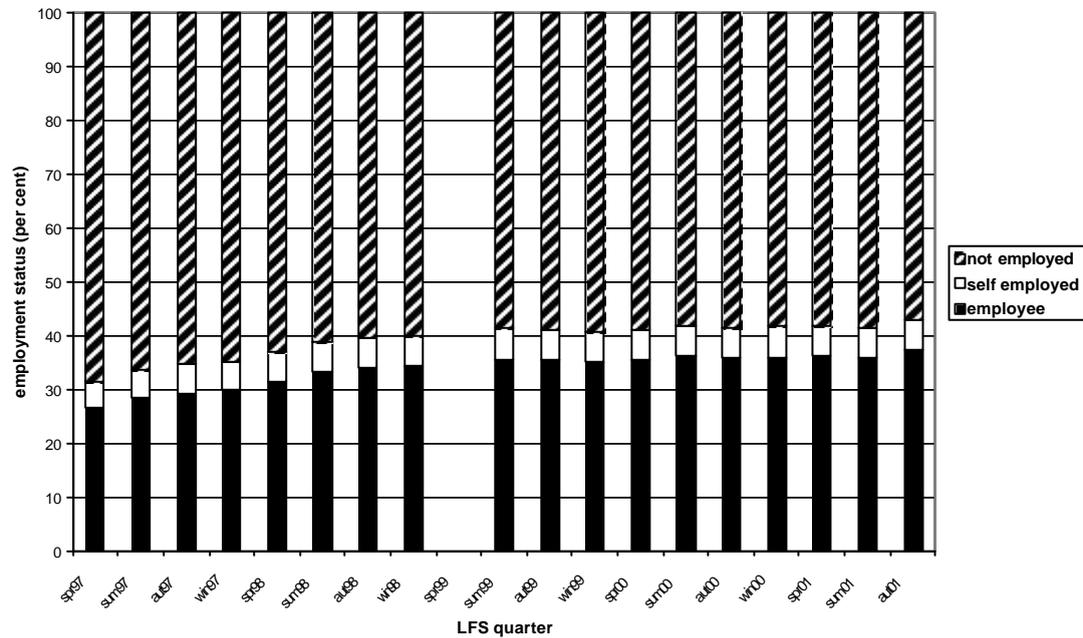
Figures 2a and 2b show the trends in employment status between Spring 1997 and Autumn 2001 for non-disabled and disabled people respectively. The share of employed non-disabled people increases slightly over this period from around 69 per cent to 73 per cent. The comparative figure for disabled people increases to a much greater extent over the same period from 27 per cent to 38 per cent. Although the employment rate for disabled people remains considerably lower than for non-disabled people it has increased from around 40 per cent of the rate for non-disabled employees to just over 50 per cent. These aggregate series show no visible evidence of a fall in employment after the introduction of the NMW in April 1999. The trends are similar for men and women when considered separately (not shown) although there are fewer women in self-employment and therefore employment rates are lower for women than for men; around 12 per cent of working age men are self-employed compared with around 4 per cent of working age women.

Figure 2a Trends in employment status for non-disabled persons in the working age population – Spring 1997 to Autumn 2001



Source: Quarterly Labour Force Surveys

Figure 2b Trends in employment status for disabled persons in the working age population – Spring 1997 to Autumn 2001



Source: Quarterly Labour Force Surveys

There are a number of possible explanations for the growth in employment rates among disabled people over this period. Previous research has indicated that disabled people's employment rates vary more with the economic cycle than those of non-

disabled people and that their response to economic upturn is often delayed (Burchardt, 2000). Implementation of the 1995 Disability Discrimination Act was continuing, with potentially important effects on the awareness of employers of their responsibilities towards disabled applicants and existing employees. In addition, the government introduced over this period a range of measures specifically designed to increase employment rates among disabled people, including the New Deal for Disabled People and changes to rules about working while claiming Incapacity Benefit. However, early evaluation of these measures suggested that their impact on overall employment rates was likely to be small (Corden and Sainsbury, 2001; Loumidis *et al*, 2001).

There were also changes to National Insurance thresholds and contribution rates (in April 1999 and April 2000) and to tax credits (in October 1999) which may have affected employment rates among both the disabled and non-disabled population. We return to the question of tax credits later in the paper.

A disproportionate share of disabled workers is employed in low paid jobs. The figures in Table 3 demonstrate the much higher incidence of low pay among disabled employees using data from the Pre NMW panel. In this period around 4 per cent of male and 12 per cent of female non-disabled employees were earning less than the equivalent April 1999 NMW rate in wave 1 compared with around 8 per cent of male and 19 per cent of female disabled employees<sup>5</sup>. At the equivalent April 1999 rate, 46.5 per cent of all non-disabled employees were earning at least twice the NMW rate compared with 37 per cent of all disabled employees. In the Span NMW period 7 per cent of all non-disabled employees were estimated to be earnings less than the adult NMW rate compared with 12 per cent of all disabled employees before the NMW was introduced. The figures in the Post NMW period are 5 per cent and 9 per cent for non-disabled and disabled employees respectively.

These high rates of employees earning less than the NMW levels in the Post NMW period are cause for concern. Employees can earn less than the NMW rate if they are

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<sup>5</sup> Prior to April 1999 wages are converted to April 1999 equivalents using the Office for National Statistics all items Retail Price Index.

undertaking an accredited training programme (which is not possible to identify in the LFS) or if the assessment period for NMW compliance is different from that which has been used to compute the wage rate in the LFS. However, it is unlikely that these two factors account for this level of employment under the NMW rate. It either means that there was a high level of non-compliance – there is little evidence of this from other sources – but more likely indicates a problem of measurement error in the LFS. This is potentially serious not just for impact analysis but because the LFS gave an overestimate of the number of employees likely to be affected by the NMW and this information was used when NMW rates were being considered<sup>6</sup>. However, as discussed above, provided measurement error has not changed over time or between sub-groups of employees, a difference in difference methodology should still be able to detect a differential impact of the NMW, if one exists, on the employment rates of sub-groups.

Table 3 also shows the distribution of employees across a number of wage groups in the Pre NMW period. Employees aged 18-21 earning less than the ‘development rate’ are separately identified. This group is often the subject of NMW impact analysis as they are expected to suffer most from a NMW due to lower rates of productivity. As very few disabled employees are in this age band the empirical analysis is restricted to individuals who qualify for the NMW adult rate (i.e. age 22 or older).

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<sup>6</sup> If measurement error has not changed over time, these estimates suggest that as few as 2 per cent of employees may have been directly affected by the introduction of the NMW.

