An investigation into the impact of disability on labour market outcomes in the UK.

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AN INVESTIGATION INTO THE IMPACT OF DISABILITY ON LABOUR MARKET OUTCOMES IN THE UK

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SUMMARY

This thesis uses data from the Labour Force Survey (LFS) and the Health Survey for England (HSE) to examine the impact of disability on labour market outcomes in the UK.

The analysis documents the extent of, and examines the reasons for, the gap in employment and earnings between disability groups. In particular, it attempts to separate the effects of observable differences in characteristics, unobserved productivity differences and discrimination. Unobserved productivity differences are found to be an important influence on employment and earnings. As such, the existing evidence, which ignores this influence, overestimates discrimination against the disabled.

Relative to the non-disabled, disabled workers are concentrated in part-time and self-employment. The analysis examines if this concentration is due to marginalisation of the disabled, or if disabled workers have different preferences for non-standard work driven by the need to accommodate disability. The concentration of the disabled in part-time employment is found to be predominately driven by differences in preferences. Amongst males, preferences are also an important explanation for the concentration in self-employment.

Estimates of the impact of self-reported disability on labour market outcomes have been criticised due to the potential influence of measurement error and justification bias. The analysis uses more objective health information in the HSE to instrument self-reported disability in a labour market participation model. Self-reported information is found to underestimate the impact of disability, which suggests measurement error is important.

The employment provisions in the 1995 Disability Discrimination Act (DDA) were intended to improve the labour market outcomes of the disabled. Data from the LFS indicate that, after controlling for characteristics, the employment gap between the disabled and non-disabled narrowed in the post-DDA period. In contrast, analysis based on a difference in difference procedure and data from the HSE (1991-2004) does not support a positive influence of the legislation.

DECLARATION

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Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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GLOSSARY

ADA	Americans with Disabilities Act, 1990
BSA	British Social Attitudes Survey
BHPS	British Household Panel Survey
BMI	Body Mass Index
CPS	Current Population Survey
CVD	Cardiovascular Disease
DDA	Disability Discrimination Act, 1995
DWP	Department for Work and Pensions
ECHP	European Community Household Panel
ELSA	English Longitudinal Study of Ageing
FRS	Family Resources Survey
FES	Family Expenditure Survey
GDP	Gross Domestic Product
GHQ12	General Health Questionnaire
GHS	General Household Survey
GSOEP	German Socio-economic Panel
HRS	Health and Retirement Survey
HSE	Health Survey for England
IB	Incapacity Benefit
IIA	Independence of Irrelevant Alternatives
IMD	Index of Multiple Deprivation
IV	Instrumental Variable
JSA	Job Seekers Allowance
LAD	Local Authority District
LFS	Labour Force Survey
LPM	Linear Probability Model
MEPS	Medical Expenditure Panel Survey
NDDP	New Deal for Disabled People
NHIS	National Health Interview Survey
NHS	National Health Service
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
ONS	Office for National Statistics
OPCS	Office of Population Censuses and Surveys
PSDA	People with Severe Disabilities Act
PSID	Panel Study of Income Dynamics
SIPP	Survey of Income and Program Participation
SOA	Super Output Area
SSDI	Social Security Disability Insurance
SSI	Supplemental Security Income
VR	Vocational Rehabilitation
WERS	Workplace Employee Relations Survey
WHS	Welsh Health Survey
UKHLS	United Kingdom Household Longitudinal Study
2SLS	Two Stage Least Squares
2SPM	Two Step Probit Model

CHAPTER ONE

INTRODUCTION

The economic analysis of disabled workers in the labour market has been relatively neglected in the UK, especially in comparison to analysis performed on the basis of gender or race. This is surprising given the size of this group, which currently represents about 20 percent of the working age population, and the observed changes in their labour market performance. There has been an increase in size of the disabled population and deterioration in their labour market outcomes since the early 1980s (Bell and Smith, 2004).[1] This has accentuated the difference in labour market outcomes between disabled and non-disabled groups. Currently, the employment rate of the disabled in the UK is less than half that of the non-disabled,[2] whilst for those disabled individuals in employment average earnings are about 10-15 percent lower than the non-disabled. The situation in the UK is even more significant when considered in an international context. The UK has the second highest rate of working age disability in Europe[3], a rate which is over ten percentage points higher than the EU average, and, the ratio of the employment rate for the disabled to the non-disabled is 52 percent, ten percentage points lower than the Organisation for Economic Co-operation and Development (OECD) average.[4]

