DISABILITY AND SKILL MISMATCH

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ABSTRACT
This paper integrates two strands of literature on overskilling and disability using the 2004 British Workplace Employment Relations Survey (WERS). It finds that disabled workers are significantly more likely to be skill mismatched in the labour market and that the adverse effect of mismatch on earnings is particularly acute for this group. Giving workers more discretion over how they perform their work may significantly reduce these negative effects.

JEL Classification I0, J2, J3, J7, J24, J31

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I Introduction

This paper combines two strands of the labour economics literature, that dealing with the incidence and impact of disability, and that on the effects of skill mismatch. The literature on the first of these strands covers a number of issues. Using a consistent definition, the rate of self-assessed disability among the working age population has been shown to vary considerably among EU member states, from 6.6 per cent in Italy to 32.2 per cent in Finland in 2002 (Dupre & Karjalainen, 2003). However, the reliability of such international data has been called into question, since individuals in different countries may have different incentives to report disability, even when measured using identical survey questions.[1] Notwithstanding these problems, disability is numerically much more important in most countries, for instance, than membership of various ethnic minorities, an issue on which there is a much more extensive literature. Further, employment rates for disabled individuals are much lower than for the non-disabled, varying among OECD countries in the late 1990s for those of working age from 20.8 per cent in Poland against 71.2 per cent for the non-disabled, to 62.2 per cent in Switzerland against 79.1 per cent for the non-disabled (OECD, 2003). Understanding the reasons for this and for the disability earnings gap has preoccupied much of the existing literature. Following DeLeire (2001) and Jones, Latreille and Sloane (2006), it has become common to distinguish between work-limited and non-work-limited disabled, with the disability affecting the amount and nature of work that the individual can do only in the former case. This approach attempts to facilitate the distinction

[1] For example, based on evaluations of the health of hypothetical individuals in internet surveys, Kapteyn, Smith and van Soest (2007) use these so called vignettes to correct individual responses to questions relating to work disability in the US and the Netherlands. They find a higher rate of self-reported disability in the Netherlands than in the US, of which over half is explained by response scale differences.

between discrimination and the unobserved impact of disability on productivity as explanations for their labour market disadvantage. The evidence suggests the latter effect is more important (DeLeire, 2001; Jones *et al*., 2006).

The second strand of literature, on skill mismatch, has concentrated on overeducation (and to a lesser extent undereducation), with the main findings being that there are pay penalties to being overeducated (see Sloane, Battu & Seaman, 1999) and reductions in job satisfaction (see Battu, Belfield & Sloane, 1999; Chevalier, 2003; Fleming & Kler, 2007). More recently, studies have focused on overskilling as new data sets have become available which include a relevant question, such as the Household, Income and Labour Dynamics in Australia (HILDA) panel survey, the British Workplace Employment Relations Survey, 2004 and The Flexible Professional in the Knowledge Society (REFLEX) survey for a number of European countries (see Allan & Van der Velden, 2001; Green & McIntosh, 2007; McGuinness & Wooden, 2009; Mavromaras *et al*., forthcoming). These find strong negative effects of overskilling on both wages and job satisfaction.[2]

The relationship between education or skill mismatch and disability in the labour market has been largely ignored, even to the extent of not always controlling for disability in the regression analyses. One recent exception is Blazquez and Malo (2005), who use Spanish data from the European Community Household Panel 1995-2000. Their finding of no significant relationship between disability and educational mismatch is surprising given, as they note, that there are good reasons to expect the problem of overeducation to be more acute for disabled workers.

[2] Our results are consistent with the existing literature, though the job satisfaction results are not reported here for reasons of space.

As with other minority groups, employer discrimination would reduce the probability of employment, so that disabled individuals may be more likely to accept employment which does not fully utilise their skills or qualifications. Similarly, the unobserved productivity effect of a disability, by lowering productivity (for a given set of educational characteristics), would also reduce employment prospects. However, there is another line of argument, found in Battu and Sloane (2004). They suggest that, for ethnic minorities, spatial constraints on job search increase the probability of educational mismatch. However, constraints on job search for disabled individuals may be multidimensional, including not only geographical location, but also the physical (or emotional) demands of employment, hours of work and accessibility. These many induce disabled individuals to search in a smaller pool of jobs and be more at risk of accepting 'mismatched' employment. Moreover, it is also possible that onset of disability reduces an individual's ability to work and so increases their probability of being underskilled (conditional on remaining in the same job). In contrast, if onset of disability is accompanied by a transition into less demanding work, there may be a greater risk of overskilling.

In this paper we make use of WERS 2004 to assess the incidence of overskilling and underskilling for disabled workers, differentiated according to whether or not the disability is work limiting, compared to the effect on the non-disabled. We find that disabled workers are more prone to both overskilling and underskilling than the non-disabled. The adverse wage effect of overskilling is found to be particularly acute for the work-limited disabled.