Table 3 Wage distribution of employees in the Pre NMW period by gender and disability status

	Men		Women	
	Disabled	Non disabled	Disabled	Non disabled
Wage <sub>1</sub> <dev rate	0.6	1.2	1.1	1.1
Wage <sub>1</sub> <adult rate	7.9	4.1	18.9	12.1
NMW<=wage <sub>1</sub> <NMW*1.2	7.0	5.9	14.7	13.5
NMW*1.2<=wage <sub>1</sub> <NMW*1.4	10.2	7.7	11.0	12.8
NMW*1.4<=wage <sub>1</sub> <NMW*1.6	9.7	9.1	11.3	10.5
NMW*1.6<=wage <sub>1</sub> <NMW*1.8	9.8	8.7	8.3	8.5
NMW*1.8<=wage <sub>1</sub> <NMW*2	9.5	8.0	8.6	7.3
Wage <sub>1</sub> >=NMW*2	45.4	55.4	26.0	34.2
Total (=100%)	508	8589	530	7695

Source: Labour Force Survey panel datasets (Pre NMW period)

Note: Wage<sub>1</sub> refers to hourly wage at wave 1.

### Estimating the impact of the NMW on employment retention

To estimate the impact of the NMW on employment retention the proportion of employees in wave 1 who are also employees in wave 5 is computed. Employment retention is used here to mean those individuals who were employed in wave 1 and wave 5. Clearly, these employees may not have been continuously employed between these two waves, which span about a twelve month period.

Table 4 compares the percentage of disabled and non-disabled male and female employees employed in wave 1 and wave 5 in the Pre and Span NMW periods (sample sizes are in the appendix). The results are shown for unweighted and weighted data; where the weights adjust for sampling and attrition bias. The first panel in the table shows the employment retention rates for all employees. Disabled employees have lower employment retention probabilities than non-disabled employees and women have marginally lower retention rates than men. There is no evidence of a decline in aggregate employment retention for disabled or non-disabled employees associated with the introduction of the NMW. If anything, the retention rates are marginally higher in the period which spans the introduction of the NMW and retention rates increased more for disabled employees relative to non-disabled employees.

The second panel shows the results for employees earning less than the equivalent April 1999 NMW levels in wave 1. This is the group most at risk of employment loss as a result of the NMW but there is little evidence of a fall in employment retention rates for disabled employees but a small fall for non-disabled employees.

The final two panels show the results for two groups of low paid workers which are used as the comparison groups. The first group is for employees earning between the April 1999 NMW levels and up to 20 per cent more than these levels. Employment retention actually increases for male and female disabled employees in the Span NMW period (8 and 9 percentage point increases respectively) compared with the Pre NMW period. No comparable affect is found for non-disabled employees. The next category of low paid workers comprises those earnings at least 20 per cent more than the April 1999 NMW levels and up to 40 per cent more than these levels in wave 1 (equivalent to £5.04 in April 1999 prices). Once again an increase in employment retention is observed among disabled employees (6 percentage points for males and 8 for females) in the Span NMW period.

Table 4 Raw employment retention probabilities

	Unweighted				Weighted			
	Men		Women		Men		Women	
	Disabled	Non-disabled	Disabled	Non-disabled	Disabled	Non-disabled	Disabled	Non-disabled
<b>All employees in wave 1</b>								
Pre NMW	88.3	95.1	86.7	94.5	87.3	94.8	84.9	93.6
Span NMW	89.4	95.4	88.4	94.2	88.9	95.2	86.8	93.2
<b>Wage<sub>1</sub>&lt;NMW</b>								
Pre NMW	80.6	91.1	77.9	90.9	82.5	92.2	74.0	89.3
Span NMW	81.6	88.7	78.4	89.6	79.5	87.5	73.3	87.0
<b>NMW&lt;=wage<sub>1</sub>&lt;NMW*1.2</b>								
Pre NMW	81.1	93.5	79.8	91.7	80.0	93.6	76.9	90.0
Span NMW	88.9	92.0	89.2	92.4	90.0	91.4	86.4	90.5
<b>NMW*1.2&lt;=wage<sub>1</sub>&lt;NMW*1.4</b>								
Pre NMW	82.7	94.0	84.1	95.1	78.8	94.0	85.5	94.1
Span NMW	89.1	94.5	92.9	93.6	90.0	93.6	93.1	95.1

Source: Labour Force Survey panel datasets

The table also includes employment retention estimates using the weighted data. The average rates of employment retention are lower when estimated using the weighted data, suggesting that the LFS panels under-represent individuals with higher rates of

job termination. However, within the wage/gender/disability groups sometimes there is a higher and sometimes a lower retention rate in the weighted data compared with the unweighted data. Among employees initially earning less than the NMW level employment retention rates are higher for men and lower for women than those observed in the unweighted data. Overall, the results from the weighted data corroborate the findings from the unweighted data with a constant or marginally falling rate of employment retention for employees initially earning less than the NMW level in contrast to increasing rates of employment retention for disabled employees with initial earnings in the two wage bands slightly above the NMW level.

The findings from the comparative raw employment retention figures suggest that there have not been large falls in employment retention over the period in which the NMW was introduced for male and female disabled and non-disabled employees. However, employment retention increased for low paid disabled employees earning up to 40 per cent more than the equivalent April 1999 NMW levels. Disabled employees earning less than the equivalent April 1999 NMW levels did not benefit from these higher employment retention figures and this may have been the result of the NMW.

### **Estimating the impact of the NMW on employment retention in a multivariate framework**

It was shown earlier that disabled employees were more likely to be earning below the NMW levels than non-disabled employees and therefore at least some of their lower employment retention rates are likely to be associated with their lower position in the earnings distribution rather than as a result of their disability status. In addition, disabled employees tend to be older than non-disabled employees and lower rates of employment retention could partly be explained by the age profile of the disabled population. In the multivariate estimation we control for age and region of residence. These control variables have been chosen because of the differences between the characteristics of the disabled and non-disabled populations and to control for differences in the composition of employees in the wage groups which could change over time and affect the associated employment retention probabilities. We choose not to control for variables such as education, occupation and industry because the

correlation between these variables and pay is likely to reduce the estimated impact of the NMW.

Separate estimates are presented for men and women as a test for restricting common coefficient estimates is rejected.

The first set of results (Table 5) is estimated using the unweighted data. The estimates presented in the table are the ‘marginal effects’ derived from logit regressions evaluated at the sample means (proportions). They provide an estimate of the relative percentage point change in the predicted probability of being in work in wave 1 and wave 5. A negative diff-in-diff estimate represents a fall in the relative employment retention probabilities between the ‘treatment’ group and the comparison group between the Pre NMW period and the period spanning the introduction of the NMW. However, we recommend caution in interpreting these estimates as the precise estimates of the impact of the NMW on employment retention due to the measurement error in wages highlighted earlier.