These trends raise concerns about the presence of discrimination in the labour market and the wider social exclusion of the disabled (Burchardt, 2003b). Moreover, the substantial increase in the number of individuals claiming Incapacity Benefit (IB), currently about 2.6 million people (see McVicar, *forthcoming*), has also had

[1] See Bound and Burkhauser (1999) for similar conclusions in the US.

[2] For example, according to recent data from the Labour Force Survey (April 2005-March 2006), 32.9 percent of the disabled are employed compared to 79.8 percent of the non-disabled. The definition of disability requires an individual to be disabled using both the Disability Discrimination Act (DDA) and work-limiting definitions.

[3] See Dupré and Karjalainen (2003).

[4] See OECD (2003).

important implications for public spending.[5] As a result, and consistent with the government's aspiration to raise the employment rate in the UK (Department for Work and Pensions, 2005), a range of legislative and other reforms, aimed at securing an improvement in the labour market position of the disabled, have recently been introduced. For example, the employment provisions of the 1995 Disability Discrimination Act (DDA) make it unlawful to discriminate against the disabled and require employers to make reasonable adjustments to their workplaces and practices to facilitate access to work for the disabled. Whilst it may be anticipated that the legislation will have a significant impact on the labour market outcomes of the disabled, as yet, little economic evaluation has been undertaken on these important policy changes in the UK.[6]

The issue of disability, however, has continued to attract considerable political attention with a high profile investigation and the publication of *Improving the Life Chances of Disabled People* by the Prime Minister's Strategy Unit (2005). In response, the Office for Disability Issues has been established, which aims to achieve the government's 20 year vision: "By 2025, disabled people in Britain should have full opportunities and choices to improve their quality of life, and will be respected and included as equal members of society" (Prime Minister's Strategy Unit, 2005, p.12).

Achieving this ambitious aim requires an understanding of the barriers and challenges the disabled face in all aspects of life, including work. However, the relatively limited existing evidence relating to disability is, in part, due to the additional complexity in analysing labour market outcomes of this group relative to groups formed on the basis of characteristics. In reviewing the international evidence relating to the impact of disability on labour market outcomes, Chapter 2 identifies the key econometric difficulties that arise during this type of empirical investigation. Indeed, features of disability often limit the applicability of estimation strategies developed and applied in the context of gender and race. Amongst others, these include the difficulty in measuring disability, the possible endogeneity of disability

[5] Data from The Department for Work and Pensions (DWP) working age client group August 2006, obtained from www.nomisweb.co.uk.
[6] This is in sharp contrast to the US, where there has been a substantial increase in publication on such issues following the passing of the Americans with Disabilities Act (ADA) in 1990.

and labour market status, the dynamic nature of disability, the heterogeneity within the disabled population, and the influence of disability on productivity and preferences. This review forms the basis of "Disability and the labour market: a review of the empirical evidence" which is forthcoming in the *Journal of Economic Studies*.

Empirical Issues

Disability is a restriction or inability rather than a demographic characteristic and, as such, there is not a single, consistently used, definition of, or method for, the classification of the disabled (Wolfe, 1984). Estimates of the labour market impact of disability are conditional on the definition of disability chosen and measures may suffer from measurement error (due to the subjective nature of reporting) and justification bias (since non-employed individuals may use disability to justify their economic status) (Bound, 1991). Characteristics such as gender and race are also strictly exogenous and thus there is a random assignment of individuals between groups. In some cases disability may be exogenous; however, for some people at least, classifying themselves as disabled will be a subjective choice. If disability status is affected by work, or if there are unobservables that affect both disability and work, they become endogenously related, giving rise to an additional bias (Lindeboom and Kerkhofs, 2002).