II The Data

WERS 2004 is a cross-sectional data set involving a national sample of interviews with managers from 2,293 establishments with at least five workers. In addition, up to 25 employees at each workplace were randomly selected for the employee survey, giving a total of 22,173 usable responses.[3] Employees were asked: *Do you have any long-term illness, health problem or disability? By long-term, we mean that it can be expected to last more than one year*. Those who respond positively to this are also asked: *Does this illness or disability affect the amount or type of work you can do?* We define the work-limited disabled as those who have positive responses to both questions. Those who respond positively to the first, but not the second, question are defined as non-work-limited disabled, and those who do not have a long-term health problem form the non-disabled group.[4] This results in 11.9 per cent of employees being classed as disabled, with 4.5 per cent being work-limited and 7.4 per cent non-work-limited. These are lower than previous estimates of the population shares, consistent with the low rate of labour market participation among disabled individuals, and this should be borne in mind when considering the results presented in this paper. Unfortunately, it is not possible to control for the potential selection bias that may arise as a result of this since employees form the entire sample in WERS. However, recent UK studies which control for non-random selection into employment produce mixed results. Jones *et al*. (2006) find a significant selection effect on the earnings of women, but not men, while Madden (2004) finds it significant only among 'healthy' men.

[3] Unfortunately, the nature of the data means it is not possible to consider the dynamics or persistence of skill mismatch. However, Blazquez and Malo (2005) find that mismatch has particularly severe consequences for disabled individuals as they have a lower probability of leaving this state to become matched and have a higher probability of exiting this state to unemployment or inactivity.

[4] Individuals should only answer the second question following a positive response to the first. A small number of mutually inconsistent responses are dropped from the analysis.

Although self-reported information on disability has been extensively used in labour market analysis (see, for example, Jones *et al*., 2006), it has been subject to a range of criticisms. Self-reported information is subject to measurement error, which arises because the response scales may differ between individuals. Further, these responses may be affected by labour market outcomes. For example, individuals may use disability to justify their (inferior) labour market status (the so called 'justification bias' hypothesis). However, the existing literature also provides positive conclusions about the reliability of self-reported measures. For example, Benitez-Silva *et al*. (2004) note that subjective measures of disability have been found to be powerful predictors of a range of labour market outcomes; and a large proportion of the population in their own study were found to have comparable reporting of disability to thresholds used by the Social Security Administration. In this paper we do not focus on the participation decision and so we would expect the extent of any reporting bias to be smaller among employees. Further, we make use of the distinction between work-limited and non-work-limited disability, and there would seem to be less incentive to misreport the latter. Indeed, in previous work the non-work-limited disabled have been shown to have labour market outcomes far more similar to the non-disabled than the work-limited disabled (see, for example, Jones, 2006). There are, however, also wider issues of endogeneity which should be acknowledged because work may affect health (Lindeboom & Kerkhofs, 2009), though the precise size of such effects has been disputed (see Cai, 2009a, 2009b).[5] Indeed, when Madden (2004) controls for the selection into disability status when examining earnings discrimination in the UK he finds it makes little difference to the results.

[5] These studies typically use measures of health or health related behaviour to instrument disability status. However, no further information about health is available in WERS.

In WERS, employees were asked a direct question about overskilling, the advantages of which, relative to the typical measures of overeducation, are outlined by McGuinness and Wooden (2009). Specifically they were asked *How well do the work skills you personally have match the skills you need to do your present job?*. Their response is listed on a five point scale as *much higher*, *a bit higher*, *about the same*, *a bit lower* and *much lower*, enabling us to distinguish three categories – overskilled, matched and underskilled, based on the employees' own perceptions of their skills and those required to do their job.[6]

We do not attempt to estimate the extent of over- and under-*education* in this paper. Though it is possible to impute it using the empirical method, a substantial number of respondents have other vocational qualifications, which are difficult to interpret in relation to their level. However, consistent with previous evidence (see, for example, Jones *et al*., 2006), disabled individuals are significantly less likely to have a first degree, A levels or AS levels than the non-disabled, and significantly more likely to have no academic qualifications (see Table 1). Furthermore, the work-limited disabled are less well qualified than the non-work-limited disabled. These differences would reduce the likelihood of finding that overeducation was a more serious problem for disabled individuals. It is not possible, for example, to be overeducated if you have no qualifications, which is the case for roughly a quarter of disabled individuals.

[6] Overskilled includes *much higher* and *a bit higher,* whereas underskilled includes *a bit lower* and *much lower*. A complete list of descriptive statistics is contained in Appendix Table 1.

The main limitation of our overskilling variable is that, like our disability measure, it is subjective, which means the responses of individuals may not be directly comparable.[7] In what follows we treat the individual's subjective assessment as accurate. Although there may be a relationship between an individual's threshold for reporting disability and reporting a skill mismatch, the direction of such relationship is not obvious.[8] Comparisons between the non-work-limited disabled and the work-limited disabled in Table 2 indicate that both disabled groups are significantly more likely to report having "much higher" skills than those required to do their job than the non-disabled. However, since there are fewer economic incentives to misreport non-work-limiting disability, it would seem less likely that overskilling among this group is a result of reporting bias. In fact, if discrimination exists, one may argue that disabled employees are unusually better placed than their employers to assess their work skills and abilities. Returning to Table 2, it is interesting to note that a greater proportion of disabled workers also report being underskilled, but this sample is small and the differences are not significant. Finally, it is also important to highlight that differences in skills and abilities between the disability groups, for example, those which stem from the gap in educational attainment, do not necesssarily imply underskilling, since job requirements also vary and individuals are asked about their skills in relation to those required in their present job.