For disabled men and women there is a higher negative effect associated with earning less than the NMW rate in the Span NMW period relative to the Pre NMW period. This implies that for employees earning less than the NMW, the relative conditional probability of being employed in wave 5 fell over the period in which the NMW was introduced. However, the relative employment probabilities are not statistically significant in the Pre NMW period and are only significant in the Span NMW period for disabled women. In addition, none of the diff-in-diff estimates are statistically significant.

For non-disabled men and women the relative employment probabilities are not consistently lower in the Span NMW period compared with the Pre NMW period (three of the diff-in-diff estimates are positive). Few of the relative conditional employment probabilities are statistically significant. Once again the relative employment probabilities in the Span NMW period are significant for women as are the Pre NMW period estimates for the higher reference wage group. The Span NMW period estimates for men are significant for the higher reference wage group.

Although the diff-in-diff estimates for non-disabled employees are less than for disabled employees, none of the diff-in-diff estimates are statistically significant.

Table 5 Difference in difference estimates of employment retention for employees earning less than the adult NMW rate in wave 1 (unweighted)

Reference group		Men		Women	
		Disabled	Non-disabled	Disabled	Non-disabled
<b>Raw estimates</b>					
NMW $\leq$ wage <sub>1</sub> <NMW*1.2	Pre NMW	-0.003	-0.017	-0.012	-0.007
	Span NMW	-0.067	-0.020	<b>-0.107</b>	<b>-0.019</b>
	Diff in Diff	-0.064	-0.003	-0.095	-0.012
NMW*1.2 $\leq$ wage <sub>1</sub> <NMW*1.4	Pre NMW	-0.014	-0.023	-0.045	<b>-0.045</b>
	Span NMW	-0.070	<b>-0.049</b>	<b>-0.184</b>	<b>-0.031</b>
	Diff in Diff	-0.056	-0.026	-0.138	0.014
<b>With controls</b>					
NMW $\leq$ wage <sub>1</sub> <NMW*1.2	Pre NMW	-0.033	-0.019	0.001	-0.006
	Span NMW	-0.082	-0.014	<b>-0.101</b>	<b>-0.019</b>
	Diff in Diff	-0.050	0.005	-0.102	-0.013
NMW*1.2 $\leq$ wage <sub>1</sub> <NMW*1.4	Pre NMW	-0.035	-0.020	-0.037	<b>-0.042</b>
	Span NMW	-0.101	<b>-0.042</b>	<b>-0.161</b>	<b>-0.032</b>
	Diff in Diff	-0.066	-0.022	-0.124	0.010

Notes: Statistically significant coefficients at the 5% level of significance are shown in **bold**. 'Diff in Diff' is Span minus Pre.

Source: Labour Force Survey panel datasets.

Table 6 contains the results when the attrition and sampling weights have been applied. Comparison with the results in table 5 shows that there are a few minor differences in the estimates but overall the results suggest that attrition has not led to bias in the estimates. Two additional coefficients are statistically significant in the weighted data estimates (non disabled men initially earnings less than the equivalent NMW in the Pre NMW period relative to the higher reference wage group). None of the diff-in-diff estimates are statistically significant.

Further estimates were made for models which included controls for type of impairment. There is an argument for including controls for impairment in case changes in employment retention rates within wage groups are affected by a change in

the composition of disabled people by type of impairment. Although there was variation in some of the point estimates the overall findings did not change.

The results presented here are for men and women separately (following a rejection of the pooled regression). However, when the sample is pooled there is some evidence of a statistically significant fall in the relative employment retention rates for disabled employees between the Span and Pre NMW periods. This suggests that while the separate models may provide a better fit the loss in sample size may lead to a loss of statistical significance but if there was a negative impact on employment retention among disabled employees it must have been small.

Table 6 Difference in difference estimates of employment retention for employees earning less than the adult NMW rate in wave 1 (weighted)

		Men		Women	
		Disabled	Non-disabled	Disabled	Non-disabled
<b>Raw estimates</b>					
NMW<=wage<NMW*1.2	Pre NMW	0.015	-0.013	-0.020	-0.005
	Span NMW	-0.120	-0.020	<b>-0.113</b>	<b>-0.023</b>
	Diff in Diff	-0.135	-0.006	-0.094	-0.018
NMW*1.2<=wage<NMW*1.4	Pre NMW	0.021	<b>-0.028</b>	-0.092	<b>-0.047</b>
	Span NMW	-0.115	<b>-0.037</b>	<b>-0.275</b>	<b>-0.045</b>
	Diff in Diff	-0.136	-0.009	-0.183	0.002
<b>With controls</b>					
NMW<=wage<NMW*1.2	Pre NMW	-0.017	-0.017	-0.008	-0.004
	Span NMW	-0.112	-0.017	<b>-0.103</b>	<b>-0.022</b>
	Diff in Diff	-0.095	0.000	-0.095	-0.018
NMW*1.2<=wage<NMW*1.4	Pre NMW	-0.002	<b>-0.010</b>	-0.082	<b>-0.044</b>
	Span NMW	-0.133	<b>-0.026</b>	<b>-0.250</b>	<b>-0.045</b>
	Diff in Diff	-0.132	-0.015	-0.168	-0.001

Notes: Statistically significant coefficients at the 5% level of significance are shown in **bold**.

'Diff in Diff' is Span minus Pre.

Source: Labour Force Survey panel datasets.

In the Pre NMW period disabled workers earning less than the NMW had a lower probability of being employed one year later relative to higher paid disabled workers. In the period which spanned the introduction of the NMW this difference increased. A smaller change occurred for non-disabled employees. However, the differences

between the Pre NMW period and the period with spanned the introduction of the NMW were not statistically significant (in the separate models). In the case of disabled employees this lack of significance could be due to small sample sizes.

### **Estimating the impact of the NMW on hours of work**

The NMW could result in an increase in hours worked through the increase in the reward for each hour worked (upward sloping supply curve) or a decrease if employers find it less profitable to employ 'less productive' labour at the new, higher, wages (downward sloping demand curve). Employers may choose to reduce existing employees' hours rather than to lay off workers. If weekly hours of work fall as a result of the NMW, low paid workers can be financially worse off, even without a loss in employment and despite an increase in hourly rates of pay. Couch and Wittenburg (2001) find that increases in minimum wage rates in US states tend to reduce hours of work of teenagers, and that the elasticity of hours worked with respect to the minimum wage is higher than the elasticity with respect to employment rates.