Characteristics such as gender and ethnicity are unlikely, in most cases, to affect productivity in work. This is not true of disability, which is complicated further by the impact of disability on productivity being unobservable and heterogeneous (Johnson and Lambrinos, 1985).[7] However, in a more similar manner to race and gender, differences in preferences may be an important determinant of the gap in labour market performance. The influence of unobservables between groups cannot be controlled for in a decomposition analysis (Oaxaca, 1973) which seeks to account for differences in labour market performance due to differences in the composition of the groups. As such, these unobservables contribute to the unexplained gap in the outcome between groups, which is typically assumed to represent an upper-bound

[7] The impact of a disability on work productivity depends both on the type and severity of disability and the exact requirements of that occupation, which are often unobserved.

estimate on discrimination. Hence, this estimate will be biased if unobservable differences in productivity or preferences are important for the disabled.

There are several features of the disabled which give rise to heterogeneity in the population which is not typically captured by controls for personal and household characteristics. Most obviously, labour market outcomes will be affected by the type of impairment (Kidd *et al.*, 2000) and severity (Berthoud, 2003) of a particular disability. Moreover, disability may not be a permanent state; a person may not be disabled for his or her entire life (Burchardt, 2000). Indeed, disability onset is correlated with personal and lifestyle characteristics giving rise to selection (Jenkins and Rigg, 2004) and timing effects (Wilkins, 2004).[8]

Research Objectives

The overarching aim of this thesis is to document and attempt to explain differences in labour market performance in the UK on the basis of disability. To achieve this aim, five main empirical Chapters develop a body of evidence which examines the impact of disability on employment, earnings and hours. Each Chapter is structured in a similar manner and considers a brief motivation, highlights the most important elements of the literature, before developing a methodology and presenting and discussing key results. The analysis of two large scale government surveys, the Labour Force Survey (LFS) and the Health Survey for England (HSE), forms the basis of this evidence and, as such, several of the main empirical issues identified above are explored during the course of the research. There is a particular focus on the influence of unobserved differences in productivity and preferences, and the measurement of disability. Further, as appropriate, the analysis also considers changes in labour market disadvantage over time to identify any change in performance of the disabled after the introduction of the DDA. In this respect, the thesis also attempts to evaluate the labour market effect of the legislation.

More specifically, the first analytical chapter (Chapter 3) focuses on explaining the differences in employment and earnings between disabled and non-disabled

[8] The timing of onset also has implications for labour market outcomes (Baldwin and Johnson, 2001). For example, disability onset while in employment affects return to work, whereas disability at birth will affect hiring and even characteristics such as educational attainment.

individuals using data from the LFS. In doing so, it examines the issue of unobserved productivity differences between disabled and non-disabled individuals and calculates an alternative measure of labour market discrimination.[9] The analysis of the employment and the earnings gap both utilise a methodology applied by DeLeire (2001) to examine wage discrimination against the disabled in the US. The decomposition technique separates the disabled population into two groups, the work-limited disabled and the non-work-limited disabled. Under two key assumptions, firstly that the disabled who are not work-limited have equal productivity to the non-disabled and, secondly, that discrimination against the non-work-limited is equal to the work-limited disabled, it is possible to isolate the unobserved effect of health on productivity and to provide a more accurate measure of unequal treatment between the groups. Moreover, given the recent changes in legislation, the research also considers how the outcomes of the disabled have changed in the six year period following the DDA.[10] Any improvement (or deterioration) in the relative labour market outcomes of the disabled can be attributed to characteristic changes or unexplained changes in their treatment, the latter of which would signify the potential influence of changes in legislation. A version of the analysis based on earnings "Disability, gender and the British labour market" was published in *Oxford Economic Papers* in July 2006 with two co-authors Dr P. Latreille and Professor P. Sloane. Similarly, the analysis of the employment gap formed the basis of "Is there employment discrimination against the disabled?" which was published in *Economics Letters* in July 2006.