A couple of other features of the data are worth noting. Consistent with their lower average educational attainment there is evidence that a smaller proportion of the work-limited disabled are concentrated in occupations that typically have the highest skill

[7] Overeducation has also been measured subjectively in most studies and there is no evidence that individuals exaggerate the extent to which the job requires the level of education they possess.
[8] It is potentially the case that those who overestimate the extent of their disability also overestimate their skills.

levels (manager or senior official; professional; and associate professional). They are also more concentrated in manufacturing; transport and communication; and public administration sectors. Further, regardless of the precise measure, disabled individuals report having less influence over their job. For example, 34.1 per cent of work-limited disabled workers report having little or no influence over the *tasks you do in your job* compared to 25.9 per cent of the non-disabled; also, 23.1 per cent of work-limited disabled workers report having little or no influence over the *order in which you carry out tasks* compared to 17.0 per cent of the non-disabled.[9]

III Methodology

(i) Determinants of Mismatch

The first stage is to estimate the determinants of underskilling and overskilling, distinguishing between non-work-limited and work-limited disabled. Since there are three possibilities, the multinominal logit model seems appropriate. This estimates two sets of coefficients, β_1 (underskilled) and β_3 (overskilled). From these we can calculate the probability P_{ij} of an individual i being underskilled (j=1) or overskilled (j=3) conditional on a vector of characteristics x_i. The probability of individual i being in under- (over-) skill group j relative to the probability of being in the default group 2 (skill matched) is given by:

$$\frac{P_{ij}}{P_{i2}} = \exp[x_i^{'}(\beta_j - \beta_2)] \qquad \text{for } j=1,3. \qquad (1)$$

With normalisation of β_2 to equal 0 to permit identification of the model, the probabilities are:

[9] Preliminary analysis suggests this is not just a consequence of the types of jobs the work-limited disabled hold.

$$P_{i2} = \frac{1}{[1 + \sum_{j=1,3} \exp[x_i' \beta_j]]} \quad \text{for } j=2. \qquad (2)$$

$$P_{ij} = \frac{\exp[x_i' \beta_j]}{[1 + \sum_{j=1,3} \exp[x_i' \beta_j]]} \quad \text{for } j=1,3. \qquad (3)$$

WERS contains a rich set of covariates which, in addition to controls for disability status, include personal and workplace related characteristics. The controls for personal characteristics include gender, age, ethnicity (white or non-white), highest academic qualifications and marital status. We also control for work related characteristics including part-time employment, having a temporary contract, union membership, tenure, (log of) workplace size, whether the workplace is part of a larger organisation as well as sector, industry, occupation and region of work. All the reported estimates from the econometric models are unweighted; weighted regressions generally produce similar results.

(ii) The Effect of Mismatch on Earnings

Next, we estimated the effect on wages of being disabled or skill mismatched. Since usual gross weekly pay is banded into 14 groups, interval regression is the appropriate procedure, as the dependent variable is categorised and ordered and the cut-off points are known. Under such circumstances, OLS regressions using the mid-point of the pay band may generate inconsistent estimates (Stewart, 1983). In practice, OLS and the interval regression estimates produce very similar results so here we only present the former, which are easier to interpret. The midpoint of the pay band is adjusted for usual

weekly hours to create a continuous measure of hourly pay.[10] The resulting earnings function is given by:

$$\ln y_i = Z_i\varphi_1 + S_{i1}\varphi_2 + S_{i3}\varphi_3 + \eta_i \qquad (4)$$

where $\ln y_i$ is the log of the derived measure of hourly pay and Z_i contains personal and employment related characteristics including educational attainment, occupation and industry. Two dummy variables capture skill mismatch, namely, S_{i1}, which captures individuals who are underskilled and S_{i3} which captures those who are overskilled. Initially, variables for disability status are included in the earnings equations estimated on data pooled across the non-disabled, non-work limited disabled and work-limited disabled workers.

Because these are matched employer–employee samples, there is both a within-establishment error term variance and an across-establishment error term variance. Under such circumstances, random effects GLS is less biased than OLS (see Moulton, 1987). We also present random effects results for each of the three groups separately – the non-disabled, the non-work-limited disabled, and the work-limited disabled.[11]

[10] Examination of the resulting distribution of hourly earnings suggests a number of outliers where high hourly earnings are generated because a relatively short number of hours are reported. In a similar manner to Dolton and Pelkonen (2008), we trim 1 per cent off the upper and lower distribution of hourly wages and, reassuringly, the correlation between the derived pay measure and the mid point of the actual hourly pay measure (of which there are only 4 bands) is relatively high at 0.55.

