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**EMPLOYMENT RELATIONS OCCASIONAL PAPER**

# Disability, health and access to training

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# About this publication

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# Executive summary

Providing disabled people with adequate training is one of the main objectives of recent legislative measures against discrimination in the labour market for the UK. In fact, when affirmative policies make it difficult for the employers to discriminate in terms of pay levels, firms could use poor access to training to substitute low current wages with low future wages. Using the 2004 British Workplace Employee Relations Survey (WERS 2004), this paper analyses the determinants of training for disabled workers both at the individual and at the firm level.

We argue that employers' decisions on training for disabled people are based on estimates of the severity of their impairment based on the available information. We find that being disabled decreases the probability of being trained, but it has a negligible effect on the length of training. We also find that workers' expected tenure influences the amount of the investment in human capital and that firms provide training by relying on hard-to-observe characteristics as long as new information is made available.

## Aims and objectives

The United Kingdom was one of the first countries in Europe to adopt measures to combat discrimination against disabled employees in the workplace. While most of the European countries started addressing the problem just after 2000 in line with a general European concern, the UK Disability Discrimination Act dates back to 1995. However, in spite of such an effort on the legislative side, discrimination against ill and disabled people at the workplace does not seem to be a rare behaviour in Great Britain as shown by recent studies aiming at assessing the degree of enforcement of disabled people's rights (Grainger and Fitzner (2007), Casebourne et al (2006))

Unequal access to training for disabled people is a strategic issue to be addressed by policy makers, not only because it can hide a form of discrimination in future wages as stated by Lazear (1979), but also because it is can discourage participation of disabled people at the workplace. In line with such a need, the Disability Right Commission's agenda explicitly states among its key objectives "to enable disabled adults to renew and refresh their skills to gain employment and progress in their careers" (Disability Right Commission 2007).

This paper studies the provision of training for disabled people by stressing the importance of the contextual factors defining the working environment where the disabled people are employed. This information is crucial to understand how the presence of an impairment can influence the process of investing in human capital and how the implementation of anti discrimination

policies can help to ensure equal opportunities for each worker regardless his health status.

## Analysis and findings

Using the cross section part of the 2004 Workplace Employment Relation Survey (WERS 2004) a new and interesting dataset of British firms matched with a sample of employees working in each establishment, the paper argues that when available information is scarce, ill-health is perceived as a characteristic signalling “risky” i.e. workers who are perceived to be more likely to drop out of the labour force, thus making the investment in human capital unprofitable.

The statistical analysis is based on the idea that the process of investing in human capital can be divided in two parts the first one indicating whether the workers received training while the second part defining the actual amount of training he gets. In general, most of the model we apply lead to the conclusion that ill-health seems to be associated with a worse access to training while it does not seem to lead to a lower investment in human capital for the sub sample of trained workers. We believe it might be due to a lack of information such that the presence of a disability is perceived as a signal of a shorter expected tenure in the firm.

In the last part of the paper, we try to take into account the factors determining no investment in human capital in the cases in which the workers are suitable for the training. This can be read as a situation in which the lack of information is reduced: we find that in such a scenario there is a separation between a group of disabled people who get more training than non disabled people and another group of disabled people which does not get training at all.

We believe that our conclusions pose a challenge for policy makers who, on the one hand, must make it possible to each employee to declare his health status, on the other hand must set up a safety net aiming at preventing every form of discrimination against disabled people.

CHAPTER ONE

# Introduction

## 1.1 Motivation

The United Kingdom was one of the first countries in Europe to adopt measures to combat discrimination against disabled employees in the workplace. While most of the European countries started addressing the problem just after 2000 in line with a general European concern, the UK Disability Discrimination Act dates back to 1995. Despite this early adoption, discrimination against ill and disabled people at the workplace does not seem to be a rare behaviour in Great Britain.

A preliminary analysis by Grainger and Fitzner (2007) on the `first Fair Treatment at Work Survey' shows that long term illness and disability play a crucial role in explaining the episodes of unfair actions against employees. The authors point out that those having a long term illness or disability are twice as likely as other workers to have experienced unfair treatment in employment and a poor health condition is perceived by the respondents to be the first cause of discrimination.[1]

Moreover, among the FTWS respondents who declared they were aware of a colleague at their workplace being treated unfairly, 3.8 per cent cite poor health conditions as reason for such an unfair treatment. Finally long term ill or disabled workers are also more likely to be victims of bulling and sexual harassment. It is worth noticing that FTWS shows that unfair treatment on the basis of long-term illness seems to be twice as common as for disability, showing that a more complex analysis should be carried out.

Such a disadvantage persists although, according to the Employment Rights at Work Survey 2005, (see Casebourne et al. (2006)), 92 per cent of employees are aware of their rights under disability discrimination law. However, the same survey shows that experiencing some forms of illness or disability increases the odds of having had a problem at work.[2]

Dupre and Karjalainen (2003) point out that among European countries, only in Finland is the rate of reported disability over the total number of the working age population higher that the one for UK. Although such comparisons can be weakened by persistent cultural bias that affect reported disability (Banks et al.

[1] Unfair treatment is self reported by the employees. Grainger and Fitzner (2007) argue that the definition of `unfair treatment' has been chosen because of its being as broad and all-encompassing as possible. Such a definition does not necessarily imply discrimination

[2] The most common `problems' experienced were related to pay, being informed through written contract and statements about the terms and conditions of the job, taking rest breaks at work, number of working hours and days.

(2004)), the study shows that the conditions of disabled employees at work should be a matter of concern for the United Kingdom.

## 1.2 Aim of the paper

Using data from the 2004 British Workplace Employee Relations Survey, this paper studies the provision of training, with particular attention to the opportunities offered to people in poor health conditions.

Although legislative bodies and human rights agencies are concerned about the possibility of unequal access to training for workers in poor health, the topic has not been directly addressed in the economic literature. The literature on human capital has largely studied the determinants of training,[3] but the role of health status in determining workers' probability of getting training has often been neglected.[4] Analogously, the literature studying the impact of disability on labour market outcomes has mainly focused on explaining low employment ratios among disabled employees and wage differentials between disabled and non-disabled.

## 1.3 Summary

The paper is divided as follows. Section 2 presents the institutional and legislative framework; section 3 and 4 discuss the theoretical background and the previous evidence; sections 5, 6, 7, 8 and 9 present the econometric specification and the results; section 10 concludes.

[3] for a review see Acemoglu and Pischke (1999)

[4] Becker (1964) observes health is one of the determinants of workers' productivity, but he explicitly admit that the analysis of investment in health is beyond the scope of his work.

CHAPTER TWO

# Institutional and theoretical background.

## 2.1 Disability and training in the UK.

The most important piece of legislation in the United Kingdom dealing with the rights of disabled workers is the Disability Discrimination Act (DDA) introduced in 1995 and then updated thorough the following decade in response to the European legislation, as a consequence of the `Employment Equality Directive' (EU council directive 2000/78/EC).

The DDA defines as `disabled' someone having or having had `*a physical or mental impairment which has a substantial and long term adverse effect on his ability to carry out normal day-to-day activities'*. In order to meet the definition of disability under the DDA, the person must show that one of the day-to-day activities adversely affected involves one of the following capacities: mobility, manual dexterity, physical coordination, continence, the lifting or moving of everyday objects, speech, hearing or eyesight, memory, concentration, learning or understanding and perception of risk and danger. `Long term illnesses' are commonly considered those having lasted or being likely to last at least for 12 months. Such a categorization potentially includes those impairments having intermittent although repeated nature.

The DDA makes it unlawful for employers to discriminate against disabled employees for reasons related to their impairment, unless such discrimination can be justified. The DDA applies to recruitment and retention of employees, promotions and transfers, dismissals and training. It originally covered only employers having 20 or more employees but has been successively extended, first to employers of 15 or more employees (December 1998) and to all small firms (October 2004) and public bodies (2005).

In addition, in April 2000 the Disability Rights Commission (DRC) was set up with the aim of assisting disabled people and establishing the extent to which the legislation applied. The role of the DRC has been recently subsumed into that of the Equality and Human Rights Commission (EHRC) which, however, does not prevent the commission from setting up specific goals for disabled people. The DRC's Disability Agenda explicitly states among its key objectives `to enable disabled adults to renew and refresh their skills to gain employment and progress in their careers' (disability right commission (2007)). In particular, it suggests the

implementation of a `Skills Escalator' programme enabling disabled workers to increase their skills and gain higher skilled employment.

## 2.2. Theoretical background

There is a huge literature in economics studying the determinants of training and explaining why firms pay for it. The first piece of work analysing training as a form of investment in human capital is Becker (1964). There are two crucial features characterising the investment in human capital. The first one is that, unlike the investment in physical capital, investment in human capital is irreversible, since the skills imbedded in the workers cannot be sold in the market. Secondly, labour is a mobile production factor and it is almost impossible for the firms to retain those workers they have invested in. Moreover, when training is general, the returns of human capital can be enjoyed by future employers who do not bear the cost of the investment. As a consequence, firms must be very careful in evaluating workers' characteristics before undertaking the investment. In addition, for the firms to pay for training, there must be some frictions in the market preventing the workers to capture the whole returns to training.

There are a few reasons explaining why disabled employees could be less likely to receive firm sponsored training. The first one is prejudice (Becker (1959)) arising if employers are biased against disabled employees. The second is imperfect information which could lead to statistic discrimination (Phelps (1972); Aigner and Cain (1977); Lang (1986); Cornell and Welch (1996); Lundberg and Starz (1983)).[5] The state of the available information is relevant since the future productivity of the workers is not known before the investment, but it can only be predicted on the basis of observed actions or observed characteristics. According to Spence's terminology (Spence (1973)) I will call the former `signals' and the latter `indices'.

We can think that for disabled workers such a lack of information is even more pertinent, since the severity of the impairment can be rarely observed directly and it can often be assessed only by a professional. If the employer relates the presence of disability to a lower expected productivity, he can be less willing to offer firm sponsored training. Moreover, even if the employers are able to observe which workers have any impairment, they can hardly have a clear picture of their health status and of the consequences their condition might have on work related performances. In particular, even in the case where disabled employees have on average the same level of productivity as people in good health, we can reasonably suppose that the variance in their performance is higher than the one for non-disabled people. Oettinger (1996) observes that when workers' productivity can be evaluated only through a signal with known mean and variance, two different subgroups with the same expected productivity can be treated differently due to the difference in the variance of the returns of their work.

[5] for a comparison between the two groups see Arrow (1973) and Cain (1986)

For all the aforementioned reasons, it becomes interesting analysing the process through which the employers get information about employees' characteristics thus employees' suitability for training.

Altonji and Pierret (2001) analyse employers' learning and how information affects the outcomes for different subgroups of employers. The authors argue that, when firms hire new workers, they discriminate among them on the basis of easily observed characteristics, while, after getting new pieces of information about the quality of the employees, they start relying on hard-to-observe characteristics. In fact, over time firms observe noisy signals of the workers' productivity, making the initial information superfluous. In particular, the paper points out that employers' beliefs about workers' productivity can influence the amount of training, thus affecting future wages.

An important piece of information the firms must take into account in deciding their investment in human capital is the expected tenure of the workers. In fact, like any other form of investment, the cost of training must be counterbalanced by the stream of expected returns generated by the increase in the worker's productivity. The investment is worthy for the firms only if the increase in the productivity can be enjoyed for a period of time long enough to cover the cost of training.

Kuhn (1993) sets up a model in which firms match employees having different degrees of labour market attachment with available jobs by involuntarily discriminating on the basis of demographic attributes. In particular, shared investments in firm specific training are offered mainly to those having a higher exogenous probability of remaining in the labour market in the period following the training. The centrality of the probability of leaving the firm becomes the rationale for the idea of `delayed training' (Loewenstein and Spletzer (1997)). The authors show that it can be preferable for employers delaying training in order to get better information on the `quality' of the workers. Such behaviour may be optimal for the firms because it makes it possible for the employers to provide training only to those workers who are less likely to leave the job.

The importance of expected tenure of the workers is also discussed by Idson (1996) in order to explain why firm sponsored training is more frequent in large firms. The author argues that in large firms there is higher intra firm job mobility related to a longer duration of employment. Such a longer time horizon makes large firms more willing to provide training. Finally, Royalty (1996) estimates job-to-job and job-to-non employment probabilities as proxies for the estimated time horizon for the investment in human capital and she argues that workers differing in their labour attachment have different probabilities of receiving training.

The latter set of models becomes even more interesting if applied to workers in bad health. In fact, on one hand we can think that disabled employees have a higher probability of leaving the firm since they have a high probability of dropping out of the labour force due to the impairments they have. On the other hand, people whose impairment is not severe can be less likely to leave the firms since they have worse outside options due to their difficulty in finding another

suitable match.[6] For example, hiring a worker with an impairment can imply higher starting costs if disabled workers are able to perform a narrower range of tasks than non-disabled. This, for the former, makes the probability of mismatch to increases, thus making matching costs to rise. Moreover, hiring costs can rise due to the need of making workplace modifications to enable the disabled person to work. This type of costs allows the firm to capture part of the returns to training. (Acemoglu and Pischke (1998), Acemoglu (1997))

Finally, the firm decision strategy is affected by anti-discrimination policies. Lazear (1979) observes that when affirmative policies make it difficult for the firms to discriminate in terms of pecuniary wages, the employers try to substitute current wages with future wages. As a consequence, even where there is no difference in the current wages between subgroups, the difference in unobserved non pecuniary components of the wage tends to increase, since an unequal access to training can be viewed as an unequal access to future wage growth.