The next two analytical Chapters are closely related and continue to examine the labour market disadvantage faced by the disabled. However, they follow recent work in the US that considers marginalisation of the disabled through non-standard employment rather than direct discrimination (Schur, 2002, 2003 and Hotchkiss, 2004a). Also using data from the LFS, the concentration of disabled workers in part-time and self-employment is identified in Chapters 4 and 5 respectively. In both cases a similar methodology is applied which seeks to identify the voluntary or involuntary nature of these outcomes. A concentration of the disabled in part-time

[9] With the exception of a paper by Madden (2004), who uses data from the Family Resources Survey (FRS), UK studies have assumed equal productivity between disability groups.
[10] The definition of disability changes in 1997 which prevents a before and after DDA comparison.

employment may reflect marginalisation by employers, which constrains the opportunities of disabled employees. However, as Schur (2002) argues, it may also be the case that the disabled are able to accommodate their disability by working part-time and thus have different preferences for hours of work. More specifically, the assumptions of DeLeire (2001) are modified to separate the role of employer marginalisation from differences in preferences which may result from the disabled being more able to accommodate their disability in part-time employment. A version of this analysis "Does part-time employment provide a way of accommodating a disability?" is forthcoming at *The Manchester School* in December 2007.

Anecdotal evidence from surveys of the disabled identifies the potentially important role self-employment plays for the disabled (see Prescott-Clarke, 1990). Consistent with evidence from Clark and Drinkwater (1998) in relation to ethnic minorities, it may be the case that the disabled are pushed into self-employment due to discrimination in the salaried sector. However, the influence of discrimination on the relative returns to self-employment is not straightforward. Borjas and Bronars (1989) argue that consumer discrimination may act in the opposite direction and reduce the relative reward from self-employment. The impact of discrimination is therefore ambiguous. However, much of the evidence presented by Prescott-Clarke (1990) suggests an alternative channel through which disability affects the self-employment decision. That is, self-employment may have accommodating features, such as the ability to choose hours, location and duties, that facilitate access to work, which will act to increase the concentration of the disabled in self-employment. In a similar manner to the part-time analysis, a modified version of the DeLeire (2001) decomposition is used to separate the influences of discrimination from accommodation and, importantly, to establish the voluntary or involuntary nature of the decision.

Chapters 3 to 5, and much of the existing literature, are based on the assumption that self-reported 'global' measures of disability, identified from survey questions, coincide with 'true' disability. The literature which focuses on health and the retirement decision highlights the potential issues associated with using self-reported disability in labour market analysis (see Deschryvere, 2005, for a review). However, there appears no reason why the potential bias created by misreporting should be confined to older workers. As such, Chapter 6 investigates the issue of justification bias and measurement error in self-reported disability for the working age population. This analysis requires more objective information on health to use as instruments for self-reported disability and, as such, the analysis uses data from the HSE. The HSE contains more objective self-reported information, such as functional limitations, together with true objective information collected from a nurse visit. By using an Instrumental Variable (IV) procedure, the sensitivity of estimates of the impact of disability on labour force participation can be tested and the direction of any bias associated with using self-reported disability identified (Campolieti, 2002). Recent and proposed reforms of the disability benefit system make examination of this issue particularly timely and policy relevant. Indeed, the existence of justification bias may suggest a differential policy response between those where disability genuinely precludes economic participation and those where impairment is used to rationalise not working.