It is particularly interesting to investigate the impact of the NMW on hours worked by disabled employees because the rules of in- and out- of work benefits for low paid/low income disabled people can impact directly on the number of hours disabled employees choose to work. Claimants of Incapacity Benefit (IB), a social insurance benefit paid to those deemed 'incapable of work', are permitted in certain circumstances to work up to 16 hours per week, provided their earnings are below a fixed weekly maximum (£67.50 in 2002, approximately 16 times the NMW). IB claimants who were working at the time the NMW was introduced, and whose hourly wage was increased, could have been obliged to reduce their hours in order to remain below the weekly earnings threshold. Similar rules apply for disabled claimants of Income Support (IS), the main social assistance benefit, except that any earnings above £15 per week are deducted from benefit entitlement pound for pound.

Assessing the impact of the NMW on hours is complicated by the fact that there were other policy changes at around the same time which were expected to affect hours: in particular, the introduction of Working Families Tax Credit and Disabled Persons Tax Credit in October 1999. Eligibility for WFTC and DPTC starts at 16 hours per week (so some employees working fewer than 16 hours could have been encouraged to

increase their hours to that level), and includes a bonus at 30 hours per week. For this reason it is important to establish as closely as possible the timing of any change in hours worked, and to examine whether the effect persisted in the longer term.

Two approaches are employed to assess the impact of the NMW on hours. Firstly, using cross-sectional data, average hours of work are examined. If the NMW had an effect, we would expect to observe an increase or decrease in the trend at or around Spring 1999. Secondly, using panel data, changes in individuals' hours of work are estimated over a one year period. If the NMW had an effect, we would expect to observe a change in individuals' hours of work over the panel spanning Spring 1999 which is significantly different from changes in periods either before the NMW was introduced or after its introduction. In both cases, the experiences of low paid disabled employees are compared to their non-disabled counterparts and to higher-paid employees.

### **Trends in hours: a cross-sectional approach**

Table 7 shows the trend in mean and median hours worked for men and women. Hours are defined as the usual hours worked per week (including paid and unpaid overtime) in the main job. Annual averages based on LFS years are given because seasonal variation in hours makes it difficult to detect a trend if quarters are shown separately. Two wage groups are compared: a low wage group (earning less than the NMW plus 20 per cent), and a slightly higher, but still low-wage, reference group (earning between 20 and 40 per cent more than the NMW). The low wage group therefore includes those directly affected by the NMW and those earning slightly above the NMW level before its introduction; this broader group was selected in order to be able to follow trends through into periods after the NMW was introduced.

Disabled employees work slightly shorter hours on average than the non-disabled, although the difference is not large, and the reference groups work slightly longer hours than the low wage groups. Among men, median hours fall slightly for all groups over the period. There is no obvious break in the trend at 1999, when the minimum wage was introduced, for any group.

Table 7 Trends in weekly hours, by gender, disability and wage group

Spring- Winter quarters	Low wage group (wage < NMW*1.2)				Reference group (NMW*1.2<=wage<NMW*1.4)			
	Disabled		Non-disabled		Disabled		Non-disabled	
	mean	median	mean	median	mean	median	mean	median
<b>Men</b>								
1997	37.9	40	42.0	41	41.2	40.5	43.6	42
1998	37.5	40	41.6	40	41.1	40	43.2	42
1999	37.5	39	40.6	40	40.6	40	42.3	42
2000	37.0	39	41.3	40	41.5	40	42.1	41
2001	38.0	40	40.3	40	41.2	40	41.9	41
<b>Women</b>								
1997	25.5	24	26.0	24	29.2	30	29.5	32
1998	24.5	21	26.1	24	29.1	30	29.5	30
1999	24.7	22	25.8	24	27.9	28	28.0	28
2000	25.4	22	25.7	24	26.5	25	27.5	27
2001	25.3	24	25.8	24	27.3	28	28.6	30

Source: Quarterly Labour Force Surveys

Average hours worked by women are significantly lower than for men. This marked gender difference is the reason for analysing hours worked by men and women separately. Among women, median hours fall initially for all groups except non-disabled low wage women, before recovering slightly in 2001. Mean hours remain steady for low wage women (whether disabled or not), but fall slightly among the reference groups. Again, there is no obvious break in the trend at 1999.

There is no evidence in these cross-sectional trends to support the hypothesis that the NMW either increased or decreased hours worked by low paid workers. However, it is possible that there are changes in hours underlying these averages.

A more detailed breakdown of hours worked for low paid disabled and non-disabled men and women is shown in Figure 3 (a-d). For disabled men, the breakdown shows that a spike at 30 hours which already existed in 1997 becomes more pronounced by 2000. A new spike at 16 hours appears in 2000 (although it is less obvious in 2001). Between them, respondents reporting exactly 16 or 30 hours per week accounted for 4.9 per cent of disabled men in this wage group in 1997, and 7.4 per cent in 2001. This is of course consistent with a move towards the thresholds set in the tax credits introduced in October 1999. The 30-hour spike can also be detected for non-disabled men.

Figure 3a Distribution of hours of disabled men earning  $< \text{NMW} \times 1.2$  (and working  $< 50$  hours pw)

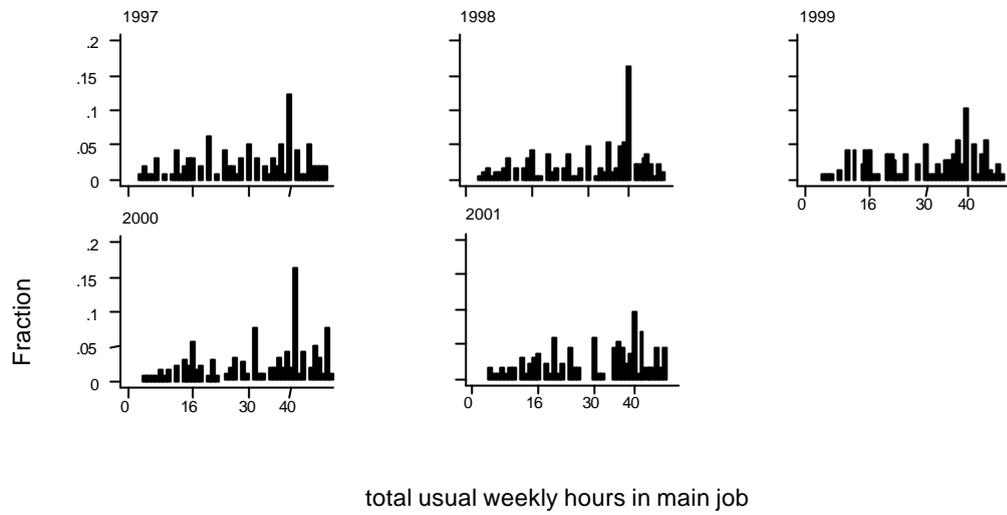


Figure 3b Distribution of hours of non-disabled men earning  $< \text{NMW} \times 1.2$  (and working  $< 50$  hours pw)