[11] The results are qualitatively similar, if instead, we control for workplace fixed effects.

IV Results

(i) Determinants of Mismatch

Disabled workers are significantly more likely to be mismatched than the non-disabled group (Table 3), the effect being stronger for the work-limited disabled as shown by the marginal effects in relation to underskilling, which is not significant for the non-work-limited disabled. The work-limited disabled are nearly six percentage points more likely to report being overskilled than are the non-disabled. This is consistent with employers underestimating the skills of disabled workers and allocating them into less demanding roles.[12] Since disabled workers may find it more difficult to obtain a job, they appear more prepared to trade-off higher skills for employment. The greater prevalence of underskilling is also consistent with disabled individuals being more constrained in job search.[13]

In contrast to Frank (1978), we find that women are less likely to be mismatched than men. This finding may, however, reflect the self-assessed nature of our dependent variable and the greater tendency for men to overestimate their own skills and abilities (see, for example, Waldman, 1994). Older workers are less likely to be underskilled and more likely to be overskilled (though this is not reported in the table). Shorter durations of tenure are positively associated with being underskilled, while educational qualifications significantly increase the probability of being overskilled. Members of ethnic minorities are significantly more likely to be overskilled, again consistent

[12] Since both the work-limited and non-work-limited disabled have a higher probability of being overskilled, it suggests this is not entirely a consequence of differences in productivity but may reflect discrimination against the entire disabled group.

[13] It may also reflect a lack of employer sponsored training among the disabled. We did experiment by including training in the multinominal logit, but there is potential reverse causation, since the overskilled are less likely to be offered training. Its inclusion does not alter the main results discussed above.

perhaps with preparedness to trade-off skills to obtain a job. In contrast, single or married individuals, or those living with a partner, are less likely to be overskilled than those who are widowed, divorced or separated.

As regards to structural factors, overskilling is positively associated with working in a larger workplace, where perhaps management–worker relations are less close; and is less likely to be present in single establishments, where the reverse may apply. We also constructed an index of worker control over their jobs which combined the ability to influence tasks, the pace of work, how the individual does the work, the order of work and time of arrival and finish of work. This index was found to have a negative impact on the probability of being mismatched and seems also to have important implications for the design of jobs.

Though not reported in Table 3, the model includes a full set of controls for industry and occupation. Underskilling is significantly more prevalent in manufacturing; electricity, gas and water; and public administration, and less so in education than in the omitted sector (other community services). Overskilling is significantly less prevalent in construction; financial services; other business services; education; and health. The more skilled the occupation the stronger the probability of underskilling and the lower the probability of overskilling, consistent with job requirements being an important demand side influence on skill mismatch.[14] Interestingly, the inclusion of controls for occupation and industry do not affect the impact of disability on overskilling, consistent with it being the allocation of roles within the broad occupational and industry groups that is driving the disability effect.

[14] We also experimented with the inclusion of workplace level controls for disability policies and practices but the main results are not sensitive.

(ii) The Effects on Earnings

Table 4 presents the results of OLS and random effects earnings equations. Columns (3-5) split the sample into non-disabled, non-work-limited disabled and work-limited disabled respectively. The non-work-limited disabled suffer no wage penalty as a result of their status, consistent with the absence of an unobserved productivity effect. However, there is a significant wage effect of around five per cent for those who are work-limited disabled, being slightly smaller under random effects estimation. Similarly, there is no significant wage difference to being underskilled, but the overskilled suffer a significant wage reduction of around three per cent, consistent with the reduced productivity of an overskilled individual relative to an otherwise identical individual who is better matched. When the sample is split, the penalty to being overskilled is about two per cent for the non-disabled, six per cent for the non-work-limited disabled and 10 per cent for the work-limited disabled. This is not surprising since the extent of overskilling reported by the work-limited disabled is greater. However, even after controlling for the extent of overskilling, disabled workers face a greater wage penalty from being in any given overskilled status.[15] Importantly, this lends support for genuine overskilling amongst disabled workers since overskilling which arises from misreporting would not be associated with a wage penalty. Further, the larger penalty for overskilling among disabled workers is consistent with the arguments made above; that is, overskilled disabled workers may have more acute unobserved productivity, job search, or discrimination effects. The other variables behave as expected, but it is worth noting that the pay penalty for work-limited disabled

[15] Results are not reported but specifications were estimated with separate controls for being severely and moderately overskilled. As expected the wage penalty is greater for the severely overskilled.

women is less than for women in the other groups.[16] Further, the work-limited disabled suffer a much larger pay penalty for being employed in a single establishment employer and gain no pay benefit from being employed in the public sector. All groups benefit from an ability to control the nature of their work.

V Conclusions

It is well known that disabled individuals are less likely to participate in the labour market than the non-disabled, and that the work-limited disabled suffer a pay penalty. In this paper we consider the possibility that disabled workers may be more prone than the non-disabled to skill mismatch. This is, indeed, confirmed by our regression analysis, both with respect to underskilling and overskilling. We are able to confirm that there is a pay penalty to being disabled, but it is significant only for the work-limited disabled; and that the additional pay penalty to being overskilled (but not underskilled) is larger for disabled workers.