Whilst Chapter 3 considers the influence of the DDA, analysis using the LFS is restricted by the discontinuity in the definitions of disability across time. Therefore the influence of the DDA on employment is reconsidered in Chapter 7, using data from the HSE (1991-2004) and by applying a more standard difference in difference approach which has been used in the US literature (Acemoglu and Angrist, 2001). The initial US evidence found the Americans with Disabilities Act 1990 (ADA) had a negative impact on the employment rate of the disabled and suggested this was a result of the increased costs to employers from accommodation and the increased risk of legal action outweighing any positive effects from any reduction in discrimination that occurred (see DeLeire, 2000 and Acemoglu and Angrist, 2001). The first study to consider the DDA in the UK, Bell and Heitmueller (2005), finds no evidence of a positive effect from the legislation using data from the British Household Panel Survey (BHPS) and the Family Resources Survey (FRS). However, since the original analysis was published in the US, a series of studies have tested the robustness of the main conclusions (see Kruse and Schur, 2003, Beegle and Stock, 2003, Jolls and Prescott, 2004 and Hotchkiss, 2004b). As a result of some of the issues raised in these studies, the present analysis conducts a range of sensitivity tests. This includes an examination of employment by firm size since, initially, small firms were exempt from the provisions of the DDA.[11] The additional information on health in the HSE also enables controls for changes in the composition of the disabled to be included in the analysis, to test that the results are not driven by changes in the composition of the disabled following the introduction of the DDA (see Kruse and Schur, 2003).

It is typical for labour market analysis of disability to split the population into two groups and consider disability as if it were homogeneous. However, recent evidence has highlighted that characteristics of the disability have an important influence on labour market outcomes (for the UK, see Berthoud, 2003). Therefore, throughout this research, consideration is given to heterogeneity within the disabled group and its implications for labour market outcomes. Since the type and severity of disability may be expected to impact on work productivity, non-work income, the disutility of work and discrimination, these features appear fundamental in the labour market analysis of the disabled. As such, the Chapters, where appropriate, also identify if the magnitude of disadvantage differs between certain sub-groups of the disabled. Indeed, there has been a long-standing recognition of the policy importance of this issue, with Baldwin and Johnson (1994 p.14) stating "the success of the Americans with Disabilities Act may depend on the extent to which implementation of its policies recognises the differences among persons with disabilities".

The final Chapter, Chapter 8, highlights the key findings from each of the empirical Chapters and establishes overall conclusions, particularly on issues that extend across Chapters. At this point, the main limitations of the current analysis are discussed and potential areas for future research are identified.

[11] The small firm exemption was removed in October 2004.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This Chapter provides an overview of the international literature relating to the impact of disability on labour market outcomes. Section 2.2 explains the rationale for the growing interest in and policy importance of the disabled population. Section 2.3 considers the definition of disability and the inherent bias and measurement error problems that arise in labour market analysis. This area has received considerable attention in the US literature. Section 2.4 reviews empirical evidence on the impact of disability on earnings and employment and considers, amongst other issues, the role of labour market discrimination, the influence of heterogeneity within the disabled group and the dynamic effects of disability. The final section, Section 2.5, focuses on literature which attempts to evaluate policy aimed at improving labour market outcomes for the disabled; the evidence is focused on legislative changes, such as the ADA, but the influence of disability benefits is also highlighted.