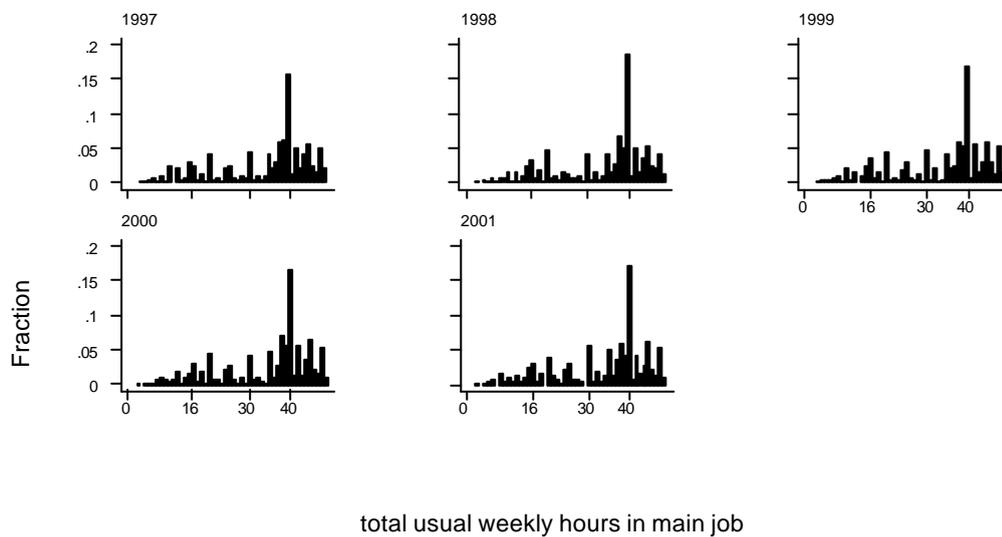


Figure 3c Distribution of hours of disabled women earning  $< \text{NMW} \times 1.2$  (and working  $< 50$  hours pw)

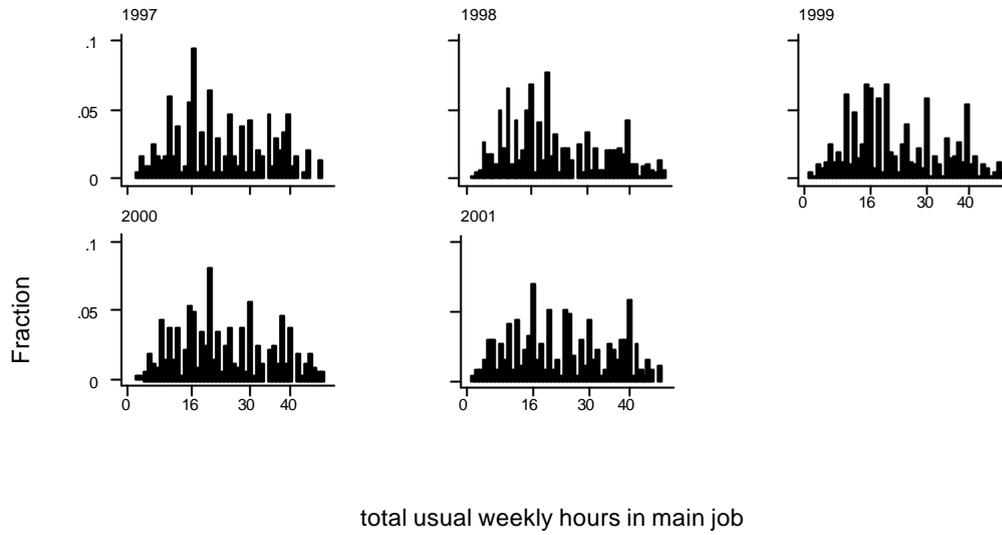
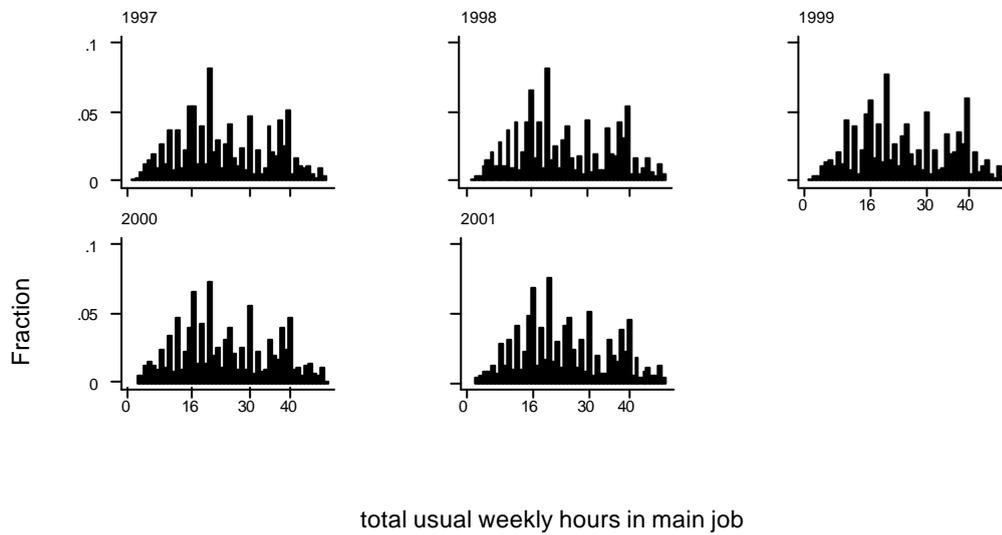


Figure 3d Distribution of hours of non-disabled women earning  $< \text{NMW} \times 1.2$  (and working  $< 50$  hours pw)



Source: Quarterly Labour Force Surveys

For disabled women, there were already concentrations at 16 (and to a lesser extent, 30) hours before Autumn 1999, and this pattern is sustained through the period. For non-disabled women, the spikes at 16 and 30 hours account for a higher proportion of respondents by the end of the period, rising from 9.2 per cent to 10.9 per cent.