My paper is based on the idea that there exist `safe' and `risky' forms of investment. I consider `safe' an investment which guarantees a long expected stream of future revenues. In line with that, I distinguish between `risky' and `safe' disabled workers on the basis of their probability of leaving the firm. The former have severe impairments, thus a high probability of dropping out of the labour force due to illness. The latter, whose disability is not severe, display higher matching and mobility costs and lower job-to-job mobility due to poor outside options.

Since people's health condition is not completely observable, employers get only noisy signals of workers' quality. As a consequence, decisions on training for disabled employees are based on estimates of the severity of their impairment based on available information.
It has been already pointed out that expected tenure is a key variable in understanding the determinants of training. In fact, the longer is the time horizon of the investment in human capital, the higher is the net present value of such an investment. We expect employers to provide training to disabled employees only when they can be reasonably sure they are not undertaking a risky investment. In other words, I argue that training is selectively provided only to those disabled employees who are likely to have a lower probability of leaving the job.

If firms use Bayesian learning to make their choice, differences in the estimated future tenure between the two groups of disabled have further consequences. In fact, in a Bayesian setting, expectations about workers' probability of staying with the firms are based also on people's past job history. Hence, employers conclude that disabled employees who have been working in the same firm for long time must belong to the group of `safe' disabled, so they must have a low probability of leaving the firm.

[6] for a discussion of the impact of outside options on the probability of leaving the firm see Blackaby, Booth, and Frank (2005)

## 2.3. Previous evidence

A growing literature studies the consequences of disability on labour market outcomes, but, as far as I am aware, no one of the papers analyses explicitly the relationship between poor health and training. The low rate of employment among disabled employees and the wage gap between workers in good health and workers having any form of impairment made the literature to focus on the impact of disability on work participation, type of employment and earnings (for the UK see: Bardasi et al. (2000); Blackaby et al. (1999); Kidd et al (2000); Jenkins and Rigg (2003); Madden (2004), while for the US see: Acemoglu and Angrist (2001); Baldwin and Johnson (1994, 1995, 2000); Haveman et al (1991); Kruse and Schur (2003)) In general, all these pieces of work conclude that disability has a negative effect both on employment and on wages. Pelkowski and Berger (2004) find that temporary health problems have no significant effects on earnings. Nevertheless, I argue that even if a bad health condition does not affect current wages, it is likely to influence future wages if it is correlated with a lower access to training. This makes temporary impairments to have permanent effects in the long run.

Few papers study the relationship between disability and expected tenure, which is of primarily importance in our analysis. Baldwin and Schumacher (2002) focus on involuntary job changes. They observe that disabled workers have a higher probability than non-disabled workers to experience involuntary job changes. It can be due either to discrimination in firing or job mismatch among workers with disabilities. However, when other forms of job mobility are analysed, the authors do not find significant differences between disabled and non-disabled workers.

Using multinomial probit models on data from the National Longitudinal Survey of Youth (NLSY), Royalty (1996) estimates the determinants of job-to-job and job-to-unemployment turnover. She finds that bad health increases the probability of making the transition to unemployment for every group of workers, while it increases the probability of job-to-job turnover only for low educated employees. It is worth noticing that the data include also transitions due to layoffs. It can partially explain the results the author got for job-to-job turnover for people in bad health. In fact, low educated workers having a form of illness or disability are more vulnerable and they are more likely to experience downward job-to-job transitions. On the contrary, for more educated workers, disability lowers the probability of job-to-job turnover, since it narrows the range of available outside options.

Royalty (1998) studies the effect of the probability of job turnover on the probability of receiving training. The author argues that different degrees of labour market attachment create differential incentives for investment in human capital. In particular, she argues that health status does not influence the amount of offered training through a direct channel, but through labour turnover since poor health conditions affect the expected time horizon of the investment in human capital. Finally, the paper observes that those articles finding an effect of

tenure on training but not controlling for the expected time horizon of the investment may suffer from omitted variable bias.

Royalty (1998) provides a rare example of a paper discussing the impact of disability on training, although the consequences of poor health conditions are not the main focus of the work. Most of the remaining literature on the determinants of training has not studied the investment in human capital for disabled[7] and it has not even included health status among the explanatory variables. A partial exception to this lack of interest is Addison and Belfield (2004). Using WERS 1998, the authors study the variables influencing `training incidence' (whether the worker got trained in the 12 months before the interview) and `training intensity' (how many days of training he got). Although the main focus of the paper is not studying the impact of disability on training, Addison and Belfield include workers' health status among the controls and they found a positive (though not significant) effect of disability on incidence of training and a opposite effect (but still not significant) on the intensity of training. Hence, according to their results, ill-health does not seem to be an important determinant of training and the common concern about an unequal provision of training for disabled employees does not seem to be justified.

However, it is worth noticing that in WERS 1998 the question asking for the amount of training the worker got does not explicitly exclude health and safety training.[8] The choice of including health and safety training is meaningful for those who want to study the opportunities of training for disabled employees. Including health and safety training in the count of days devoted to investing in human capital can mask an unequal provision of training for people in different health status. In fact, if such kind of training is offered mainly to disabled workers, the distribution of the overall training turns out to be more equal than the distribution of those investments in human capital leading to increases in future wages.

[7] Instead, much emphasis has been given to the opportunity of training offered to other disadvantaged subgroups of workers such as low educated people, women and ethnic minorities (Lynch (1992); Arulampalam, Booth, and Bryan (2004) ; Blundell, Dearden, and Meghir (1996)) or to the impact of labour market institutions on human capital accumulation (Arulampalam, Booth, and Bryan (2004), Almeida-Santos and Mumford (2005), Booth and Böheim (2004); Booth, Francesconi, and Zoega (2003))

[8] while WERS 2004 does

CHAPTER THREE

# Data and sample description

## 3.1 WERS 2004

This paper uses the cross-section part of the 2004 Workplace Employment Relation Survey (WERS 2004). WERS 2004 cross-section survey is based on a stratified[9] random sample of British establishments having more than 5 employees and a random sample of employees within each establishment.

The sampling procedure of workplaces excluded firms operating in agriculture, hunting and forestry, fishing, mining and quarrying as well as all private households with employed persons and extra territorial bodies. As a consequence, the dataset covers workplaces belonging to the sectors of manufacture, electricity gas and water, construction, wholesale and retail, hotels and restaurants, transports and communication, financial services, other business services, public administration, education, health and other commercial services. Those firms selected for the 1998-2004 WERS panel dataset are also excluded.[10]

The primary unit sampling yielded a sample of 2,295 firms. In the responding workplaces a fixed number of employees was interviewed.[11] The final design yielded a sample of 22,451 workers.

[9] the strata are constructed on the basis on the basis of the SIC sector of activity and the IDBR recorded workforce size.

[10] WERS includes a set of matched employer-employees cross sections and a panel of firms. Firms contained in the panel are not surveyed for the cross sectional part

[11] for firms having less than 25 workers all the employees have been included in the sample, while for smaller firm a random sample of 25 workers has been drawn.

## 3.2. Selected sample

In line with the literature on WERS[12], I chose to include in our sample just private firms, since public and private firms are likely to face different incentives and to be exposed to a different degree of risk.

Private and public workplaces seem also to differ in a series of characteristics related both to disability and training. Descriptive statistics on managers' answers show that public firms have a higher percentage of disabled workers than private firms. Table 3.1 shows the distribution of the share of disabled employees for the two groups. We can see that 88 per cent of the managers employed in the private sector declare that no disabled employees work in their firm. In public sector firms such a percentage only exceeds 78 per cent.

**Table 3.1: number of disabled people**

| | private | | public | |
|---|---|---|---|---|
| percentage disabled | perc | cum | perc | cum |
| 0 | 88.08 | 88.08 | 78.59 | 78.59 |
| less than 1 percent | 1.14 | 89.22 | 1.59 | 80.18 |
| 1 to less than 2 percent | 1.46 | 90.68 | 2.96 | 83.14 |
| 2 to less than 3 percent | 1.27 | 91.95 | 3.23 | 86.37 |
| 3 to less than 4 percent | 1.27 | 93.13 | 3.23 | 89.6 |
| 4 to less than 6 percent | 1 | 94.13 | 2.15 | 91.75 |
| 6 to less than 10 percent | 2.08 | 96.2 | 3.95 | 95.69 |
| more than 10 percent | 3.8 | 100 | 4.31 | 100 |
| number of valid cases | | 1,601 | | 505 |

Not only are public and private firms different in their average number of disabled workers, but they also differ in the level of implementation of the policies against discrimination. The manager questionnaire contains an extensive section dealing with Equal Opportunities policies and practices in the workplace. The data summarised in table 3.2 show that in the public sector the practices promoting fair treatment at work for disabled employees are much more common than in the private sector.

[12] see, for example, Booth and Böheim (2004)

**Table 3.2: Policies against discrimination**

| | private | public |
|---|---|---|
| favouring applications of disabled | 5.75 | 31.1 |
| policy mentioning discrimination against disabled | 48.69 | 83.01 |
| monitoring recruiting and selection | 14.21 | 54.01 |
| reviewing recruitment and selection | 12.45 | 41.84 |
| monitoring promotions | 5.1 | 23.06 |
| reviewing promotions | 6.11 | 27.2 |
| reviewing relative pay rates | 2.01 | 11.5 |

When we look at the proportion of trained workers that emerges from the managers' questionnaire, we observe that in public firms 44.51 per cent of the managers declare that the whole workforce is trained, while in the private sector the same answer is given only by less than 27.00 per cent. Again, employers reporting no training at all are 26.04 per cent in the private sector and a tiny 4.31 per cent in the public sector (see table 3.3).

**Table 3.3: Proportion of trained workers**

| | private | | public | |
|---|---|---|---|---|
| proportion of trained workers | perc | cum | perc | cum |
| all (100%) | 26.95 | 26.95 | 44.51 | 44.51 |
| almost all (80-99%) | 5.33 | 32.28 | 11.41 | 55.92 |
| most (60-79%) | 7.31 | 39.59 | 9.49 | 65.41 |
| around half (40-59%) | 8.42 | 48.01 | 13.54 | 78.95 |
| some (20-39%) | 9.88 | 57.9 | 7.86 | 86.82 |
| just a few (1-19%) | 16.06 | 73.96 | 8.47 | 95.28 |
| 0 | 26.04 | 100 | 4.72 | 100 |
| number of valid cases | | 1,694 | | 566 |

Finally, not only do public firms offer training to a greater proportion of employers, but they also provide workers with longer programmes (table 3.4).

**Table 3.4: days of training**

| | private | | public | |
|---|---|---|---|---|
| days of training | perc | cum | perc | cum |
| no time | 2.03 | 2.03 | 0.22 | 0.22 |
| less than one day | 5.69 | 7.73 | 4.67 | 4.89 |
| 1 to less than 2 days | 27.64 | 35.36 | 15.4 | 20.29 |
| 2 to less than 5 days | 36.31 | 71.67 | 36.78 | 57.07 |
| 5 to less than 10 days | 14.85 | 86.52 | 25.85 | 82.91 |
| 10 days or more | 13.48 | 100 | 17.09 | 100 |
| number of valid cases | | 1,427 | | 525 |

I have also excluded those observations for which I did not have complete information on the variables of interest. The exclusion of missing records led to a 18.52 per cent decrease in the sample size. The distribution of the missing values does not present sharp differences across categories of respondents

although very young and older workers as well as workers belonging to ethnic minorities have lower response rate. Unsurprisingly, people in good health have a higher response rate than those having a disability, being the percentage of non respondents equal to 7.93 per cent for people in good health, 9.35 per cent for those having a non work limiting disability and 9.77 per cent for those having a work limiting disability. However, mean comparison tests suggest that the response rate is statistically different only when we compare people in good health and people living with a work limiting disability, while the intermediate categories do not seem to differ in this respect.

As a consequence, the broader sample I used includes 12436 workers clustered in 1177 firms.

## 3.3 Descriptive statistics

First of all I am interested in the proportion of disabled in the WERS sample. WERS describes health related conditions through single-item, global and self reported questions. Due to self reporting, the derived measure of disability must be considered subjective.

The data permit us to derive two alternative measures of disability.[13] The first definition is indicated by the acronyms LSI and it describes self reported Long Standing Illness or disability (LSI). The idea of LSI is meant to capture the negative effect of poor health as perceived by the respondent. The acronym for the second definition is WLD. It indicates a `Work Limiting Disability' reflecting the respondent's perception of his ability to carry out paid work. The question assessing WLD is always hypothetical in order to avoid an endogenous recording of health status. In fact, the respondents are asked to relate their health conditions to the type of job they can, might or could do.

In the WERS cross section of employees, health condition is assessed through two different questions. Workers are first asked whether they have a long term illness, health problem or disability[14] and then they are asked whether their illness or disability affects the amount or type of work they can do. Such a two step question, which allows a distinction to be made between two different classes of ill and disabled employees, was introduced in the last survey, since WERS 1998 used the LLSI definition.[15] This means that any comparison between the two surveys on estimates of disability must be done with caution.

The presence of two different but related questions regarding people's health status makes it difficult to create a measure of disability without making assumptions on the basis of their responses. In particular, I decided to exclude

[13] there are other two possible definitions which are not used here i.e. whether the respondent is covered by the Disability Discrimination Act (DDA disabled) and whether the individual has an impairment limiting him in his in their day-to-day life (LLSI: `Limiting Long Standing Illness or disability')

[14] where a `long-term' disability is defined is an illness, health problem or disability that can be expected to last for more than one year

[15] the exact wording of the 1998 survey is `do you have any long standing health problem or disability which limit what you can do at work, at home or in your leisure time?'