2.2 Background

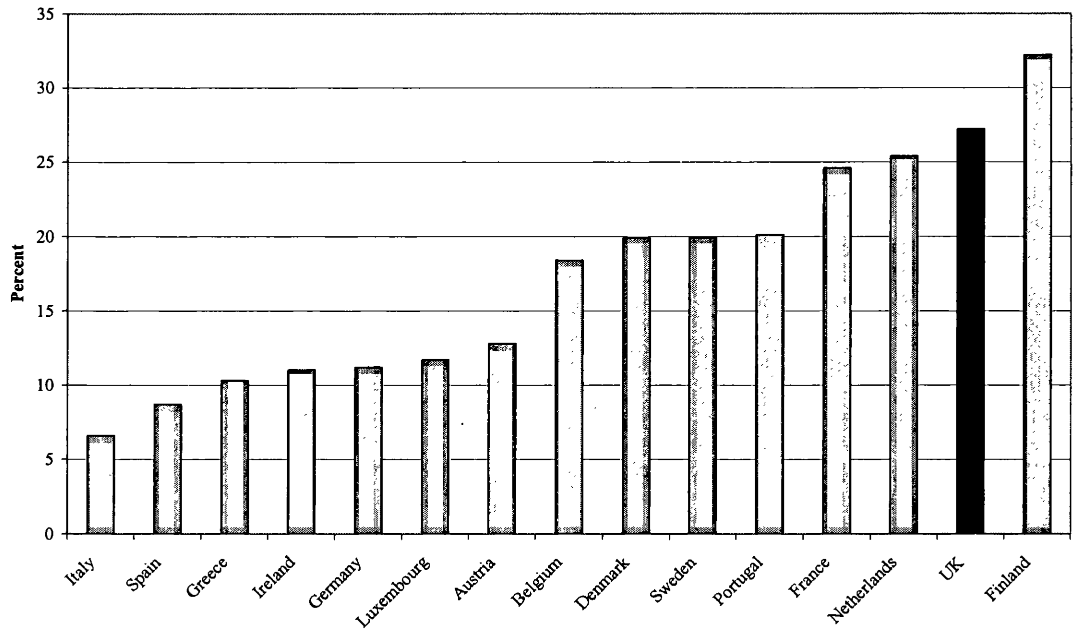
The change in the composition of the economically inactive population over the last twenty years has been widely identified as a major problem facing the UK labour market (Gregg and Wadsworth, 1999, Dickens *et al.*, 2000 and Nickell and Quintini, 2002). One of the most visible features has been the growth in the number of people classified as long-term sick or disabled at a time when the general level of health of the population has improved (Beatty *et al.*, 1997, Gregg and Wadsworth, 1999 and Faggio and Nickell, 2003). This increase has had extremely significant implications for public spending: the number of individuals claiming long-term sickness benefits doubled in the 1980s alone (Disney and Webb, 1991). Moreover, this phenomenon has not been confined to the UK; countries including the US (Bound and Burkhauser, 1999), the Netherlands and Scandinavian countries (Bowitz, 1997 and Beljaars and Prins, 2000) and Australia (Wilkins, 2004) have all experienced increases in disability benefit claimants.

In the UK, the disabled represent about 20 percent of the working age population, corresponding to 3.7 million men and 3.4 million women (Smith and Twomey, 2002). The size of the group and the extent of the problem facing policy makers are illustrated by international comparisons. With the exception of Finland, in 2002 the UK reported the highest rates of long-standing health problem or disability amongst those of working age in all EU15 countries.[12] As Figure 2.1 shows, the UK rate of 27.2 percent vastly exceeds that of Italy, which has the lowest rate of 6.6 percent, Spain at 8.7 percent and Ireland at 11 percent. Data from the OECD presented in Figure 2.2 also confirm that the labour market disadvantage associated with disability is higher in the UK than in the majority of OECD countries. With the exception of Poland and Spain, the UK has the lowest ratio of the employment rate of the disabled to the non-disabled. These statistics have been confirmed in cross country empirical studies such as Bardasi *et al.* (2000) who find that, whilst 41 percent of disabled men are in employment in the UK, the corresponding figure in Germany is 67.8 percent and in the USA is 71.8 percent.[13]

[12] Eurostat News Release STAT/03/142 5 December 2003.