These results raise the questions of why employers would choose to hire disabled workers but not utilise their skills to the same degree as the non-disabled; and why disabled workers stay in jobs that do not fully utilise their skills. As to the first, employers may have low expectations about the capabilities of disabled workers and hire them only for less demanding jobs and/or offer them more routine tasks within any given employment. Alternatively, it may be that some employers require additional skills as compensation for hiring a disabled worker, either because of discrimination or unobserved productivity effects. As to the second, unlike the non-disabled group,

[16] The sole exception to this is the positive association between part-time work and hourly earnings. This appears to be a consequence of measurement error in reported hours of work. However, the key results discussed above are not sensitive to restricting the sample to full-time workers.

disabled workers may have fewer opportunities within the labour market and would therefore be more willing to accept this type of employment.

Clearly, further research is required to investigate these issues, and particularly to address the problems of measurement error and endogeneity associated with disability. Datasets combing information on labour market participation and health with detailed information on employment conditions and skill mismatch would assist here. Further, work that is also able to consider the dynamic nature of disability and mismatch is likely to enhance our understanding of their causes and persistence.

Our results suggest that reducing the extent of their mismatch in the labour market would improve the earnings of disabled employees. Employers could be encouraged to more formally assess the skills and abilities of disabled employees. However, the evidence also suggests that giving workers greater discretion over how they perform their work tasks would have similar results. Greater flexibility for disabled employees in this respect would seem consistent with the reasonable adjustment element of the UK Disability Discrimination Act, as well as providing potential benefits to both employees and employers.

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Table 1
Academic Qualifications by Disability Status.

	Highest academic qualification		
	Non-disabled	Non-work-limiting disabled	Work-limiting disabled
Higher Degree	6.64	6.14	5.85
First Degree	20.04	17.40**	14.68***
A level or AS level	15.02	13.14*	10.10***
GCSE level	25.69	25.92	24.45
Other	16.22	16.03	19.89**
None	16.39	22.37***	25.02***

Notes: Data are weighted. '*' '**' '***' denote significance from the non-disabled group at the 10 per cent, 5 per cent and 1 per cent level respectively.

Table 2
Skill Mismatch by Disability Status.

	How well do the work skills you personally have match the skills you need to do your present job?		
	Non-disabled	Non-work-limiting disabled	Work-limiting disabled
Much higher	21.02	25.50***	29.56***
A bit higher	32.25	31.69	29.97
About the same	42.37	37.87***	35.15***
A bit lower	3.68	4.08	4.26
Much lower	0.68	0.86	1.07

Notes: Data are weighted. '*' '**' '***' denote significance from the non-disabled group at the 10 per cent, 5 per cent and 1 per cent level respectively.

Table 3
Multinomial Logit Model of the Determinants of Skill Mismatch.

	Coefficients		Marginal effects	
	Underskilled	Overskilled	Underskilled	Overskilled
Constant	-1.502***	0.109		
	(3.88)	(0.68)		
Non-work-limited disabled	0.327**	0.225***	0.008	0.048***
	(2.33)	(3.72)	(1.33)	(3.35)
Work-limited disabled	0.634***	0.306***	0.020**	0.058***
	(4.01)	(3.99)	(2.51)	(3.27)
Female	-0.317***	-0.296***	-0.006*	-0.067***
	(3.61)	(7.87)	(1.75)	(7.39)
Tenure 1-2 years	-0.311**	0.196***	-0.014***	0.054***
	(2.38)	(3.31)	(3.91)	(3.87)
Tenure 2-5 years	-0.384***	0.009	-0.013***	0.010
	(3.51)	(0.17)	(3.98)	(0.79)
Tenure 5-10 years	-0.538***	-0.019	-0.017***	0.005
	(4.18)	(0.34)	(4.90)	(0.37)
Tenure more than 10 years	-0.469***	-0.116**	-0.014***	-0.020
	(3.69)	(2.07)	(3.58)	(1.46)
Any vocational qualification	0.108	0.265***	-0.001	0.064***
	(1.31)	(7.51)	(0.47)	(7.46)
Other academic qualifications	-0.053	0.355***	-0.009**	0.088***
	(0.36)	(5.96)	(1.98)	(6.31)
GCSE level qualifications	-0.063	0.569***	-0.014***	0.140***
	(0.44)	(9.97)	(3.13)	(10.62)
A level qualifications	0.002	0.748***	-0.015***	0.177***
	(0.01)	(11.56)	(-3.47)	(12.78)
Degree level qualifications	0.205	0.869***	-0.011**	0.201***
	(1.34)	(13.48)	(2.44)	(14.61)
Higher degree level qualifications	0.534***	0.952***	-0.003	0.205***
	(2.81)	(11.23)	(0.52)	(12.46)
Single	0.010	-0.184***	0.004	-0.046***
	(0.06)	(2.77)	(0.69)	(2.86)
Married	-0.103	-0.109**	-0.002	-0.025*
	(0.77)	(2.04)	(0.32)	(1.92)
Non-white	0.020	0.185**	-0.003	0.045***
	(0.12)	(2.55)	(0.55)	(2.64)
Log workplace size	0.040	0.039***	0.001	0.009***
	(1.57)	(3.73)	(0.72)	(3.50)
Single establishment	0.099	-0.119***	0.006	-0.032***
	(0.98)	(2.77)	(1.60)	(3.05)
Public sector	-0.122	-0.074	-0.003	-0.016
	(0.91)	(1.42)	(0.62)	(1.26)
Control index	-0.091***	-0.013***	-0.003***	-0.001
	(8.79)	(2.84)	(8.57)	(1.16)
Likelihood ratio χ^2	1045.51 [0.00]			
Observations	18770			