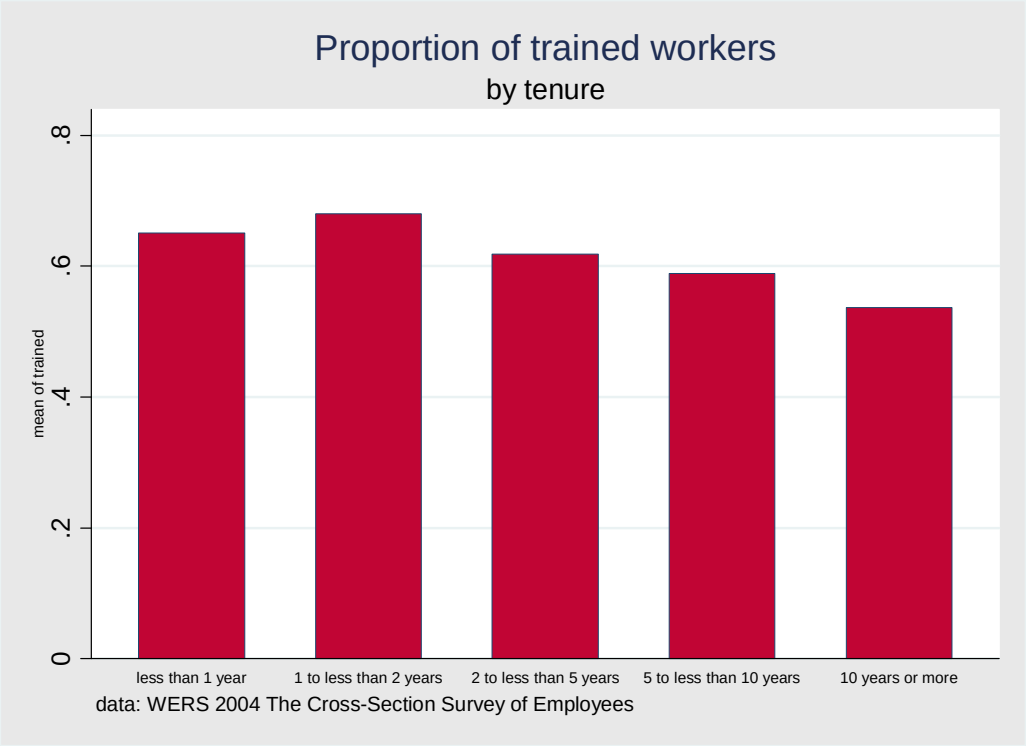
from my analysis those whose answers were not coherent i.e. those answering the question defining the consequences of the impairment on job performances after declaring they do not have a LSI. The appendix explains this choice and it compares the distribution I got with the estimates derived from other important surveys in the UK.

Table 3.5 sheds light on the health status of the workers employed in private firms. According to my data, more than 87 per cent are in good health, almost 5 per cent has a disability limiting the amount or the type of work they can do and the remaining 8 per cent has a long lasting illness which, however, does not affect job performances.

**Table 3.5: workers' health status in private firms**

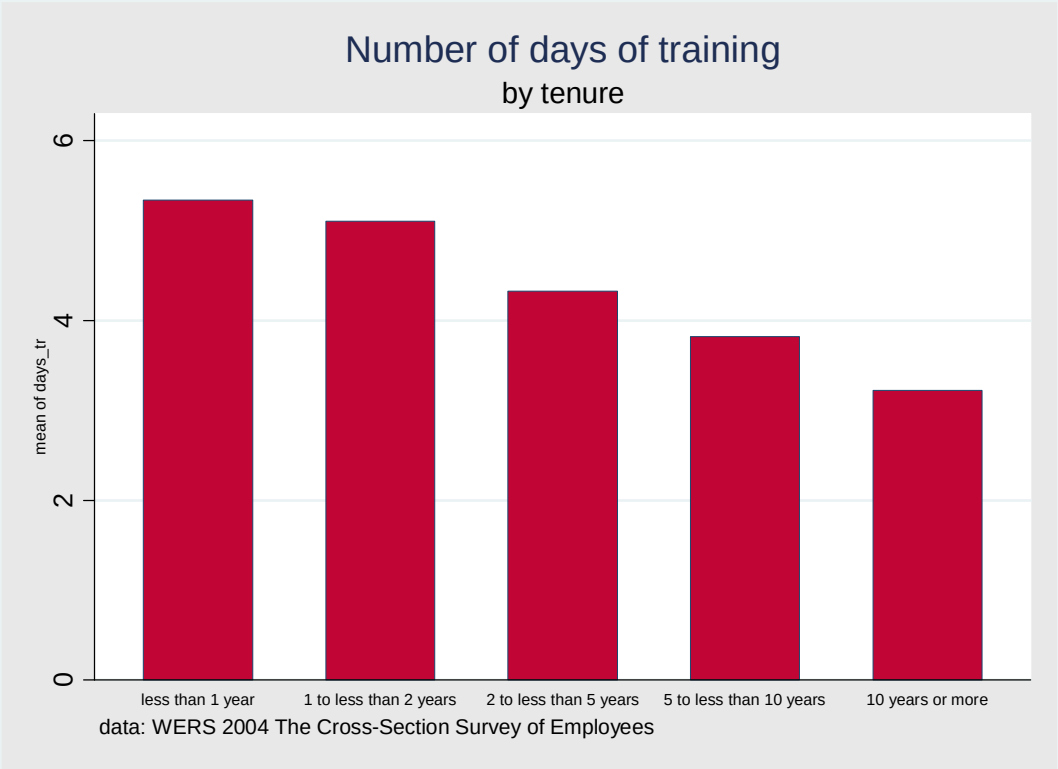
| health status | perc | cum |
|---|---|---|
| good health | 87.39 | 87.37 |
| work limiting disability (WLD) | 4.89 | 92.28 |
| non work limiting disability | 7.72 | 100 |
| number of valid cases | | 13,596 |

**Figure 3.1: proportion of trained workers by tenure**




In the previous paragraph I argued that actual tenure is an informative variable in explaining the provision of training. Figure 3.1 shows the proportion of trained workers in each recorded band of tenure. Unsurprisingly training is offered in the first part of people's career and it declines with tenure, however, such a relationship does not seem to be linear, given that the bigger investment in human capital seems to take place between the first and the second year of tenure.

**Figure 3.2: number of days of training by tenure**




When we look at the number of days of training (see figure 3.2), we get a similar pattern displaying a peak between the first and the second year in the firm and a decreasing trend after reaching the maximum. Such a stylised fact indicates that there is a type of training (not necessarily induction training) which is offered to the workers when they are still in the earlier part of their career, but they have spent some time in the firm.[16] It is in line with the idea that the employers prefer to delay training in order to collect more information on the quality of the workers (Loewenstein and Spletzer (1997)) Similarly, training taking place in the first year of tenure can be interpreted as a `screening device' as argued by Autor (2001).

If we analyse the provision of training by dividing the workers according to their health status,[17] we notice that the proportion of workers who are trained is lower for disabled people than for people in good health (see figure 3.3). It suggests that when health and safety training is excluded rom the calculus of the days devoted to increasing workers' human capital, the public concern about a lower access to training for people in bad health seems to be justified. Such a gap does not seem to change significantly with tenure.

[16] This training has not been necessarily provided after at least one year in the firm, however, being the respondents in their second year in the establishment, the information reported is unlikely to refer to the proper induction training which takes place in the very first few weeks after being hired.

[17] I have used the LSI definition of disability by putting together WLD and non WLD disabled

**Figure 3.3: Proportion of trained workers by tenure and health status**

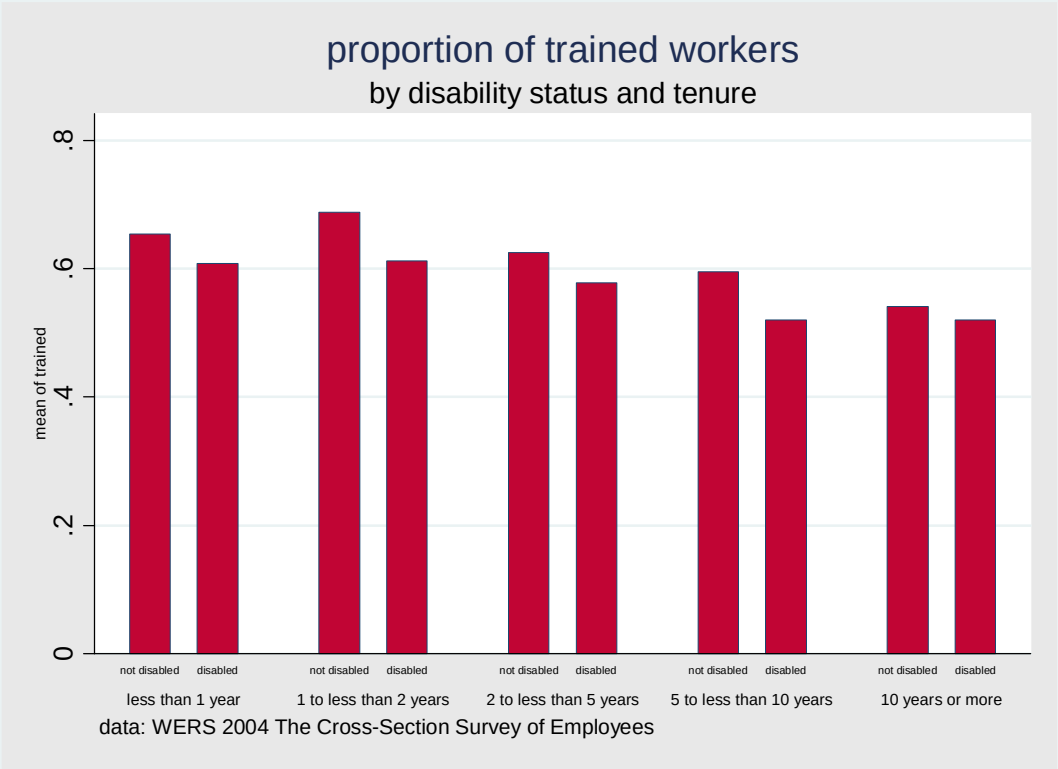
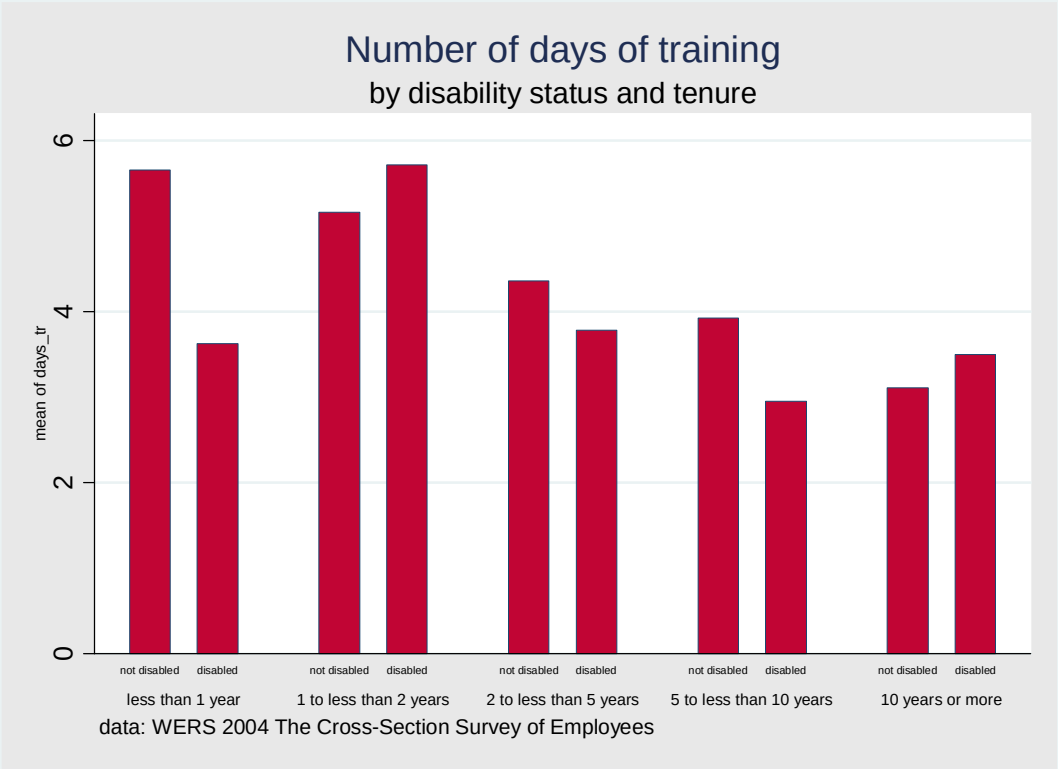



Figure 3.4 looks at the number of days of training offered to people in different health status. The gap between disabled and non-disabled employees is very large for newly hired, it almost vanishes between the first and the second year in the firm, then it appears again after the peak and declines with tenure.[18]

[18] the group of those having tenure between 5 and 10 years is the smallest group, which makes descriptive statistics for this band slightly unreliable

**Figure 3.4: number of days of training by tenure and health status**




It is not desirable drawing strong conclusions on the basis of figure 5.4. alone, given that some of the variance in the height of the bars is due to the upper value we used for the right censored band in the number of days of training (more than 10 days). However, the graph leads to think that there might be a postponement in the induction training for people with disabilities, which might explain both the huge gap between disabled and non disabled people for the days of training offered to people in their first year in the firm and the `catching up' which seems to take place in the case of people who are in their second year in the firm. An explanation for such a phenomenon could be that, when the employers do not have enough information about workers' `quality', they use disability as a signal of low productivity or poor labour attachment. This leads to a lower access to training for newly hired disabled worker and, perhaps, to a postponement of the investment in human capital for a sub sample of disabled employees.