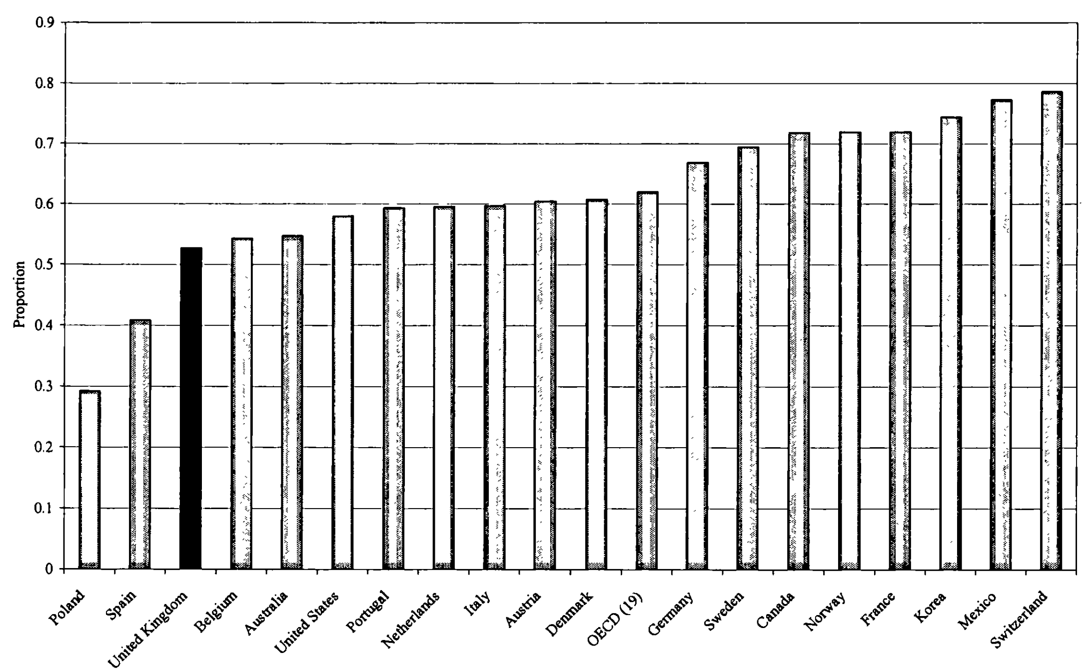
[13] They focus on long term work-limited disabled, although the definition differs between the British Household Panel Survey (BHPS), German Socio-Economic Panel (GSOEP) and the Panel Study of Income Dynamics (PSID).

Figure 2.1. Working Age Disability Rates in Europe



Source: Data obtained from Eurostat, Statistics in Focus, Population and Social Conditions, Theme 3 – 26/2003.

Figure 2.2. Disabled Employment Rates as a Proportion of the Non-disabled by Country.



Source: Data from Transforming Disability into Ability: Policies to Promote Work and Income Security for Disabled People, OECD 2003 (Table 3.3).

As a result of the disadvantage faced by the disabled, there have been important legislative and other reforms over the last few years aimed at securing improvements in the labour market position of disabled individuals in the UK. The most important legal change in this regard was the passing of the DDA in 1995, which was designed to protect the disabled against discrimination and to facilitate and enhance their access to employment by imposing obligations on employers to make reasonable adjustment to their premises and employment arrangements. In addition, the Disability Rights Commission was established in 2000 to provide advice and information for disabled people and to support them in securing their rights under the DDA, and campaign on their behalf. The Government has also improved incentives to work via the tax and benefit system and through the Disabled Person's Tax Credit in particular. The New Deal for Disabled People (NDDP), introduced in July 2001, further attempts to help those out of employment to get back into work.

It is also important to note there is substantial regional (and intra-regional) variation in disability rates in the UK. For example, Smith and Twomey (2002), using data from the LFS, find that the disability rates are highest in the North West and Wales (24.2 percent and 23.0 percent respectively) and lowest in the South East (16.3 percent). Labour market outcomes for the disabled also vary by region and Jones *et al.* (2006b) demonstrate that the employment rate of the disabled varies from 26.7 percent in Wales to 49.8 percent in the South West. Consistent with this, McVicar (2006) identifies a North South divide in the number of disability benefit claimants. Moreover, O'Leary *et al.* (2005) find that regional differences in ill-health are a dominant explanation of regional differences in rates of employment and inactivity.

As Smith and Twomey (2002) surmise:

> "the reasons for regional variations in disabilities... are likely to be associated with regional variation in: the distribution of industries; the availability of, and access to healthcare and adequate housing; lifestyle and dietary behaviour; levels of education; and the age distribution of the population." (p. 418)

Characteristics of the population and environment may explain some of the difference in disability rates across both countries and regions. However, social norms, public policy initiatives and individuals' perceptions of their disability are likely to affect the propensity both to register as disabled and to participate in the labour market. Senior (1998), after accounting for influences such as working environment, lifestyle, deprivation and area demographics, finds that individuals in Wales are more likely to report a disability, confirming that cultural factors are important. These, in addition to more traditional supply side (for example, the severity of the disability) and demand side (for example, the existence of prejudice) factors are likely to influence the effect of a given disability on an individual's labour market outcome.[14]