Notes: Data are unweighted. Model also includes controls for age, temporary contracts, part-time employment, trade union membership, presence of children and a full set of regional, occupational and industrial dummy variables which are not reported here. T statistics reported in parenthesis. '*', '**', '***' indicate significance at the 10 per cent, 5 per cent and 1 per cent level respectively. The base category is having correctly matched skills. The figure in square brackets is a p-value based on the likelihood ratio test where the null hypothesis is that the slope coefficients are jointly equal to zero.

Table 4
The Determinants of Hourly Earnings

	OLS	Random Effects GLS			
	All	All	Non-disabled	Non-work-limited disabled	Work-limited disabled
Constant	1.202***	1.204***	1.213***	1.084***	1.125***
	(46.57)	(36.53)	(35.60)	(9.77)	(7.92)
Non-work-limited disabled	-0.000	0.001			
	(0.01)	(0.16)			
Work-limited disabled	-0.057***	-0.047***			
	(4.75)	(4.18)			
Female	-0.128***	-0.114***	-0.116***	-0.130***	-0.095***
	(21.27)	(19.39)	(18.54)	(5.51)	(3.26)
Tenure 1-2 years	0.012	0.015*	0.012	0.014	0.070
	(1.26)	(1.69)	(1.27)	(0.36)	(1.32)
Tenure 2-5 years	0.046***	0.041***	0.042***	0.029	0.047
	(5.77)	(5.30)	(5.09)	(0.86)	(1.02)
Tenure 5-10 years	0.064***	0.066***	0.062***	0.058	0.092*
	(7.20)	(7.66)	(6.83)	(1.64)	(1.92)
Tenure more than 10 years	0.111***	0.109***	0.109***	0.070**	0.134***
	(12.37)	(12.48)	(11.71)	(2.03)	(2.83)
Any vocational qualification	0.040***	0.040***	0.037***	0.036	0.085***
	(7.04)	(7.38)	(6.46)	(1.61)	(2.99)
Other academic qualifications	0.085***	0.074***	0.078***	0.056*	0.042
	(8.87)	(8.07)	(7.88)	(1.67)	(1.05)
GCSE level qualifications	0.133***	0.112***	0.115***	0.127***	0.109***
	(14.49)	(12.73)	(12.11)	(3.84)	(2.64)
A level qualifications	0.201***	0.180***	0.181***	0.240***	0.157***
	(19.44)	(18.07)	(16.96)	(6.28)	(3.12)
Degree level qualifications	0.300***	0.262***	0.267***	0.296***	0.232***
	(29.25)	(26.33)	(24.92)	(7.83)	(4.84)
Higher degree level qualifications	0.356***	0.319***	0.321***	0.375***	0.351***
	(26.55)	(24.51)	(23.08)	(7.26)	(5.41)
Part-time work	0.027***	0.059***	0.060***	0.028	-0.003
	(3.72)	(8.44)	(8.09)	(0.97)	(0.09)
Trade union member	0.061***	0.059***	0.060***	0.054**	0.070**
	(10.11)	(9.37)	(8.98)	(2.41)	(2.44)
Single	-0.037***	-0.031***	-0.031***	0.003	-0.075
	(3.53)	(3.08)	(2.94)	(0.09)	(1.46)
Married	0.017**	0.015*	0.018**	0.025	-0.023
	(2.04)	(1.88)	(2.07)	(0.82)	(0.56)
Non-white	-0.072***	-0.057***	-0.060***	-0.023	-0.105*
	(6.29)	(5.04)	(5.07)	(0.46)	(1.81)
Log workplace size	0.021***	0.023***	0.022***	0.024***	0.028***
	(12.35)	(8.48)	(8.04)	(3.46)	(3.11)
Single organisation	-0.015**	-0.014	-0.007	-0.032	-0.106***
	(2.13)	(1.30)	(0.65)	(1.08)	(2.85)
Public sector	0.034***	0.039***	0.044***	0.052	-0.059
	(4.12)	(2.85)	(3.17)	(1.54)	(1.39)
Underskill	0.006	-0.004	0.000	-0.038	-0.002
	(0.45)	(0.30)	(0.03)	(0.80)	(0.04)
Overskill	-0.033***	-0.026***	-0.022***	-0.060***	-0.104***
	(6.32)	(5.25)	(4.19)	(2.96)	(4.01)
Index of control	0.013***	0.012***	0.012***	0.012***	0.009***