Of course some of these shifts in the distribution of hours among low-paid workers may be due to new entrants to the labour force rather than to existing employees changing their hours. In order to investigate what happened to the hours of those in employment at the time of the introduction of the NMW, we turn to the panel data.

### **Changes in hours: longitudinal analysis**

A difference in difference approach is particularly important when it comes to considering hours of work, because the hours of disabled workers are likely to fluctuate and/or decrease to a greater extent than non-disabled workers, due to health and impairment related problems. By comparing the difference in experience of disabled workers in two periods, with the difference in experience of non-disabled workers in the same periods, we can assess whether the NMW had a differential effect on the hours of disabled workers *who remained in employment*.

The first comparison is made between the period before the introduction of the NMW (Pre NMW) and the period spanning its introduction (Span NMW), and looks at whether employees increased (or decreased) their hours to a greater extent in one period than another across all wage groups. Changes in hours are calculated as hours at wave 5 minus hours at wave 1 (using the same definition of hours as for the cross-sectional analysis).

In the Pre NMW period, both disabled and non-disabled men decreased their hours over the period of a year. Among non-disabled men there was a gradient with respect to wages, with the biggest average decreases occurring among lower wage groups. Similarly, in the period spanning the introduction of the NMW, both disabled and non-disabled men, especially the low-paid, decreased their hours.

For women, there was little year-on-year change in hours among the non-disabled in the Pre or Span NMW periods. Disabled women in the Pre-NMW period generally

decreased their hours, with the biggest decreases occurring among the lowest paid. In the period spanning the introduction of the NMW, several of the higher-paid groups of disabled women significantly increased their hours.<sup>7</sup>

Difference in difference estimates for changes in hours are summarised in Table 8. For the purposes of this analysis - as for the analysis of employment retention - those who were earning less than the NMW at wave 1 ( $wage_1 < NMW$ ) are compared to two reference groups: those earning between the NMW and 20 per cent above it at wave 1 ( $NMW \leq wage_1 < NMW * 1.2$ ), and those earning between 20 and 40 per cent more than the NMW at wave 1 ( $NMW * 1.2 \leq wage_1 < NMW * 1.4$ ).

In general, a positive diff in diff value indicates that the gap between ‘treatment’ and ‘reference’ wage groups narrowed between the Pre and Span period, and a negative diff in diff value indicates the gap widened. However, care must be taken in interpreting diff-in-diffs where the sign of the first difference changes between periods, in other words where the ‘advantage’ enjoyed by one wage group is reversed in the following period. In these cases, a negative value for the diff-in-diff may result whether the *magnitude* of the difference between wage groups has increased or decreased over time.

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<sup>7</sup> Given the particular constraints on hours faced by disabled people who are combining work and benefit receipt, it would be interesting to investigate the experience of this sub-group in more detail. Unfortunately the numbers involved are too small to produce robust estimates from these data.

Table 8 Difference in difference calculations (unweighted)

*Year-on-year change in weekly hours for 'treatment group' ( $wage_1 < NMW$ ) relative to change in hours for 'reference group'*

Reference group		Men		Women	
		Disabled	Non-disabled	Disabled	Non-disabled
<b>Raw estimates</b>					
NMW $\leq$ wage <sub>1</sub> <NMW*1.2	Pre NMW	1.867	-0.121	-0.443	<b>-0.840</b>
	Span NMW	-1.573	-1.014	-1.382	<b>-1.259</b>
	Diff in Diff	-3.440 <sup>#</sup>	-0.893	-0.939	-0.419
NMW*1.2 $\leq$ wage <sub>1</sub> <NMW*1.4	Pre NMW	2.428	-0.749	-1.109	<b>-0.707</b>
	Span NMW	-0.523	<b>-1.938</b>	-0.604	-0.461
	Diff in Diff	-2.951 <sup>#</sup>	-1.189	0.505	0.246
<b>With controls</b>					
NMW $\leq$ wage <sub>1</sub> <NMW*1.2	Pre NMW	1.121	-0.195	-0.715	<b>-0.902</b>
	Span NMW	-2.113	-1.075	<b>-1.679</b>	<b>-1.262</b>
	Diff in Diff	-3.234 <sup>#</sup>	-0.880	-0.964	-0.361
NMW*1.2 $\leq$ wage <sub>1</sub> <NMW*1.4	Pre NMW	0.521	<b>-1.433</b>	<b>-2.048</b>	<b>-1.401</b>
	Span NMW	-2.267	<b>-1.775</b>	-1.451	<b>-1.318</b>
	Diff in Diff	-2.788 <sup>#</sup>	-0.342	0.597	0.083

Notes: OLS regressions on change in hours (wave 5 minus wave 1), separately for each gender and disability sub-sample, with interaction between period and wage band. Controls are hours at Wave 1, and age group.

# Sign of difference in Pre NMW period is opposite to sign in Span NMW period, i.e. the gap between wage groups was reversed.

'Diff in Diff' is Span minus Pre.

Statistically significant coefficients at the 5% level of significance are shown in **bold** (using robust standard errors for regressions with controls).

Source: Labour Force Survey panel datasets.

The first point to note is that few of the differences between treatment and control groups in either the Pre or Span periods are statistically significant, and none of the difference in differences are significant. In other words, for none of the gender and disability sub-groups was the difference between change in hours for the treatment and control groups in the period during which the NMW was introduced significantly different from the period before the NMW was in force.

The raw estimates shown in the top half of the table impose no conditions on the data but do not take account of differences in characteristics between disabled and non-disabled workers, nor of any changes in the composition of the groups over time. The

bottom half of the table therefore shows diff in diff estimates after controlling for age group and initial hours worked (i.e. weekly hours at wage 1). Age group is important because of the older age profile of disabled workers; initial hours worked is important because those working shorter hours are more likely to increase their hours in a given period than those working longer hours.

The raw estimates and the multivariate estimates produce similar results. Substantial change in the coefficients occurs only in a couple of instances (for example, for non-disabled men with respect to the higher wage reference group), and in these cases the coefficients for the raw estimates were not significant.

Looking at the estimates from regressions with controls, among non-disabled men there was a widening of the gap between those earning less than the NMW and those earning just above the NMW, but the diff-in-diff is not statistically significant. The same result holds with respect to either reference group. For disabled men, an initial 'advantage' for the lowest paid group (increasing their hours more than either reference group) was reversed during the period spanning the introduction of the NMW, but again the diff-in-diff is not significant.

If the results are taken at face value, they suggest that the behaviour of the lowest paid disabled men became more like their non-disabled counterparts during the Span NMW period. This is driven by the *increase* in hours for disabled men earning less than the NMW in the Pre NMW period (an observation which is not replicated for other wage groups or in other periods) and the subsequent decrease. The lack of statistical significance suggests that this should not be interpreted as evidence of a differential NMW effect on disabled workers.