CHAPTER FOUR

# Investing in human capital

## 4.1. A two parts process

The main intuition of this paper is that the process of investing in human capital can be divided in two parts: the first one indicating whether the worker got any training and the second one indicating how many days of training she got, conditional on being selected for training. As a consequence, the probability of receiving $\bar{x}$ days of training can be written as:

$$P\left(x=\bar{x}\right)=P\left(x>0\right)P\left(x=\bar{x}\mid x>0\right)$$

where $P\left(x>0\right)$ is the probability of getting any training and $P\left(x=\bar{x}\mid x>0\right)$ is the probability conditional to get a positive amount of training.

In line with part of the literature on training (see, for example, Addison and Belfield (2004) and Booth and Böheim (2004)), I will call the first part of the process `training incidence', while the second part `training intensity'. I believe that it is informative to study separately `training incidence' and `training intensity' since they are different in nature. In particular, the sub sample of those receiving training is not a random sample of the total workforce, but it is mainly composed by workers who are perceived to be `safe investments'.

My dependent variables are derived by using the question in WERS asking the employees: `*apart from health and safety training, how much training have you had during the last 12 months, either paid for or organised by your employer?'*. The possible answers are: `None', `Less than 1 day', `1 to less than 2 days', `2 to less than 5 days', `5 to less than 10 days', `10 days or more'. Training incidence is a dichotomous variable indicating whether the worker got any training. In my specification training intensity indicates the number of days the worker got, given that she got a positive amount of firm sponsored training. As a consequence, I excluded the null records and I focused on the observations reporting positive amounts of training.[19]

[19] In this choice, our paper is different from the previous literature

## 4.2 Explanatory variables and their expected coefficients

The independent variables can be divided in two groups: individual and firm characteristics.

Among the individual variables, the one we am mostly interested in is `disability' since the aim of the paper is studying whether and in which cases ill-health is associated with poor access to training. We mainly focused on the LSI definition of disability defining as `disabled' those having an impairment which lasted or it is expected to last for at least 12 months. We did this for two reasons. First the perception of disability is likely to depend partially on the respondent's occupation, as a consequence, using the WLD definition of disability introduces an additional potential source of endogeneity. Second, since disabled employees are a small percentage of the whole workforce, splitting them into two groups does not seem to be desirable, since the number of observation for each group becomes really tiny.

One of the most important variables is workers' actual tenure. As my descriptive statistics have shown, people's actual tenure seems to be important for understanding the provision of training for people in poor health. However, any statement about any causal effect of tenure on training must be made with caution, since the variable is clearly endogenous. Nevertheless, we think that the sign of the correlation between actual tenure and firm sponsored training is extremely meaningful in the case of people in poor health. Tenure is measured by using three dummy variables. The first one indicates whether the respondent has been working in the firm for a period of time ranging from one to two years. This is also the reference category since we have shown that in this time band there is a peak in the amount of training provided (whatever indicator is used) and the investment in human capital seems not to be different for workers in different health conditions.

Moreover, in order to exploit better the relationship between disability and permanence within the firm, I included also a set of interactions between disability and tenure which are meant to capture the changes in the effect of disability as long as the time spent in the firm increases.

The individual controls are: sex, age (in linear and in quadratic form), ethnicity, marital status, presence of dependent children, higher educational qualification and occupation (SOC 2000 major groups).[20]

Furthermore, we controlled for a dummy indicating whether in the twelve months before the interview the respondent has ever worked more than 48 hours a week (to control for absence).[21] The information on the extra hours worked is aimed at

[20] Controlling for education and occupation can hide the indirect effect of disability on training, since disabled employees are more likely to be less educated and to be in low-paid jobs (Hale et al. (1998); Blackaby et al. (1999)). However, we think that failing to control for those variables would lead to biased estimates

[21] the variable takes value equal to one if the worker has never done extra hours in the time span considered

capturing the time spent at work in the year before the interview in order to take into account not just the usual workload, but also the presence at work during the time span in which also training is recorded. It can be a (negatively related) proxy of the days lost due to poor health conditions. Workers in poor health conditions can be more likely to be excluded from training not only because their probability of being selected for training in a specific day is lower (for example because the firms think they are not a safe investment), but also because they simply have fewer available working days, since they are more likely to be absent from work as a consequence of their illness.

The WERS managers' questionnaire provides a broad set of firm specific variables permitting the analysis of the effect of firm level covariates on the decision of offering paid off-the-job training.[22] Perhaps the most important set of firm level variables is the one referring to the average expected tenure for workers in the firm since believe that the expected tenure of the worker helps to understand why firms invest in workers' human capital. In order to construct such a variable we used the managers' questionnaire where the employers are asked the extent in which they agree or disagree with the sentence: `*Employees are led to expect long-term employment in this organisation'*. The question is important not only since it sheds some light on the average expected tenure of the workers for each firm, but also because it gives some information on the way in which the tenure is perceived by the employers. Using information derived from the employers' side is informative, given that the variable determining firms' investment in human capital is not the actual tenure of the workers, but the expectation the managers have on that.

The answers to this question are recorded in five bands, depending on whether the manager declared to `strongly agree', `agree', `neither agree, nor disagree', `disagree' or `strongly disagree' with the sentence presented. I collapsed the first two and the last two categories and I divided the firms into three groups. In the first group (long tenure) we have included all those firms in which workers are likely to expect a long tenure, while in the second group (neither long nor short tenure) there are all those firms whose managers answered they neither agreed nor disagreed with the statement. Finally, in the last group, which is also the reference group for the dummy variables, we aggregated all those firms whose managers disagreed or strongly disagreed.

Being a subjective measure, the validity of the variable can be questioned. Figure 4.1 plots a raw measure of labour turnover for each group of expected tenure. WERS 2004 does not contain a direct measure of workers' turnover, but it reports the number of employees who left the firm due to dismissals, resignations, redundancies and other reasons including retirements. We think that the first three causes can be negatively correlated with tenure. Since the category `other

[22] studying the consequence of disability on people's life becomes even more important after the introduction by the World Health Organisation of the `biopsychosocial model of disability'. In fact, the `International Classification of Functioning, Disability and Health' (ICF) developed in 2000 provides a new standard framework for the analysis of health and health-related states and it emphasises the importance of the interaction between health status and environment where people live (see WHO (2002).

reasons' includes retirements, we suspect that this can be positively correlated with average expected tenure, being tenure closely linked to age.

We created the variable summarising the number of people who left the firm in 2003 by adding just dismissals, redundancies and resignations. Then we computed the mean of the variable for each of the three groups of expected tenure constructed according to what stated in the employers' questionnaire. Group number one in the x axis includes all the firm whose managers declared they either strongly agree or agree with the aforementioned question, group two includes all those firm where no clear answers were given and group three includes firm where workers are perceived not to expect a long tenure. The mean of the variable, computed for each group of declared expected tenure, has the expected behaviour, given that it is low for the group 1 and it increases monotonically for the following groups, thus giving evidence in favour of our measure for the expected time horizon of the investment.

**Figure 4.1: percentage of workers who left the firm in the year before the interview**


Moreover, we included a set of firm level variables indicating firms' attitudes towards training and disability. Among the former, the first set of dummies indicates the presence of direct forms of consultation about training between the employers and the employees and it is a measure of the possibility for the workers to influence directly the process of skill formation. In the WERS managers' questionnaire the workers are asked whether there exist `meetings between senior managers and the whole workforce (either altogether or group by group)', furthermore, they are asked to indicate the content of these meetings. A similar question assesses the presence of meetings where supervisors and line managers discuss with the workers they are responsible for. Finally, the

questionnaire asks if there are committees of managers and employees aimed at consultation rather than negotiation (`joint consultative committees', `works councils' or `representative forums') and the topics they mainly deal with.

Since alternative forms of direct participation display a great level of complementarity or substitutability, responses to the aforementioned questions are likely to be highly correlated. As a consequence, we aggregated them in a set of three dummy variables. Therefore, we divided the firms in three groups. The first group is composed by all the firms where there is no form of direct consultation or negotiation. The second group includes those workplaces where there is at least a meeting or a committee where employers and employees can interact directly but training is not among the topics discussed. The third group indicates the firm where there are both direct consultation through meetings or committees and discussion about training. The last group is also the reference category.

Obviously direct consultation is not the only channel through which employers and employees interact. WERS contains information also about the use of representative bodies. In particular, the managers' are asked whether there is any form of bargaining with the employees' representatives on a set of topics including training. A scale of different degrees of interaction is used, ranging from `no interaction at all' to `negotiation of training'.[23] The question is asked twice: the first time referring to unions and the second time referring to non union representatives. We created a variable indicating whether there exists any form of negotiation on training between employers and either union or non union employee representatives.

We have also created a variable summarising firms' attitude towards fair treatment at work with a particular focus on disability.[24] I have first considered if firms have a formal written policy on equal opportunities explicitly mentioning disabled people among the protected categories. Moreover, I have considered the following anti discrimination actions: whether recruitment, selection and promotion procedures are monitored and reviewed in order to identify indirect discrimination by disability, whether relative pay rates are reviewed by disability and whether in filling vacancies the firm has any special procedure for encouraging the application of disabled people.

Since the above are likely to be different aspects of a more general commitment of the firm against disability, I used factor analysis to create a common factor describing firms' anti-discrimination behaviour which can be used in place of the single variables to avoid multicollinearity. Table 4.1 shows the contribution of each analysed practice in the determination of the common factor. It also shows that in the main the extracted factor summarises data very well.

[23] The intermediate steps are `the managers inform representatives about training' and `the managers consult representative about training'.

[24] In order to derive it, I used the section in the employers' questionnaire called `fair treatment at work' which was highly improved in the 2004 cross section. The section contains rich information about the degree of implementation within the firm of different policies against discrimination against people in poor health.

**Table 4.1: Factor analysis for the variable describing the degree of discrimination against disabled**

| Eigenvalue | 2.662 | | |
|---|---|---|---|
| | factor loadings | Uniqueness | Scoring coefficients |
| written policy | 0.307 | 0.906 | 0.062 |
| monitor recruitment | 0.682 | 0.535 | 0.213 |
| review recruitment | 0.726 | 0.473 | 0.234 |
| monitor promotions | 0.759 | 0.424 | 0.27 |
| review promotions | 0.76 | 0.422 | 0.274 |
| review relative pay rates | 0.481 | 0.768 | 0.093 |
| fill vacancies | 0.436 | 0.81 | 0.092 |

Although anti discrimination practices are very unlikely to influence directly the overall training, the variable has been included in order to control for unobserved firms' attitude towards disability. In fact, in order to avoid biased estimates of the coefficient for disability, the unobserved firm effect, after controlling for the covariates at firm level, must be uncorrelated with the variable of interest.

Finally, I controlled for firm size (in linear and quadratic form) and for a variable indicating the average period of time it takes for the newly hired to become able to do their job as well as more experienced workers already employed in the firm.[25] This variable can be interesting for two reasons. First of all, it can measure the average complexity of the task performed in the firm. Following Schumacher and Baldwin (2000), we argue that there could be endogenous sorting of disabled people in less complicated jobs. Hence, when omitted requirements of the job are correlated with disability status, the estimates of the effect of health condition on the outcomes in the labour market can be biased.[26] The second reason observes that the time it takes for a new hired employee to become as skilled as an experienced worker is correlated with training. Loewenstein and Spletzer (1999) use the number of weeks it takes until a new hired becomes fully trained as a control in an equation analysing the determinants of training. The authors interpret the variable as a proxy of on-the-job training and they find a positive relationship between job complexity and actual training. If interpreted as a proxy of the amount of on-the-job training, a positive correlation implies a form of complementarity between on-the-job and off-the-job training.

[25] in the tables it is called `difficulty'

[26] the paper focus on wage differentials, but the argument can be reasonably extended to other outcomes in the labour market.

CHAPTER FIVE

# Empirical Analysis

For the empirical analysis we use a set of different econometric models whose common characteristic is separating the two parts of the process of investing in human capital. The first set of models exploits the multilevel nature of my data since the individual observations are nested into firms. The second set of models follows Cragg (1971), but it explicitly accounts for the fact that days of training are recorded in bands.

## 5.1 random intercept and random coefficient models

Let $y_{ij}^{*}$ be the latent variable indicating the propensity of receiving training. We can now define two new variables for training incidence $y_{ij}$ and training intensity $\tilde{y}_{ij}$. The former takes only two possible values (0 and 1), while the latter can take 5 different values corresponding to each of the positive intervals in which the data are recorded.

I have estimated $y_{ij}$, through logit models. The latent variable specification for the logit is the following:

$$y_{ij} = \begin{cases} 1 & if \quad y^{*}_{ij} > 0 \\ 0 & if \ otherwise \end{cases} \qquad (1)$$

$\tilde{y}_{ij}$ has been estimated through ordered-logit models using only positive records. The formula for ordered logit is:

$$\tilde{y}_{ij} = \begin{cases} 1 \ if & y^{*}_{ij} \le \kappa_1 \\ 2 \ if & \kappa_1 \le y^{*}_{ij} \ge \kappa_2 \\ 3 \ if & \kappa_2 \le y^{*}_{ij} \ge \kappa_3 \\ 4 \ if & \kappa_3 \le y^{*}_{ij} \ge \kappa_4 \\ 5 \ if & \kappa_5 \le y^{*}_{ij} \end{cases} \qquad (2)$$

where $\kappa_1$, $\kappa_2$, $\kappa_3$, $\kappa_4$, $\kappa_4$ are the thresholds, 1-5 are the possible outcomes: less than one day of training, one to less than two days, two to less than five days, five to less than ten days, ten days or more.