	(17.97)	(17.63)	(16.70)	(4.46)	(2.69)
F-test	342.49 [0.00]				
Wald χ^2		14169.39 [0.00]	13055.55 [0.00]	1233.28 [0.00]	664.27 [0.00]
Observations	18156	18156	15988	1343	825
R-squared (overall)	0.53	0.53	0.54	0.51	0.48
Number of workplaces	-	1717	1709	867	618

Notes: Data are unweighted. Model also includes controls for age, temporary contracts, presence of children and a full set of regional, occupational and industrial dummy variables which are not reported here. T statistics reported in parenthesis. '*', '**', '***' indicate significance at the 10 per cent, 5 per cent and 1 per cent level respectively. The figures in square brackets are p-values based on the F-test or Wald test where the null hypothesis is that the slope coefficients are jointly equal to zero.

Appendix Table 1
Descriptive Statistics

		Non-disabled	Non-work-limited disabled	Work-limited disabled
Log hourly pay	Log of hourly pay (midpoint band of weekly pay/usual weekly hours).	2.163	2.186	2.104
Overskill	Dummy variable equals 1 if employee reports their work skills are *much higher* or *a bit higher* than those required to do their present job; 0 otherwise.	0.528	0.570	0.592
Underskill	Dummy variable equals 1 if employee reports their work skills are *much higher* or *a bit lower* than those required to do their present job; 0 otherwise.	0.044	0.046	0.061
Female	Dummy variable if female; 0 otherwise	0.541	0.500	0.477
Single	Dummy variable if marital status is single; 0 otherwise	0.229	0.167	0.187
Married	Dummy variable if marital status is married or living with partner; 0 otherwise	0.673	0.728	0.707
Separated/divorced/widowed (omitted)	Dummy variable if marital status is either separated/divorced or widowed; 0 otherwise	0.098	0.105	0.106
Children	Dummy variable equals 1 if employee has dependent children; 0 otherwise	0.403	0.319	0.339
Non-white	Dummy variable equals 1 if non-white ethnic group (mixed, asian, black or chinese); 0 otherwise	0.061	0.044	0.048
Age 16-21 (omitted)	Dummy variable equals 1 if employee is aged between 16 and 21; 0 otherwise	0.064	0.027	0.026
Age 22-29	Dummy variable equals 1 if employee is aged between 22 and 29; 0 otherwise	0.164	0.095	0.078
Age 30-39	Dummy variable equals 1 if employee is aged between 30 and 39; 0 otherwise	0.262	0.158	0.199
Age 40-49	Dummy variable equals 1 if employee is aged between 40 and 49; 0 otherwise	0.266	0.268	0.295
Age 50-59	Dummy variable equals 1 if employee is aged between 50 and 59; 0 otherwise	0.202	0.365	0.331
Age 60+	Dummy variable equals 1 if employee is aged 60 and over; 0 otherwise	0.042	0.086	0.070
Tenure <1 year (omitted)	Dummy variable equals 1 if employee has been working at this workplace for less than 1 year; 0 otherwise	0.163	0.132	0.109
Tenure 1-2 years	Dummy variable equals 1 if employee has been working at this workplace for between 1 and 2 years; 0 otherwise	0.131	0.112	0.107
Tenure 2-5 years	Dummy variable equals 1 if employee has been working at this workplace for between 2 and 5 years; 0 otherwise	0.273	0.232	0.229
Tenure 5-10 years	Dummy variable equals 1 if employee has been working at this workplace for between 5 and 10 years; 0 otherwise	0.185	0.195	0.203
Tenure 10 years+	Dummy variable equals 1 if employee has been working at this workplace for more than 10	0.249	0.330	0.353