For women, the results are sensitive to which reference group is selected. The gap between women earning just above the NMW and women earning less than the NMW increased during the period the NMW was introduced. On the other hand, the gap between women earning 20 to 40 per cent above the NMW and women earning less than the NMW decreased. These results hold for both disabled and non-disabled women, although the difference between the two periods is greater for disabled women. The sensitivity of the results for women to the choice of reference group, and

the lack of statistical significance for the diff-in-diffs, means there is no evidence for a significant NMW effect.

The same estimations using weighted data produce similar results overall<sup>8</sup>. The difference between Pre and Span periods in year-on-year changes in weekly hours for the lowest paid disabled women is greater, relative to either reference group, than the corresponding difference for lowest-paid non-disabled women. The weighted results indicate slightly larger diff-in-diffs between Pre and Span periods for disabled employees than do the unweighted results, but they still do not reach statistical significance.

There is some variation in the hours worked by disabled people according to type of impairment. In particular, those with mental health problems or learning difficulties work fewer hours, on average, than other disabled workers (41.2 hours per week for men and 25.5 hours per week for women in the Pre NMW period, compared to 43.0 and 30.5 hours per week for other disabled men and women respectively). Moreover, men and women with mental health problems are more likely to reduce their hours during the course of a year than are other disabled workers. If the composition of the disabled workforce had changed between the Pre and Span NMW periods – for example due to differential employment retention - this could have affected average year-on-year changes in weekly hours for disabled workers, and hence the difference in difference estimates shown in Table 8. Multivariate analysis including controls for type of impairment (categories as listed in Table 2), confirms that employees with mental health problems or learning difficulties are more likely to reduce their hours over the course of a year, but does not alter the sign of the difference-in-difference estimates or the comparison between disabled and non-disabled.<sup>9</sup>

The cross-sectional trends indicated that some movement in hours may have been due to the reform of tax credits rather than to the NMW. If the difference in differences reported in Table 8 are genuinely related to the introduction of the NMW, one would expect the period *after* the NMW to look more like the Pre NMW period than the

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<sup>8</sup> Details available from the authors on request.

<sup>9</sup> Point estimates are affected by the inclusion of controls for type of impairment; this is to be expected especially where the original estimate is not statistically significant.

Span NMW period. (Having adjusted the hours of their employees in accordance with the new minimum wage, employers had no further NMW-related reason to adjust the hours of existing adult employees, until the adult rate of the NMW was raised in October 2000). Comparing periods after the introduction of the NMW with earlier periods is complicated by two factors. Firstly, the  $wage_1 < NMW$  group no longer exists, assuming 100% compliance with the minimum wage. (In fact as noted earlier, a number of respondents in LFS continue to report wages below the NMW). Secondly, the change in retention rates over the period in which the NMW was introduced (shown in Table 4) will affect the composition of the wage groups available for analysis, since the outcome of interest here, ‘year on year change in weekly hours’ is conditional on being an employee at both wave 1 and wave 5. The first problem can be accommodated by selecting the broader low wage group ( $wage_1 < NMW*1.2$ ) as a consistently-defined group across time periods, while retaining the same reference group ( $NMW*1.2 \leq wage_1 < NMW*1.4$ ). The second problem must be borne in mind when interpreting the results.

Table 9 Difference in difference calculations - Pre, Span and Post NMW

*Year-on-year change in weekly hours for 'treatment group' ( $wage_1 < NMW*1.2$ ) minus change in hours for 'reference group'*

Reference group		Men		Women	
		Disabled	Non-disabled	Disabled	Non-disabled
<b>Raw estimates</b>					
NMW*1.2 $\leq$ wage <sub>1</sub> <NMW*1.4	Pre NMW	1.256	-0.682	-0.894	-0.262
	Span NMW	-0.012	<b>-1.402</b>	0.104	0.188
	Post NMW	-1.575	0.003	-0.241	-0.465
	Span – Pre	-1.268 <sup>#</sup>	-0.720	0.998 <sup>#</sup>	0.450 <sup>#</sup>
	Post – Span	-1.563	1.404 <sup>#</sup>	-0.345 <sup>#</sup>	-0.653 <sup>#</sup>
<b>With controls</b>					
NMW*1.2 $\leq$ wage <sub>1</sub> <NMW*1.4	Pre NMW	-0.258	<b>-1.326</b>	-1.718	<b>-0.924</b>
	Span NMW	-1.661	<b>-1.208</b>	-0.597	<b>-0.655</b>
	Post NMW	<b>-2.428</b>	-0.334	-0.517	<b>-0.699</b>
	Span – Pre	-1.403	0.118	1.121	0.269
	Post – Span	-0.767	0.874	0.079	-0.044

Notes: OLS regressions on change in hours (wave 5 minus wave 1), separately for each gender and disability sub-sample, with interaction between period and wage band. Controls are hours at Wave 1, and age group.

# Sign of difference changes between periods, i.e. the gap between wage groups was reversed. Statistically significant coefficients at the 5% level of significance are shown in **bold** (using robust standard errors for regressions with controls).

Source: Labour Force Survey panel datasets.

Once again, neither the results with controls nor those without controls produce statistically significant difference in differences, for either the Span relative to Pre comparison, of the Post relative to Span comparison. This suggests that there were not large differences in the changes in weekly hours of the low wage group relative to their slightly higher-paid counterparts over this extended period.

The estimates with controls show larger differences between treatment and reference groups (for most gender and disability sub-groups) in each period than do the estimates without controls. A certain amount of movement in the estimates is to be expected because so few are statistically significant in the raw data. In addition, a number of estimates which were not significant in the raw data become so when controls are introduced. Despite this, the difference in differences are not significant.

Concentrating on the multivariate point estimates, among disabled men the difference between treatment and reference group is smallest in the Pre period and greatest in the Post period: the gap widens over time. For the other three gender and disability sub-groups, the gap generally narrows or remains constant over time. In no case does the Post period resemble the Pre period, with a distinctive pattern in the Span period in between.

Extending the analysis to a period after the introduction of the NMW (albeit using a different definition of the lowest wage group) indicates that shifts in the relative position of wage groups in terms of year-on-year changes in weekly hours, for both disabled and non-disabled workers, continued to take place well after Spring 1999. No pattern of changes unique to the Span NMW period can be identified. Had the introduction of the NMW had a large positive, or negative, effect on the hours worked by low paid disabled or non-disabled employees, relative to others, a distinctive and statistically significant pattern of changes in hours in the Span period would have been observed.