For each model I have allowed for two types of firm specific random effects: a linear one determining a random intercept and a multiplicative one which takes the form of a random coefficient for the variable disability. The rationale for this

second random effect is studying whether, after controlling for the relevant firm specific characteristics, firm specific unobserved characteristics make poor health status to have differential consequences on training.

The equation for the latent variable measuring the `propensity for receiving training' can be written as follows:

$$y^{*}_{ij} = \left(\beta_1 + \zeta_{1j}\right) + \left(\beta_2 + \zeta_{2j}\right)d_{ij} + \overline{\beta}'_3 \overline{x}_{ij} + \overline{\beta}'_4 \overline{x}_j + \varepsilon_{ij} \quad (3)$$

or

$$y^{*}_{ij} = \beta_1 + \beta_2 d_{ij} + \overline{\beta}'_3 \overline{x}_{ij} + \overline{\beta}'_4 \overline{x}_j + \zeta_{2j} d_{ij} + \zeta_{1j} + \varepsilon_{ij} \quad (4)$$

Where $d_{ij}$ is the dummy variable indicating the health status of person *i* in firm *j*, $\overline{x}_{ij}$ is a vector of individual and match specific covariates describing worker *i* in firm *j*, $\overline{x}_j$ is a vector of firm specific covariates for firm *j* and $\varepsilon_{ij}$ has a standard logistic distribution (with variance equal to $\pi^2$).

$\zeta_{1j}$ is a firm specific random intercept i.e. the deviation from the mean intercept $\beta_1$ due to firm characteristics. $\zeta_{2j}$ is the random slope i.e. the firm specific deviation from the mean slope $\beta_{2j}$ .

Variances and covariance between the two random effects are:

$$Var\left(\zeta_{1j}\right) = \psi_{11} \quad (5)$$

$$Var\left(\zeta_{2j}\right) = \psi_{22} \quad (6)$$

$$Cov\left(\zeta_{1j}, \zeta_{2j}\right) = \psi_{21} \quad (7)$$

Moreover, we also have:

$$\beta_1 = 0 \quad (8)$$

where (8) is the usual restriction for ordinal logit for identifying the thresholds.

Comparing dichotomous logit and ordered logit models suggests a strategy for the identification of causal effects. Controlling for a large set of covariates is not always desirable, therefore, even controlling for observed firm and individual characteristics, there might be still some potential source of endogeneity, due to an omitted variable problem.
In this paper we are not interested in the effect of disability *per se* on training, but we want to study how the effect of disability changes when more information is

made available and when a selected subgroup of workers is taken into account. In this way, we do not need to assume complete exogeneity but only that the potential endogeneity has a comparable effect across all the stages of the process.

***Results***

I analysed training incidence and training intensity allowing both for a single linear firm effect and for two firm effects: a random coefficient and a random intercept. The results are contained in tables 5.1, 5.2., 5.3. and 5.4 . The models in column (1) include only few individual variables: age, sex, ethnicity and disability i.e. those characteristics which are thought to be related with some form of discrimination. The results in column (2) refer to a more complicated model including the full set of covariates at the individual level, finally column (3) contains the full model using both individual and firm specific characteristics.

Random coefficient and random intercept models yield exactly the same results in terms of size and significance of the coefficients. The main difference is that, in the case of random coefficient models, few additional parameters are estimated and they include the variance of the multiplicative effect and the covariance between the two unobserved firm effects. The estimated values for the variance of the second random effect suggest that the random coefficient model does not seem to fit the data better that the simple random intercept model. However, in order to prove it formally, I tested the null hypothesis of zero variance for the multiplicative random effect.

Since the random intercept model can be seen as a restricted version of the random coefficient model, I used a likelihood ratio test comparing the value of the likelihood in the two specifications (Table 5.1 summarises the results). The main problem for this test is that the hypothesis that the slope of the coefficient for disability does not vary across firms lies at the boundary of the parameter space, as a consequence, the usual chi-square test with two degrees of freedom for the two additional parameters (variance of the second random effect and covariance between the two effects) cannot be used. The solution suggested by Snijders and Bosker (1999) is dividing the p-value by two, thus making less restrictive the criteria leading to reject the null. However, the minuscule values I got for the test statistics especially for training incidence, is not high enough to make the hypothesis of using random coefficient attractive.

**Table 5.1: random intercept and random coefficient models**

| incidence | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | |
| | r.i. | r.c. | r.i. | r.c. | r.i. | r.c. |
| log likelihood | -8224.23 | -8223.83 | -7834.97 | -7834.6 | -7473.41 | -7473.11 |
| var(1) | 1.231 (0.086) | 1.256 (0.092) | 0.953 (0.073) | 0.973 (0.078) | 0.827 (0.067) | 0.844 (0.072) |
| var(2) | | 0.007 (0.015) | | 0.006 (0.014) | | 0.005 (0.014) |
| cov(2,1) | | -0.091 (0.101) | | -0.078 (0.091) | | -0.067 (0.087) |
| cor(2,1) | | -1 | | -1 | | -1 |
| LR test | 0.810 | | 0.742 | | | |
| intensity | | | | | | |
| | (1) | | (2) | | (3) | |
| | r.i. | r.c. | r.i. | r.c. | r.i. | r.c. |
| log likelihood | -12411.2 | -12411.2 | -12070.3 | -12070.3 | -11547.7 | -11547.5 |
| var(1) | 0.400 (0.041) | 0.399 (0.043) | 0.368 (0.040) | 0.371 (0.042) | 0.330 (0.040) | 0.339 (0.040) |
| var(2) | | 0.000 (0.000) | | 0.001 (0.004) | | 0.005 (0.013) |
| cov(2,1) | | 0.00 (0.056) | | -0.01 (0.056) | | -0.04 (0.056) |
| cor(2,1) | | 1 | | -1 | | -1 |
| LR test | 0.004 | | 0.07 | | 0.502 | |

**Table 5.2: training incidence**

| | incidence | | |
|---|---|---|---|
| type | min var | individual | firm |
| sample size (lev2) | 13379 | 13071 | 12548 |
| sample size (lev1) | 1238 | 1235 | 1177 |
| age | 0.001 | 0.005 | -0.001 |
| age squared | 0.000** | 0.000 | 0.000 |
| male | 0.220*** | 0.146*** | 0.143*** |
| ethnic minority | -0.041 | -0.098 | -0.073 |
| disabled | -0.135** | -0.334* | -0.372* |
| tenure shorter than 1 yr | no | -0.189** | -0.165** |
| tenure longer than 2 yrs | no | -0.372*** | -0.393*** |
| disabled*<1y tenure | no | 0.225 | 0.208 |
| disabled*>2y tenure | no | 0.254 | 0.281 |
| individual controls | no | yes | yes |
| long expected tenure | no | no | 0.076 |
| neither long nor short expected tenure | no | no | 0.090 |
| any meeting, no training | no | no | -0.338*** |
| no meetings, no training | no | no | -0.930*** |
| training negotiated wt representatives | no | no | 0.207 |
| no discrimination | no | no | 0.203*** |
| firm specific controls | no | no | yes |

note: * significant at 10%; ** significant at 5%; *** significant at 1%, standard errors in parentheses

Tables 5.2 and 5.3. show the results I got by running random intercept logit/ordered logit models for the variables `training incidence' and `training intensity'.[27] In the model studying training incidence (see table 8), disability is associated with lower access to training.[28] If the employers think that, on average, disabled people have a higher probability of leaving the firm, they will offer less training to workers in poor health.[29] This could explain the negative and significant coefficient we found for training incidence. The coefficient on disability becomes even more negative when the individual controls are added and it further decreases in the model including firm level variables. The drop in the coefficient for disability after taking into account the characteristics of the workplace suggests that disabled people tend to select into firm providing a greater amount of training, however, such an effect is small in size.

The coefficients for the dummy variables indicating the respondent's tenure are both negative and statistically significant, thus confirming what shown by my descriptive statistics i.e. that the peak in the proportion of those receiving training is reached in the period of time between one year and two years of tenure. However, the most negative coefficient is found for the group of those having longer tenure indicating that some form of induction training takes place in the first year of tenure and that the incidence of the investment in human capital decreases for workers who have been working in the firm for long time.

The coefficients for the interaction terms are positive but non statistically significant, suggesting that the probability of getting trained for disabled employees does not change over time. Analogously, expected tenure does not seem to play a role in determining the probability of being trained, given that neither of the two variables indicating the length of the expected time horizon of the investment turns out to be significant (although both have the expected sign). Again, the probability of being trained is positively associated with the existence of meetings where training is directly discussed, while negotiation with union and non union representatives is not statistically significant.

The individual and the firm specific controls have in general the expected sign, which does not change across specification. However, for some of the firm level variables commonly used in the literature: firm size (see: Adams (1970); Schumacher and Baldwin (2000); Holtmann and Idson (1991); Brown (1990); Dunne and Schmitz (1995); Barron, Black, and Loewenstein (1987)) and `difficulty of the job' (Loewenstein and Spletzer (1999)) we found minuscule coefficients. The first result suggests that, once we control for differences in the organisational practices implemented in the workplace, firm size *per se* has a negligible effect. The real importance of the effect is, obviously, not clear, given that scale economies for large firms can be associated with the use of practices favouring training. It means that firm size influences training at least through an indirect channel. However, it seems that controlling only for firm size hides much of the heterogeneity at firm level, which can be correlated (although not

[27] the complete results (tables 18 and 19) are shown in appendix.}

[28] this is in contrast with what Addison and Belfield (2004) found for WERS 1998, however the question contained in WERS 1998 does not explicitly exclude `health and safety training'. This could mask the real process of investing in human capital for disabled people

[29] It applies also if disabled do not have lower productivity than non-disabled

necessarily due) to firm scale. The coefficient associated with my measure of the difficulty of the job is unsurprisingly positive, showing that more difficult jobs require also greater amount of off-the-job training. If, as suggested by Loewenstein and Spletzer (1999), we interpret the variable as a proxy for `learning-by-doing', the result shows that there is complementarity rather than substitution between the two forms of investment in human capital.

If we look at training intensity (table 5.3.) we can notice that most of the variables of interest have a different behaviour in the two parts of the process.

## 5.2 estimating the two processes jointly

The previous section suggests that the variables determining training incidence and training intensity are indeed different, however, it seems that, after controlling for the rich set of firm level variables, unobserved firm effects, especially multiplicative firm effects for the variable disability seem to play a minor role. Moreover, the previous approach has the disadvantage of limiting the sample size for the study of training intensity since only positive records are used. Finally, ordered logit do not really allow taking into account the differences in the actual number of days of training since they rely on rankings rather than on quantities. The following models use the whole sample size for both training incidence and training intensity while exploiting the variation in the length of training programmes. All the models from this section onwards are estimated through maximum likelihood.

The first model we estimate is the simplest possible. The decision leading training incidence is estimated through a probit model, while the process determining training intensity is represented by a standard regression modified to take into account of the bounded nature of my data and obviously truncated at zero. The main drawback of this model is that it might not be appropriate when the distribution of positive records is skewed. The second model addresses this problem by adding to the initial probit model a logarithmic regression which fits data which are both positive and positively skewed (see figure 5.1.). Also this model uses interval regression for fitting bounded data.

**Figure 5.1: distribution of training**

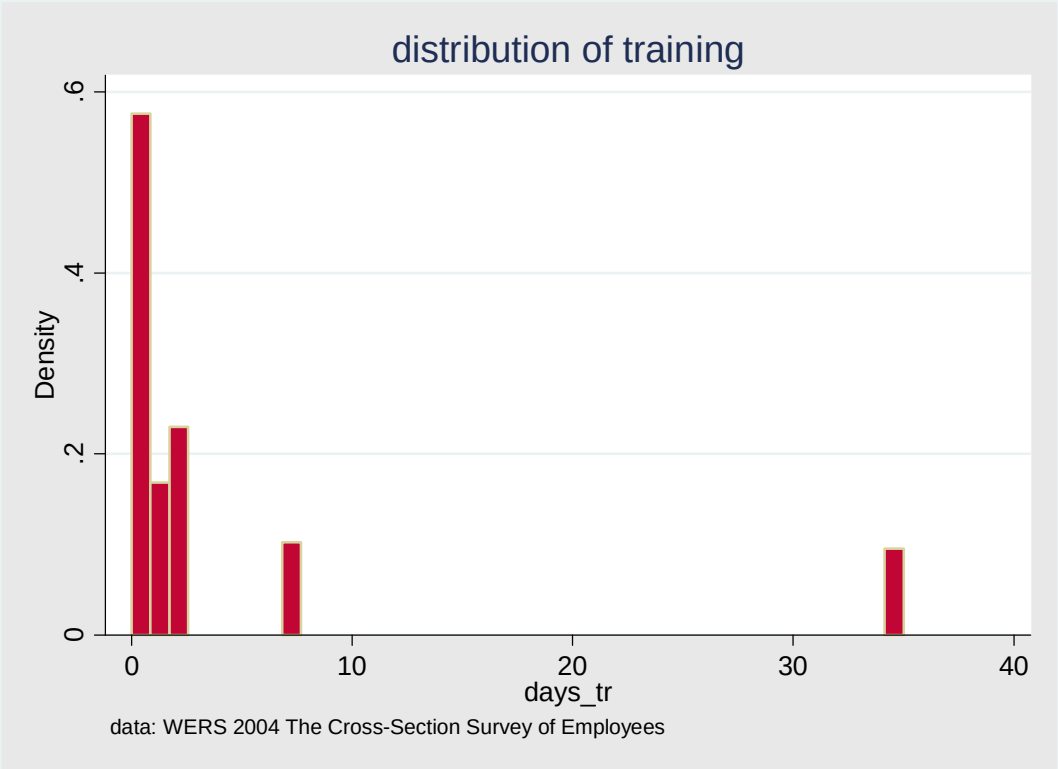



Table 5.4. shows the results for the two models. The variables I have used are pretty much the same I used in the models I commented in the previous sections. However, although it is not specifically required for the identification of the models, the covariates I used for the two parts are not exactly the same as for the multilevel models, being the dummy variables indicating expected tenure excluded from the specification for the initial probit. In fact, the regressions for training incidence alone show that expected tenure does not seem to play any role in determine training incidence. The results for the first hurdle are obviously the same in both models, since the logarithmic transformation is applied only to the second part of the process, however, also the results for training intensity do not seem to differ significantly, suggesting that failing to correct for the skewness does not bias significantly the results. In general, the conclusion we draw from these estimates are the same we present earlier in the paper, suggesting that the results are quite robust across specifications.