	years; 0 otherwise			
Any vocational qualification	Dummy variable equals 1 if employee has any type of vocational qualification; 0 otherwise	0.641	0.667	0.659
No academic qualifications (omitted)	Dummy variable equals 1 if employee's highest academic qualification is none; 0 otherwise	0.151	0.207	0.227
Other academic qualifications	Dummy variable equals 1 if employee's highest academic qualification is other (includes GCSE grades D-G); 0 otherwise	0.153	0.162	0.200
GCSE academic qualifications	Dummy variable equals 1 if employee's highest academic qualification is GCSE level (grades A-C); 0 otherwise	0.264	0.246	0.256
A level academic qualifications	Dummy variable equals 1 if employee's highest academic qualification is A level or AS level; 0 otherwise	0.150	0.133	0.110
Degree level academic qualifications	Dummy variable equals 1 if employee's highest academic qualification is degree level; 0 otherwise	0.211	0.188	0.149
Higher degree level qualifications	Dummy variable equals 1 if employee's highest academic qualification is higher degree level (masters degree or PhD); 0 otherwise	0.070	0.064	0.057
Temporary	Dummy variable equals 1 if employee is on a temporary or fixed period contract; 0 otherwise	0.079	0.069	0.065
Part-time	Dummy variable equals 1 if employee usually works less than 30 hours per week; 0 otherwise	0.220	0.196	0.249
Trade union member	Dummy variable equals 1 if employee is a member of a trade union or staff association; 0 otherwise	0.355	0.455	0.483
Occupation 1	Dummy variable equals 1 if employee's occupation is manager or senior official; 0 otherwise	0.114	0.117	0.085
Occupation 2	Dummy variable equals 1 if employee's occupation is professional; 0 otherwise	0.121	0.126	0.105
Occupation 3	Dummy variable equals 1 if employee's occupation is associate professional and technical; 0 otherwise	0.170	0.155	0.144
Occupation 4	Dummy variable equals 1 if employee's occupation is administrative and secretarial; 0 otherwise	0.190	0.187	0.187
Occupation 5	Dummy variable equals 1 if employee's occupation is skilled trades; 0 otherwise	0.066	0.065	0.098
Occupation 6	Dummy variable equals 1 if employee's occupation is personal services; 0 otherwise	0.089	0.086	0.086
Occupation 7	Dummy variable equals 1 if employee's occupation is sales and customer services; 0 otherwise	0.070	0.056	0.065
Occupation 8	Dummy variable equals 1 if employee's occupation is process, plant and machine operatives; 0 otherwise	0.071	0.089	0.104
Occupation 9 (omitted)	Dummy variable equals 1 if employee's occupation is elementary; 0 otherwise	0.110	0.119	0.128
Industry 1	Dummy variable equals 1 if employee works in the manufacturing industry; 0 otherwise	0.146	0.144	0.186
Industry 2	Dummy variable equals 1 if employee works in electricity, water and gas; 0 otherwise	0.018	0.019	0.022
Industry 3	Dummy variable equals 1 if employee works in the construction industry; 0 otherwise	0.047	0.038	0.049
Industry 4	Dummy variable equals 1 if employee works in the wholesale and retail trade; 0 otherwise	0.099	0.084	0.098

Industry 5	Dummy variable equals 1 if employee works in the hotel and restaurant industry; 0 otherwise	0.026	0.019	0.019
Industry 6	Dummy variable equals 1 if employee works in transport and communication; 0 otherwise	0.062	0.068	0.073
Industry 7	Dummy variable equals 1 if employee works in financial services; 0 otherwise	0.063	0.055	0.047
Industry 8	Dummy variable equals 1 if employee works in other business services; 0 otherwise	0.116	0.116	0.086
Industry 9	Dummy variable equals 1 if employee works in public administration; 0 otherwise	0.081	0.110	0.101
Industry 10	Dummy variable equals 1 if employee works in the education; 0 otherwise	0.121	0.118	0.107
Industry 11	Dummy variable equals 1 if employee works in health; 0 otherwise	0.159	0.181	0.161
Industry 12 (omitted)	Dummy variable equals 1 if employee works in other community services; 0 otherwise	0.061	0.050	0.050
Region 1	Dummy variable equals 1 if workplace is located in the North East; 0 otherwise	0.041	0.045	0.040
Region 2	Dummy variable equals 1 if workplace is located in the North West; 0 otherwise	0.137	0.140	0.140
Region 3	Dummy variable equals 1 if workplace is located in Yorkshire and Humberside; 0	0.092	0.096	0.119
Region 4	Dummy variable equals 1 if workplace is located in the East Midlands; 0 otherwise	0.067	0.070	0.070
Region 5	Dummy variable equals 1 if workplace is located in the West Midlands; 0 otherwise	0.097	0.087	0.092
Region 6	Dummy variable equals 1 if workplace is located in the East of England; 0 otherwise	0.091	0.082	0.093
Region 7	Dummy variable equals 1 if workplace is located in London; 0 otherwise	0.104	0.107	0.080
Region 8	Dummy variable equals 1 if workplace is located in the South East; 0 otherwise	0.124	0.119	0.112
Region 9	Dummy variable equals 1 if workplace is located in the South West; 0 otherwise	0.088	0.083	0.087
Region 10	Dummy variable equals 1 if workplace is located in Scotland; 0 otherwise	0.112	0.113	0.106
Region 11 (omitted)	Dummy variable equals 1 if workplace is located in Wales; 0 otherwise	0.046	0.059	0.058
Single establishment	Dummy variable equals 1 if workplace is a single independent establishment not belonging to another body; 0 otherwise	0.184	0.171	0.185
Public	Dummy variable equals 1 if public ownership; 0 otherwise	0.312	0.362	0.352
Log workplace size	Log of the total number of employees in the workplace.	4.764	4.803	4.814
Control index	Scale from 0-15 indicating greater control over nature of employment.[17]	9.966	9.865	9.167

Notes: Data are unweighted and relate to all available observations.

[17] Creating by summing the following: influence over tasks, over pace of work, over how work is done, over order of work and on start/finish time. Each is ranked from 0-3 where 0 indicates no control and 3 indicates a lot of control.