Both the cross-sectional and longitudinal analysis suggest that low paid disabled men and women changed their hours around the time of the introduction of the minimum wage (relative to other groups), but the cross-sectional data and the extended analysis into the Post NMW period indicate this may be part of a longer-term trend rather than a result of the NMW itself.

One candidate for an alternative explanation is the introduction of WFTC and DPTC in October 1999. This is given support by the emergence of a 16-hour and 30-hour spike in the distribution of low-paid disabled men's hours. The hours worked by low paid disabled women seem to have been less affected by these policy changes, perhaps because they were already concentrated at the lower end of the hours distribution.

## Conclusions

The national minimum wage was introduced in the UK in April 1999 in a period of labour market expansion. Trends show that disabled employees experienced rising levels of employment up to the time the NMW was introduced and these rates held firm after its introduction. Rising levels of employment were accompanied by improved employment retention rates for low paid disabled employees but more detailed analysis reveals that disabled employees earning less than the NMW rates before they were introduced did not enjoy the same improvement. Comparing the experience of low paid disabled employees with low paid non-disabled employees reveals that the NMW had a greater negative impact on employment retention among disabled employees. However, modelling the employment retention probabilities for men and women separately, and taking into account differential rates of attrition, reveals that these differences are not statistically significant. When men and women are pooled there is a statistically significant fall in relative employment retention rates which suggests that sample size may be a problem.

There is evidence that low paid disabled men changed their hours around the time of the introduction of the minimum wage (relative to other groups), but the cross-sectional data and the extended longitudinal analysis into the 'Post NMW' period indicate this may be part of a longer-term trend rather than a result of the NMW itself.

Given the change in the pattern of working hours the most likely explanation is the introduction of WFTC and DPTC in October 1999. This theory is supported by the emergence of a 16-hour and 30-hour spike in the distribution of low-paid disabled men's hours (low paid workers have to work a minimum of 16 hours per week to qualify and are paid a bonus if they work 30 hours per week or longer). Low paid disabled women seem to have been less affected by these policy changes, perhaps because they were already working fewer hours than men and claiming Family Credit (WFTC replaced FC which had similar incentives to work 16 or 30 hours a week).

There are a number of areas of further research which could validate and extend this research. Firstly, when looking at employment we have focused on estimating the impact of the NMW on transitions from employment. This gives a partial picture as the NMW can reduce the chances of non-employed individuals gaining employment.

Secondly, we have relied on the difference-in-differences methodology to deal with the measurement error in the wage variable. One consequence is that we do not estimate the *magnitude* of the impact of the NMW on disabled workers, only whether it had a differential impact on disabled and non-disabled workers. It may be possible to use data from later periods when improved wage information was collected to assess any influence of measurement error on the main findings. Recent increases in the NMW, such as the 40p increase in the adult NMW rate to £4.10 in October 2001, could be used to validate our findings. Finally, disability is far from being a permanent status; further analysis could take into account the dynamics of disability.

Given our data limitations we cannot rule out a small negative effect of the NMW on employment retention among low paid disabled employees. A possible negative effect of the NMW on employment retention among low paid disabled employees, relative to other groups, does not imply that disabled employees should be exempt from the NMW. There are three main reasons why low paid disabled employees may lose their jobs following the introduction of a minimum wage. Firstly, they can lose their jobs because the value of their intrinsic levels of productivity prices them out of the labour market when wages are increased to the minimum wage level. Secondly, they can lose their jobs because employers have not made sufficient adaptations in the workplace for them to be as productive as their intrinsic level of abilities. Thirdly, they can lose their jobs because the jobs they are employed in have low productive value. (Disabled employees may be disproportionately forced to accept such jobs.)

The policy response to each of these situations is different. Under the first, disabled employees with very low levels of intrinsic productivity should be helped through supported employment programmes, subsidised through the state. Funding for these schemes would need to be set in accordance with NMW rates in order to avoid a reduction in programme places. Under the second situation, better enforcement of anti discrimination policy and the Disability Discrimination Act should be used to improve the match between disabled people and their jobs, alongside greater use of schemes like Access to Work which help towards the cost of adaptations. Under the third scenario there is an argument that in the medium to long term the loss of these jobs is no bad thing for the labour market as a whole, including disabled workers, despite the fact that some disabled employees suffer in the short term.

Exempting disabled employees from the NMW would be likely to increase discrimination against disabled people by giving a clear signal to employers and others that disabled workers can be treated less favourably. This is in direct opposition to the Disability Discrimination Act. The vast majority of disabled employees earning less than the NMW before it was introduced did not lose their jobs following its introduction (if there was an effect it was very small). The NMW, therefore, led to an increase in the wage of these low paid disabled employees, and increase in their earnings and, depending on the interaction with any benefit/tax credit receipt, an increase in their net income. Another reason for not exempting disabled employees from the NMW is that the majority of disabled employees were not earning less than the April 1999 NMW rate so exempting all disabled employees could not be justified. Even within groups of disabled employees with the same type of impairment by no means all were earning less than the NMW before its introduction. The administration of targeted exemptions would be too complex for serious consideration.

A much better approach would be to continue to keep disabled employees under the scope of the NMW legislation, improve the enforcement of the Disability Discrimination Act and to support disabled employees with very low intrinsic levels of productivity through supported employment programmes. Furthermore policy would be better targeted at correcting the low levels of skill and education among the disabled population, which is most often the root cause of low wages and high rates of non-employment.

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Table A1 Sample sizes in panel datasets

	Pre NMW panel				Span NMW panel			
	Men		Women		Men		Women	
	Disabled	Non disabled	Disabled	Non disabled	Disabled	Non disabled	Disabled	Non disabled
wage <sub>1</sub> < adult rate	36	291	104	988	38	266	97	839
NMW ≤ wage <sub>1</sub> < NMW*1.2	37	368	84	1059	27	301	102	930
NMW*1.2 ≤ wage <sub>1</sub> < NMW*1.4	52	517	63	975	64	472	70	886
NMW*1.4 ≤ wage <sub>1</sub> < NMW*1.6	41	619	65	798	72	571	69	806
NMW*1.6 ≤ wage <sub>1</sub> < NMW*1.8	51	657	47	686	41	678	56	701
NMW*1.8 ≤ wage <sub>1</sub> < NMW*2	46	627	41	591	49	578	35	546
wage <sub>1</sub> ≥ NMW*2	242	4665	153	2851	287	4589	158	2789
All employees in wave 1	505	7744	557	7948	578	7455	587	7497