**Table 5.4: two parts models**

| | probit + normal | probit+ lognormal |
|---|---|---|
| *training intensity* | | |
| age | -0.01 | 0.01 |
| age squared | -0.00 | -0.00* |
| male | 0.46*** | 0.14*** |
| ethnic minority | -0.36** | -0.12** |
| disabled | 0.57 | 0.12 |
| extra hours | -0.68*** | -0.24*** |
| o level | 0.03 | 0.03 |
| a level | 0.10 | 0.06 |
| degree | 0.09 | 0.08* |
| tenure shorter than 1 year | 0.47*** | 0.12*** |
| tenure longer than 2 years | -0.16 | -0.04 |
| disabled*<1y tenure | -1.47*** | -0.36** |
| disabled*>2y tenure | -0.52 | -0.09 |
| long expected tenure | 0.26* | 0.10** |
| neither long nor short e. tenure | 0.23 | 0.09* |
| any meeting, no training | -0.33*** | -0.11*** |
| no meetings, no training | -0.62** | -0.23*** |
| training negotiated wt representatives | -0.01 | -0.01 |
| no discrimination | 0.03 | 0.02 |
| Constant | 4.03*** | 0.72*** |
| individual controls | yes | yes |
| firm specific controls | yes | yes |
| variance | 3.56*** | 1.06*** |
| *training incidence* | | |
| age | 0.01 | 0.01 |
| age squared | -0.00 | -0.00 |
| male | 0.03 | 0.03 |
| ethnic minority | -0.00 | -0.00 |
| disabled | -0.19* | -0.19* |
| extra hours | -0.23*** | -0.23*** |
| o level | 0.18*** | 0.18*** |
| a level | 0.29*** | 0.29*** |
| degree | 0.39*** | 0.39*** |
| tenure shorter than 1 year | -0.07 | -0.07 |
| tenure longer than 2 years | -0.20*** | -0.20*** |
| disabled*<1y tenure | 0.10 | 0.10 |
| disabled*>2y tenure | 0.14 | 0.14 |
| any meeting, no training | -0.19*** | -0.19*** |
| no meetings, no training | -0.53*** | -0.53*** |
| training negotiated wt representatives | 0.09 | 0.09 |
| no discrimination | 0.10*** | 0.10*** |
| Constant | 0.13 | 0.13 |
| individual controls | yes | yes |
| firm specific controls | yes | yes |

**Table 5.3: training intensity**

| | intensity | | |
|---|---|---|---|
| type | min var | individual | firm |
| sample size (lev2) | 8129 | 7960 | 7626 |
| sample size (lev1) | 1162 | 1151 | 1098 |
| age | 0.01 | 0.006 | 0.005 |
| age squared | 0.00** | 0.000 | 0.000 |
| male | 0.33*** | 0.239*** | 0.236*** |
| ethnic minority | -0.14 | -0.196** | -0.159* |
| disabled | 0.00 | 0.244 | 0.204 |
| tenure shorter than 1 yr | no | 0.231*** | 0.216*** |
| tenure longer than 2 yrs | no | -0.037 | -0.058 |
| disabled*<1y tenure | no | -0.579** | -0.552** |
| disabled*>2y tenure | no | -0.207 | -0.176 |
| individual controls | no | yes | yes |
| long expected tenure | no | no | 0.201** |
| neither long nor short expected tenure | no | no | 0.179 |
| any meeting, no training | no | no | -0.176** |
| no meetings, no training | no | no | -0.364** |
| training negotiated wt representatives | no | no | -0.123 |
| no discrimination | no | no | 0.044 |
| firm specific controls | no | no | yes |

note: * significant at 10%; ** significant at 5%; *** significant at 1%, standard errors in parentheses

First of all, the behaviour of the variable disability is completely reverted: the coefficient on disability becomes positive (though not statistically significant) indicating that on average disabled employees in the selected group of trained workers are likely to be perceived to be as `safe' as non-disabled employees. Also tenure does not seem to be as important as in the previous model, given that the band of longer tenure does not appear to be significantly different from the omitted category.

The most interesting results are perhaps the ones regarding the interaction terms between tenure and disability. Disabled employees in their first year of tenure get significantly less training than every other category, even if the coefficient for the two dummies considered separately are not negative. The idea is that firms have very little information on newly hired workers, as a consequence, they must compute the expected returns to training by relying on easily observed characteristics. When the employers are not able to distinguish between `safe' and unsafe `workers', the presence of disability can be seen as a bad signal for the employers. After the first year and as long as the employees stay with the firm, the employers collect enough information allowing them to have more precise beliefs on who the `risky' disabled employees are. Therefore, the managers start making their decisions on the basis of characteristics that in the first stage are unobserved. We think this creates a `separating equilibrium' where safe disabled employees get high amounts of training while risky disabled employees do not have access to training at all. It can also explain why the interaction term is not significant for training incidence.

One might argue that a spell of disability can start also after the worker is hired. In this case employers are not able to assess the severity of the impairment even when the worker has been working in the firm for long time. It could break the explained relationship between disability and tenure which works through an increasing amount of information. However, we believe that the negative effect of disability for senior workers disappears also in this scenario. In fact, even when the firm does not have information about the severity of the illness, in the case of senior workers employers can use part of the information that was hidden in the first stage. As a consequence, in making they choices the managers do not need to rely on indices, since they can use the information they have been collecting throughout time on a broad set of initially hard-to-observe characteristics. When more information is available, the presence of a physical impairment does not influence firms' expectation any longer.

An alternative hypothesis is that firms use Bayesian learning to estimate the probability of leaving the job. As a consequence, expectations on workers' expected tenure are not formed only by taking into account people's health status, but also by considering their past job history within the firm. Hence, the probability of leaving the firm for a disabled employee who has been working in the workplace for at least two years does not need to be lower that the same probability estimated for a worker in good health with the same tenure. Only in this case, the insurgence of an impairment at a later stage of people's career can lead to misleading conclusions.

Another interesting result is the one regarding the expected time horizon of the investment, since the variable indicating long expected tenure is now positive and significant. We interpret this by observing that, before undertaking a costly investment in human capital, the firms take into account the future stream of revenues given by an increase in productivity. If the value of the investment is big enough to counterbalance the cost of training, the investment takes place. It explains the positive relationship between expected tenure and training.

The variable constructed via factor analysis and proxying for firms' behaviour against discrimination on the basis of disability has a positive and significant coefficient only in the model studying training incidence. Once again, it confirms the hypothesis according to which indices and firm level variables are more likely to affect training when we consider the whole workforce, while individual characteristics matter more in the selected sample of trained workers. The behaviour of the other firm specific variables does not differ from the previous model and we will not discuss it. In fact, since firm characteristics are likely to be endogenous with respect to training, we decided to focus only on the variables whose effect changes in the two models.

Instead, some of the individual controls behave differently for training incidence and training intensity. For example, while education appears to be significant in determining training incidence, its effect on training intensity is much weaker. Education seems to have mainly the function of signalling those who are suitable for training, while it does seem to determine the amount of the investment. This is more in line with the theory of signalling than with the idea that education raises productivity directly by increasing the returns to training. While belonging to an ethnic minority was not significant in the case of training incidence, it has a negative coefficient for training intensity. It can happen because well consolidated affirmative policies against racism succeed in guaranteeing equal access to training for everybody, but they do not fill the gap between different groups when the length of the training programmes is considered.

## 5.3 Excess of zeros and double hurdle models.

In this paragraph we address the problem of the existence of `excess of zeros'. The main idea behind it is that some of the null records we observe in the dataset are not `real' zeros. There are two reasons why we can observe a zero value when the propensity of getting trained is, in principle, positive. the first one is due to reporting, given that it might be a discrepancy between the timing of giving training and the timing of its reporting, since the plan of investing in workers' human capital does not necessarily coincide with the period of time over which training is recorded. However, there is no reason why this bias should affect different categories of people in a different way, so we will not discuss it. The second reason is more interesting. There are some factors that, even when the worker `deserves' training, can inhibit the investment in human capital, they can be due, as explained by Cragg (1971), to transaction costs, search costs or lack of information. We think the last case applies to my analysis. Hence, we can look at the results of the double hurdle model as a proxy of what it would have happened if we did not have excess of zeros. If we believe that the excess of zeros comes from a lack of information, this implies that double hurdle models show us the behaviour of the determinants of training when signals are substituted by the underlying information.

Let suppose that, in order to be trained, the workers must cross two hurdles, the first hurdle determining whether the individuals have any chance of receiving training and the second one indicating whether the investment takes place. Therefore, those who did not reach the first hurdle can be considered those who are excluded from training since they are perceived as `bad investments', while the zero records observed for those who crossed the first hurdle may be due to the effect of current circumstances. Finally, those who did report any training are those who crossed the second hurdle.

Both hurdles are defined by an equation based on personal and firm characteristics, but, like in my previous models, the sign and the magnitude of the coefficients in the two equations do not have to be the same.

***The standard double hurdle models***

The double hurdle models are defined by two equations:

$$h_{ij}^{*} = \bar{x}_{ij}^{'}\alpha + \varepsilon_{ij} \qquad (9)$$

$$y_{ij}^{**} = \bar{z}_{ij}^{'}\beta + \eta_{ij} \qquad (10)$$

where $\bar{x}_{ij}^{'}$ and $\bar{z}_{ij}^{'}$ are matrices including match specific and firm specific variables. Note again that the two matrices do not need to be the same.

In the standard double hurdle models, the errors are normally and independently distributed as follows.

$$\begin{pmatrix} \varepsilon_{ij} \\ \eta_{ij} \end{pmatrix} \sim N\left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & \sigma^2 \end{pmatrix} \right] \tag{11}$$

The first hurdle can be written:

$$h_{ij} = \begin{cases} 1 & if \quad h_{ij}^{*} > 0 \\ 0 & otherwise \end{cases} \tag{12}$$

while the second hurdle takes the form:

$$y_{ij}^{*} = \max\left(y_{ij}^{**}, 0\right) \tag{13}$$

and the observed value of the dependent variable is determined as:

$$y_{ij} = h_{ij} y_{ij}^{*} \tag{14}$$

Finally, the log likelihood function becomes:

$$\log L = \sum_{0} \ln\left[ 1 - \Phi\left(\bar{z}_{ij}^{'}\alpha\right)\Phi\left( \frac{x_{ij}^{'}\beta}{\sigma} \right) \right] + \sum_{+} \ln\left[ \Phi\left(\bar{z}_{ij}^{'}\alpha\right)\frac{1}{\sigma}\Phi\left( \frac{y_i - x_{ij}^{'}\beta}{\sigma} \right) \right] \tag{15}$$

***My specification***

The standard double hurdle model does not seem the best way of fitting my data. First of all, in order to take into account the skewness of the distribution, we must transform the dependent variable, since double hurdle models imply normally distributed errors. The logarithmic transformation we have used earlier in the paper is clearly inadequate, given the high proportion of zeros in my sample, as a consequence, following Jones and Yen (2000), we transformed the dependent variable by using the Box-Cox transformation according to the formula:

$$y^T = \frac{y^\lambda - 1}{\lambda} \tag{16}$$

Where $\lambda$ ranges from 0 to 1.

The Box Cox transformation permits to accommodate the skewness of the distribution, while allowing a certain degree of flexibility. Both the linear and the logarithmic transformations can be obtained as special cases of the Box Cox model when $\lambda$ is close to the boundaries of the space of the parameters (when $\lambda$ tends to zero my model tends to the logarithmic transformation, while when $\lambda$ tends to one my model approximates the linear transformation). Lastly, due to the bounded nature of my data, we wrote the likelihood contribution from positive records by using interval regression (see Moffatt (2005)).

Therefore, the equation for the first hurdle is equal to (12), while the second hurdle becomes:

$$y_{ij}^{*T} = \max\left( y_{ij}^{**}, -\frac{1}{\lambda} \right) \tag{17}$$

$$y_{ij}^{T} = y_{ij}^{*T} \tag{18}$$

if $d_{ij} = 1$
and

$$y_{ij}^{T} = -\frac{1}{\lambda} \tag{19}$$

if $d_{ij} = 0$

Finally, the log likelihood can be written as:

$$\log L = \sum_{0} \ln\left[1-\Phi\left(\bar{z}_{ij}^{'}\alpha\right)\Phi\left(\frac{x_{ij}^{'}\beta+\frac{1}{\lambda}}{\sigma}\right)\right]+\sum_{+}\ln\left[\Phi\left(\bar{z}_{ij}^{'}\alpha\right)\sum_{j=1}^{J} I\left(y_{ij}\in I_J\right)\Phi\left(\frac{b_j^T-x_{ij}^{'}\beta}{\sigma}\right)\right]- \quad (20)$$

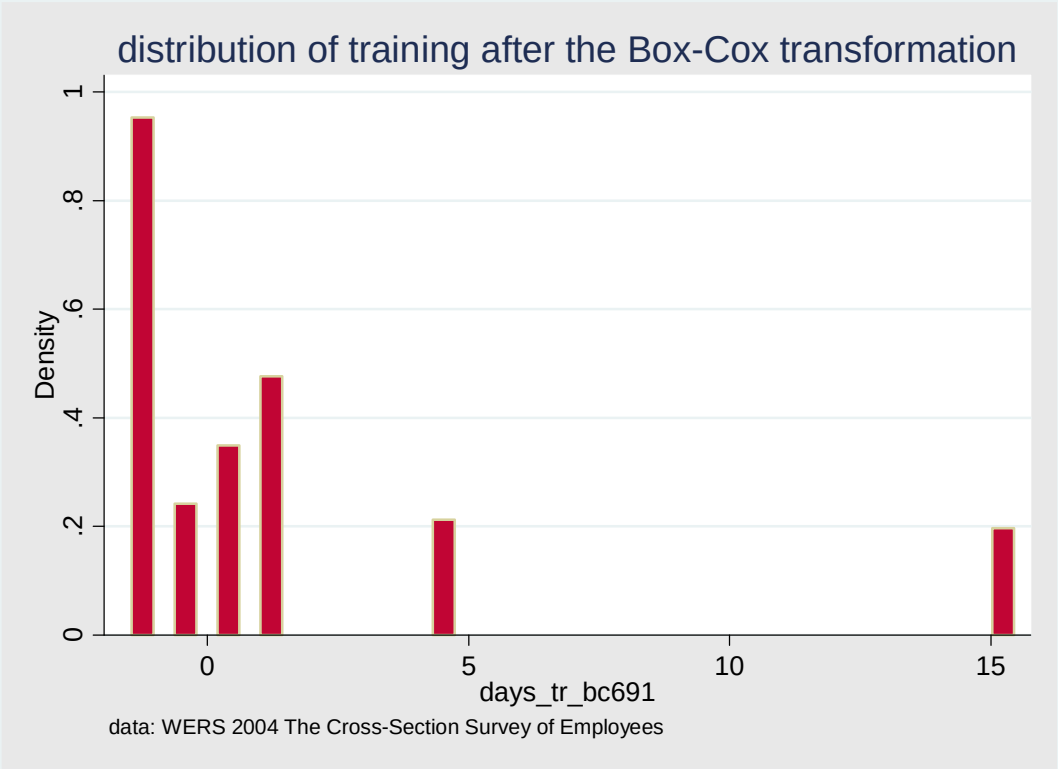
$$-\Phi\left(\frac{a_j^T-x_{ij}^{'}\beta}{\sigma}\right)$$

where *I(.)* is the indicator function defining the intervals in which the latent variable falls, while $a_j^T$ and $b_j^T$ are the extremes of each interval after applying the Box Cox transformation.

***Results***

Table 5.5. shows the results I got by using the double hurdle model we presented above. First of all let us notice that the value we estimated for $\lambda$ is equal to 0.69, which is neither a logarithmic nor a linear transformation. This is an encouraging result, given that a value of $\lambda$ close to zero would have been problematic in the case of the null records, while a value of $\lambda$ close to one would not have corrected significantly the skewness of the distribution. Figure 5.2. shows the new distribution of training after applying the Box Cox transformation with $\lambda$ equal to the estimated value from my model.

**Figure 5.2: distribution of training after Box Cox transformation**




More interestingly, the pattern we have discussed for disability does not change and we still have a negative and significant coefficient for training incidence and a positive (although not significant) coefficient for training intensity. The result seems to be particularly strong now, suggesting a sharp separation between a small number of `good quality' trained disabled employees who get training at least as much as non disabled people and a group of disabled people which does not get training at all, also when we correct for the excess of zeros.
When we look at the interactions between disability and tenure, we notice that after the correction there is a perfect relationship between the probability of getting training for each band of tenure and the amount of training people get, in particular, when most of the investment takes place (between the first and the second year of tenure), the probability of being selected for a disabled employee is the lowest, but the amount of training selected disabled people get is the highest. This suggests a scenario where firms are able to discriminate among disabled workers.

Finally, two minor observations. In the `probit-normal model' and in the `probit-lognormal model' the variables indicating education are significant just for training incidence. We have already discussed this result for the case of multilevel models observing that it is in line with the theory of signalling. It is interesting noticing that now we got the same result as before although we used the same sample size for both parts of the process. However, such a distinction disappears in the double hurdle models and the results we got seem to corroborate the thesis looking at education as a productive form of investment in human capital. Finally the double hurdle model shows that when we account for the excess of zeros we find lower incidence of training for mail workers, suggesting that a

positive discrimination in favour of males might take place in the provision of training.

**Table 5.5: double hurdle models**

| | double hurdle |
|---|---|
| *training intensity* | |
| age | 0.03 |
| age squared | -0.00** |
| male | 0.41*** |
| ethnic minority | -0.30* |
| disabled | 0.51 |
| extra hours | -0.80*** |
| o level | 0.38*** |
| a level | 0.72*** |
| degree | 0.93*** |
| tenure shorter than 1 year | 0.23 |
| tenure longer than 2 years | -0.40*** |
| disabled*<1y tenure | -1.35** |
| disabled*>2y tenure | -0.56 |
| long expected tenure | 0.43*** |
| neither long nor short e. tenure | 0.37** |
| any meeting, no training | -0.42*** |
| no meetings, no training | -1.56*** |
| training negotiated wt representatives | 0.47 |
| no discrimination | 0.04 |
| Constant | -1.24** |
| individual controls | yes |
| firm specific controls | yes |
| variance | 3.64*** |
| *training incidence* | |
| age | -0.05 |
| age squared | 0 |
| male | -0.23* |
| ethnic minority | 0.19 |
| disabled | -1.24*** |
| extra hours | -0.36*** |
| o level | 0.32** |
| a level | 0.27 |
| degree | 0.32* |
| tenure shorter than 1 year | -0.54* |
| tenure longer than 2 years | -0.58** |
| disabled*<1y tenure | 1.79** |
| disabled*>2y tenure | 1.09*** |
| any meeting, no training | -0.35*** |
| no meetings, no training | -0.17 |
| training negotiated wt representatives | -0.56* |
| no discrimination | 4.86*** |
| Constant | 5.93*** |
| individual controls | yes |
| firm specific controls | yes |
| lambda | 0.69*** |

CHAPTER SIX

# Concluding remarks

The process of investing in human capital can be divided in two parts. In the first stage the firm decides whether to give some positive amount of training to each worker, while in the second part it determines the length of the training. In particular, when available information is scarce, ill-health is perceived as a characteristic signalling `risky' workers, since it is often associated with shorter expected tenure due to high probabilities of dropping out of the labour force. It can explain the negative coefficient we got for newly hired disabled people in the model explaining training incidence.

However, if we consider only the group of trained workers, poor health conditions do not seem to determine a lower investment in human capital. We argue that it may be due to the fact that the sub sample of trained workers is different from the workforce as a whole along a set of dimensions which are relevant for my analysis. In fact, workers who got training are likely to be a `selected' sub sample, given that the firm has chosen to invest in them. In particular, we think that disabled workers belonging to this group are more likely to be of the type of workers we labelled as `safe'. It explains why poor health conditions do not have a negative effect on training intensity. This is also a reason why the negative effect of disability decreases with tenure as shown by the descriptive statistics. Moreover, my results are also consistent with the hypothesis that firms use Bayesian learning to evaluate the net present value of the investment in human capital for disabled people.

Using double hurdle models allowing for excess of zeros, we tried to correct for all the factors determining zero records for those having a positive propensity of getting training. In my case this result can describe a situation when the lack of information is reduced. We found that in this new scenario there is a clear separation between a group of disabled people who get more training that non disabled people and a group of workers in poor health who do not get training at all. If we correct for the difference in the null records we also find evidence in favour of the theory of education as investment in human capital and for the presence of a positive discrimination towards men in the access to training.

Unfortunately it is not possible to evaluate the effect of the anti discrimination law on the provision of training for disabled people, since this would require some longitudinal information we do not have in WERS. However, some conclusions can be drawn on the role of information in the investment in human capital and on how the anti-discrimination measures can help conjugating efficiency and equality. Our analysis using the double

hurdle models suggests that filling the informational gap could lead to different outcomes for different groups of disabled people with a sub group of disabled workers excluded from the investment in human capital and another sub group receiving an amount of training comparable to or bigger than the one offered to workers in good health. This could create, for the workers having any impairment, incentives not to reveal their real health status which on the one hand could lead to inefficiencies, given that the employers would not able to predict the expected returns of the investment in human capital, on the other hand it could have negative consequences for the disabled workers themselves, who would not be able to claim their rights as protected under the Disability Discrimination Act.

The anti discrimination law, together with a set of mechanisms rewarding those firms investing in disabled people can overcome such a difficulty, making it possible for everybody to enhance his skills irrespectively of his health status.

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# Annex A: Estimates of disability

## A1.1. Estimates of disability according to different surveys in the UK

There is no a widely accepted definition of disability nor there exists a unique way for measuring it. The most important surveys for the UK have adopted both different measures of disability and different strategies for the question wording. As a consequence, the estimates of the proportion of disabled people vary a lot even when we compare sub samples having analogous characteristics.

I have estimated the proportion of disabled people by using both the British Household Panel Survey (wave 15) and the Labour Force Survey. In both cases I considered just those respondents who were in paid employment and I have excluded both employees and self employed. I did so because I want my estimates to be as comparable as possible with the WERS data. I will present a set of estimates using different surveys for the UK in order to derive an estimate of the number of LSI and WLD disabled. In fact, WERS data on disability are not completely coherent and further analysis is required in order to identify who the disabled are.

The first survey I considered is the Labour Force Study. The survey is interesting for my comparison because of its presenting different definitions of disability, in addition, the LFS questions do not differ much from the ones used in WERS and they permit to derive an estimate of the number of workers having a work limiting disability (WLD). In fact, in both surveys the respondents are first asked whether they have an illness or disability and then they are asked whether such an impairment limits the amount or the kind of job they might do. It makes it possible estimating both the proportion of LSI disabled and the proportion of WLD disabled. The first question in LFS is almost the same as the one in WERS. It asks: *Do you have any health problems or disabilities that you expect will last for more than a year?'.* Then two different questions ask whether the impairments affect the kind and the type of work people might do. The exact question wording is: `*Does this health problem affect the kind of paid work that you might do?*' and `*Does this health problem affect the amount of paid work that you might do?'*

The first question permits to derive an estimate of the number of people living with a LSI disability, while a combination of the second and the third question permits to estimate the proportion of WLD disabled. I have considered WLD disabled those answering that their disability affects the kind OR the amount of work they can do and I have estimated their proportion in the selected sub sample by using the sample weights. I have also excluded workers living in

Northern Ireland in order to make the data comparable with those in the WERS survey.

Table A.1. shows the proportion of British workers for each health status as emerges from LFS data. We can notice that, according to the estimates derived by LFS data, those who do not have a LSI disability are nearly 80 per cent, while the disabled whose disability does not affect the amount or the type of job they do are twice ad much as the WLD disabled. The question wording and the order of the questions does seem to affect the measures of disability. Before spring 1997 the LFS respondents were first asked whether they had a work limiting disability and then whether such an impairment was perceived to last for more than one year. According to Cousins et al (1998) the change of the order of the questions adopted in the recent waves of the survey made people to underreport the WLD disability.

**Table A.1: health status according to the LFS**

| | Percent | Cum. |
|---|---|---|
| good health | 78.33 | 78.33 |
| affecting disability | 7.69 | 86.01 |
| disability, unknown severity | 0.05 | 86.06 |
| non affecting disability | 13.81 | 99.87 |
| missing | 0.13 | 100 |

LFS contains also a derived variable distinguishing between different kinds of disabilities. Such a variable permits also to estimate the number of those considered disabled according to the Disability Discrimination Act (DDA disabled). It is derived by combining the three abovementioned questions plus another one asking whether the respondent's health status limits his activities (not necessarily at work).[30] Those answering they do not have a long lasting illness and those answering that their disability does not limit their day-to-day life are considered `non-disabled', while those having a limiting disability which does not affect the amount or the type of the job they can do are considered DDA disabled, but they are not considered WLD disabled. table A.2. reports the proportion of disabled according to this derived variable.

**Table A.2: disabled people according to the LFS**

| | Percent | Cum. |
|---|---|---|
| dda disabled and work-limiting disabled | 4.78 | 4.78 |
| dda disabled | 5.03 | 9.81 |
| work-limiting disabled only | 2.9 | 12.72 |
| non-disabled | 87.28 | 100 |

Here the percentage of those who can not be considered disabled is higher than in the previous estimate (87.28 per cent). It is due to the fact that those having a long lasting illness which does not limit the respondent's activities are not

[30] it can be considered a measure of Limiting Long Standing Illness (LLSI).

considered disabled. It is worth noticing that different uses of the same survey can lead to big differences in the description of the respondents' health conditions.

Let us consider now the estimates I have derived from the British Household Panel Survey. BHPS contains a very rich set of questions whose aim is assessing the health status of the respondent. However, I focused on the three questions which can be compared with the one in WERS. The first question I used asks the respondent whether he considers himself as a disabled. It is the question that can be more closely compared with the ones assessing the presence of long lasting illness or disability in WERS. In fact BHPS does not have a question explicitly asking for impairments which are likely to have effect in the long run. Table A.3. shows the estimated proportions.

**Table A.3: disabled people according to the BHPS (1)**

| | Percent | Cum. |
|---|---|---|
| self declared disabled | 2.84 | 2.84 |
| not self declared disabled | 97.16 | 100 |

According to the answers to this question, the percentage of disabled people in paid employment is below 3 per cent. It is much smaller than whatever estimate can be found in the literature. It is not surprising since we can seen that only a tiny percentage of those having a long lasting impairment consider themselves as disabled. As a consequence, the estimated percentage of `non-disabled' according to the answers to this question is likely to overestimate the number of people in good health. If my definition of `people in good health' indicates those who do not have a LSI, the above question can be considered an upper bound for the measure we are looking for.

n order to define a lower bound I used a question asking whether the interviewed has any specific health problem listed in a card. I considered the proportion of people declaring they have no problems as a measure of the people in good health. This second question is really general, since the declared health problem should not be necessarily a long lasting one. Hence, the number of people who do not have any health problem according to the third question underestimates the number of people who do not have a LSI disability. We can think of this estimate as the lower bound for the measure we are looking for.

Table A.4. shows that if we relax the requirement of the duration of the illness the situation changes sharply and less than a half of the sample declares not to have any health problem. The results are very different from the previous ones, so that we can derive only a very wide band suggesting that the share of people in good health should be somewhere between 50 per cent and 97 per cent with no clear indication on how to distinguish people having a non WLD impairment from non-disabled.

**Table A.4: disabled people according to the BHPS (2)**

| | Percent | Cum. |
|---|---|---|
| not in good health | 50.37 | 50.37 |
| good health | 49.63 | 100 |

Estimating the number of the workers having a work limiting disability is easier than estimating non WLD disabled. In fact, the BHPS question is very similar to the one in WERS and it asks whether the respondent's health status limits the amount or the kind of work he can do. However, the status of WLD disabled is now assessed through a single question and it does not depend on a previous question asking for a presence of long term illness or disability.

**Table A.5: disabled people according to the BHPS (3)**

| | Percent | Cum. |
|---|---|---|
| health condition limiting work | 7.22 | 7.22 |
| non WLD (including people in good health) | 92.78 | 100 |

From table A.5. we can notice that the percentage estimated by BHPS data, once we selected a sub sample with the same characteristics, is very similar to the one we estimated by using LFS data and it is slightly higher than 7 per cent. Unfortunately very few surveys contain a question directly assessing the presence of WLD, so that is difficult to find further pieces of evidence confirming this finding.

## A1.2. WERS and my definition of disability

We have already explained how the presence in WERS of two separate questions dealing with disability and the way in which the data are collected force the researcher to make some choices in order to define who a disabled is. In particular, it must be decided how to treat the group of people declaring they do not have a long lasting disability and then answering the question defining a Work Limiting Disability. Three different alternatives are possible: excluding the whole group from the analysis (choice 1), treating them as disabled either WLD or non-WLD according to their answer to the second question (choice 2) or treating them as people in good health by neglecting completely their responding to the question asking for WLD (choice 3). The first choice seems to be the better since it does not require any assumption about people's responding. However, it implies throwing away more than 1000 observation. In order to shed light of what the choice implies I have estimated the proportions of disabled people how it emerges by making the different assumptions. Table A.6. shows the results we got.

**Table A.6: disabled people in WERS**

| | choice 1 | | choice 2 | | choice 3 | |
|---|---|---|---|---|---|---|
| | Percent | Cum. | Percent | Cum. | Percent | Cum. |
| good health | 86.71 | 86.71 | 77.49 | 77.49 | 88.12 | 88.12 |
| WLD | 5.21 | 91.92 | 4.66 | 82.15 | 4.66 | 92.78 |
| non WLD | 8.08 | 100 | 17.85 | 100 | 7.22 | 100 |

Choice 2 seems to be really unlikely, since it implies a disproportionately low percentage of people in good health and a disproportionately high percentage of people having a LSI if compared with those having a WLD. In fact, in LFS the number of people in good health is estimated around 78 per cent, but Bajekal et al. (2004) argue that the Labour Force Survey tends to overestimate the number of disabled. The percentage of disabled people we got through choice 2 is even below such a lower bound. In addition, LSI disables are more than three times as much as WLD disabled and the latter are a tiny 4 per cent, much lower than value of 7 per cent estimated by using both BHPS and LFS. Choice 1 and 3 are quite similar. The only difference is that through method one we got the highest percentage of WLD disabled which is also the estimates which is closest to the one I got by using other survey data. As a consequence, in spite of its cost in terms of sample size, we chose choice 1.

# Annex B: Supplementary tables

**Table A2.1: training incidence (all the coefficients)**

| type | incidence min var | individual | firm |
|---|---|---|---|
| sample size (lev2) | 13379 | 13071 | 12548 |
| sample size (lev1) | 1238 | 1235 | 1177 |
| age | 0.001 | 0.005 | -0.001 |
| age squared | 0.000** | 0.000 | 0.000 |
| male | 0.220*** | 0.146*** | 0.143*** |
| ethnic minority | -0.041 | -0.098 | -0.073 |
| disabled | -0.135** | -0.334* | -0.372* |
| couple | | -0.001 | 0.017 |
| children | | -0.058 | -0.060 |
| extra hours | | -0.424*** | -0.423*** |
| olevel | | 0.277*** | 0.248*** |
| alevel | | 0.471*** | 0.426*** |
| degree | | 0.642*** | 0.612*** |
| tenure shorter than 1 yr | | -0.189** | -0.165** |
| tenure longer than 2 yrs | | -0.372*** | -0.393*** |
| disabled*<1y tenure | | 0.225 | 0.208 |
| disabled*>2y tenure | | 0.254 | 0.281 |
| professional occupations | | 0.804*** | 0.600*** |
| Ass. professional and technical occupations | | 0.836*** | 0.753*** |
| Administrative and secretarial occupations | | 0.954*** | 0.896*** |
| Skilled trades occupations | | -0.045 | -0.040 |
| Personal service occupations | | 1.171*** | 1.110*** |
| Sales and customer service occupations | | 0.699*** | 0.602*** |
| Process, plant and machine operatives | | -0.065 | -0.037 |
| difficulty | | | 0.007** |
| firm size | | | 0.000** |
| firm size squared | | | 0.000** |
| long expected tenure | | | 0.076 |
| neither long nor short expected tenure | | | 0.090 |
| any meeting, no training | | | -0.338*** |
| no meetings, no training | | | -0.930*** |
| training negotiated with representatives | | | 0.207 |
| no discrimination | | | 0.203*** |
| constant | | | -0.416 |

## Table A2.2: training intensity (all the coefficients)

| | intensity | | |
|---|---|---|---|
| type | min var | individual | firm |
| sample size (lev2) | 8129 | 7960 | 7626 |
| sample size (lev1) | 1162 | 1151 | 1098 |
| age | 0.01 | 0.006 | 0.005 |
| age squared | 0.00** | 0.000 | 0.000 |
| male | 0.33*** | 0.239*** | 0.236*** |
| ethnic minority | -0.14 | -0.196** | -0.159* |
| disabled | 0.00 | 0.244 | 0.204 |
| couple | | 0.019 | 0.016 |
| children | | -0.051 | -0.060 |
| extra hours | | -0.422*** | -0.430*** |
| olevel | | 0.055 | 0.055 |
| alevel | | 0.125 | 0.119 |
| degree | | 0.169** | 0.164** |
| tenure shorter than 1 yr | | 0.231*** | 0.216*** |
| tenure longer than 2 yrs | | -0.037 | -0.058 |
| disabled*<1y tenure | | -0.579** | -0.552** |
| disabled*>2y tenure | | -0.207 | -0.176 |
| professional occupations | | 0.458*** | 0.353*** |
| Ass. professional and technical occupations | | 0.543*** | 0.504*** |
| Administrative and secretarial occupations | | 0.470*** | 0.426*** |
| Skilled trades occupations | | 0.408*** | 0.359*** |
| Personal service occupations | | 0.739*** | 0.695*** |
| Sales and customer service occupations | | 0.238** | 0.161 |
| Process, plant and machine operatives | | 0.220* | 0.195* |
| difficulty | | | 0.008*** |
| firm size | | | 0.000* |
| firm size squared | | | 0.000 |
| long expected tenure | | | 0.201** |
| neither long nor short expected tenure | | | 0.179 |
| any meeting, no training | | | -0.176** |
| no meetings, no training | | | -0.364** |
| training negotiated with representatives | | | -0.123 |
| no discrimination | | | 0.044 |

**Table A2.3: training incidence (all the coefficients, two parts models)**

| *training incidence* | | | |
|---|---|---|---|
| | probit + normal | probit+ lognormal | double hurdle |
| age | 0.01 | 0.01 | -0.05 |
| age squared | -0.00 | -0.00 | 0 |
| male | 0.03 | 0.03 | -0.23* |
| cohabitation | 0.02 | 0.02 | 0.05 |
| children | -0.03 | -0.03 | 0.05 |
| minority | -0.00 | -0.00 | 0.19 |
| disabled | -0.19* | -0.19* | -1.24*** |
| extra hours | -0.23*** | -0.23*** | -0.36*** |
| o level | 0.18*** | 0.18*** | 0.32** |
| a level | 0.29*** | 0.29*** | 0.27 |
| degree | 0.39*** | 0.39*** | 0.32* |
| tenure shorter than 1 year | -0.07 | -0.07 | -0.54* |
| tenure longer than 2 years | -0.20*** | -0.20*** | -0.58** |
| disabled*<1y tenure | 0.10 | 0.10 | 1.79** |
| disabled*>2y tenure | 0.14 | 0.14 | 1.09*** |
| Professional occupations | 0.32*** | 0.32*** | 0.39 |
| Ass. Professional and technical occupations | 0.37*** | 0.37*** | 0.38 |
| Administrative and secretarial occupations | 0.46*** | 0.46*** | 5.39 |
| Skilled trades occupations | -0.01 | -0.01 | -0.17 |
| Personal service occupations | 0.56*** | 0.56*** | 0.54* |
| Sales and customer service occupations | 0.33*** | 0.33*** | 0.36 |
| Process, plant and machine operatives | -0.03 | -0.03 | 0.17 |
| difficulty | 0.00*** | 0.00*** | 0 |
| firm size | 0.00*** | 0.00*** | 0.00* |
| firm size squared | -0.00*** | -0.00*** | 0 |
| any meeting, no training | -0.19*** | -0.19*** | -0.35*** |
| no meetings, no training | -0.53*** | -0.53*** | -0.17 |
| training negotiated with representatives | 0.09 | 0.09 | -0.56* |
| no discrimination | 0.10*** | 0.10*** | 4.86*** |
| Constant | 0.13 | 0.13 | 5.93*** |
| lambda | | | 0.69*** |

**Table A2.4: training intensity (all the coefficients, two parts models)**

| *training intensity* | | | |
|---|---|---|---|
| | probit + normal normal | probit+ lognormal | double hurdle |
| age | -0.01 | 0.01 | 0.03 |
| age squared | -0.00 | -0.00* | -0.00** |
| male | 0.46*** | 0.14*** | 0.41*** |
| cohabitation | -0.07 | -0.00 | -0.01 |
| children | -0.09 | -0.03 | -0.13 |
| minority | -0.36** | -0.12** | -0.30* |
| disabled | 0.57 | 0.12 | 0.51 |
| extra hours | -0.68*** | -0.24*** | -0.80*** |
| o level | 0.03 | 0.03 | 0.38*** |
| a level | 0.10 | 0.06 | 0.72*** |
| degree | 0.09 | 0.08* | 0.93*** |
| tenure shorter than 1 year | 0.47*** | 0.12*** | 0.23 |
| tenure longer than 2 years | -0.16 | -0.04 | -0.40*** |
| disabled*<1y tenure | -1.47*** | -0.36** | -1.35** |
| disabled*>2y tenure | -0.52 | -0.09 | -0.56 |
| Professional occupations | 0.62*** | 0.24*** | 1.10*** |
| Ass. Professional and technical occ | 0.72*** | 0.29*** | 1.26*** |
| Administrative and secretarial occ | 0.64*** | 0.25*** | 1.18*** |
| Skilled trades occ | 0.42** | 0.21*** | 0.53** |
| Personal service occ | 1.13*** | 0.40*** | 1.88*** |
| Sales and customer service occ | 0.37** | 0.12** | 0.93*** |
| Process, plant and machine operatives | 0.33* | 0.12** | 0 |
| difficulty | 0.01*** | 0.00*** | 0.02*** |
| firm size | 0.00*** | 0.00** | 0.00** |
| firm size squared | -0.00** | -0.00* | -0.00** |
| long expected tenure | 0.26* | 0.10** | 0.43*** |
| neither long nor short e. tenure | 0.23 | 0.09* | 0.37** |
| any meeting, no training | -0.33*** | -0.11*** | -0.42*** |
| no meetings, no training | -0.62** | -0.23*** | -1.56*** |
| training negotiated wt representatives | -0.01 | -0.01 | 0.47 |
| no discrimination | 0.03 | 0.02 | 0.04 |
| Constant | 4.03*** | 0.72*** | -1.24** |
| sigma | 3.56*** | 1.06*** | 3.64*** |

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