2.3 The Measurement of Disability[15]

There are two main ways to determine the existence of a disability from survey data. Disability can be self-assessed, where an individual assesses their own condition and capacity to undertake work, without any reference to outside standards. This type of information is widely collected in large scale surveys such as the LFS and the General Household Survey (GHS) in the UK, and the National Health Interview Survey (NHIS), Current Population Survey (CPS), Survey of Income and Program Participation (SIPP) in the US. The survey questions typically take the form *Do you have a health condition that limits the kind or amount of work you can perform?*. However, the exact wording of the question does affect the number classified as disabled (see Banks *et al.*, 2004). The main advantage of these questions is that they give direct information on work ability and, as such, they are extensively used in

[14] The literature relating to 'hidden unemployment' highlights the importance of demand side factors on the activity status of those with a health problem. For example, Beatty *et al.* (2000) argue that the sick/disabled are particularly vulnerable and that during the decline of heavy industry, disabled individuals moved from employment to inactivity (sickness related benefits).

[15] The International Classification of Impairments, Disabilities and Handicaps (World Health Organisation, 1980) provides definitions for each of these concepts. An Impairment is *any temporary or permanent loss or abnormality of a body structure or function, whether physiological or psychological. An impairment is a disturbance affecting functions that are essentially mental (memory, consciousness) or sensory, internal organs (heart, kidney), the head, the trunk or the limbs. A* Disability is a *restriction or inability to perform an activity in the manner or within the range considered normal for a human being, mostly resulting from impairment.* A Handicap is *the result of an impairment or disability that limits or prevents the fulfilment of one or several roles regarded as normal, depending on age, sex and social and cultural factors.*

labour market analysis (Kidd *et al.*, 2000, Acemoglu and Angrist, 2001 and DeLeire, 2000). However, determining whether an individual has a long-term health problem and if it is work-limiting, are both subjective. A certain medical condition may be interpreted as work-limiting by one individual, but not by another, making self-reported disability non-comparable across individuals (Campolieti, 2002). This subjective individual nature of reporting creates measurement error in self-reported information. This measurement error is compounded across countries where institutions, policy regimes and culture may differ significantly. Banks *et al.* (2004) examine differences in the rate of self-reported disability across countries and across labour market states. The results suggest that over 50 percent of the difference in rates of self-reported disability between US and the Netherlands is due to differences in disability thresholds. If the American thresholds were imposed on the Dutch population, the self-reported work disability rate in the Netherlands would fall by 7.6 percentage points to 27.3 percent, which would narrow the gap between self-reported disability rates in the US and the Netherlands from 14.1 percentage points to 6.6 percentage points.

There may, however, be social and economic incentives to misreport disability status; therefore, an individual's declaration may depend on their preference for work and the possibility of claiming disability benefits. If the propensity to classify a given disability as work-limiting is affected by employment status, disability becomes endogenous in regression analysis. This 'justification bias', that is, that disability is over-reported amongst the non-employed to justify their economic status, has been examined extensively in the US literature (see Bound, 1991, Kreider, 1999 and Currie and Madrian, 1999).[16]

Importantly, the reporting of disability, and particularly work-limiting disability, depends on a range of factors, including an individual's own employment opportunities (Kruse and Hale, 2003), the accessibility of the workplace, technological advances, changes in the nature of employment and labour market conditions (Baldwin and Johnson, 2001). Thus, even if an individual had the same

[16] The rationale for justification bias may also extend to other circumstances. For example, even amongst the employed, individuals may use disability to justify labour market outcomes such as not getting promotion or working part-time.

reporting thresholds for health, since disability, by definition, depends on individual circumstances, it is likely to differ between individuals. Moreover, an individual's own reporting of disability may change over time as a result of changes in their circumstances. Policy changes that increase the accessibility of workplaces may, thus, affect the number of people reporting a work-limiting disability (Kruse and Schur, 2003). The effect of social stigma (which may result in under-reporting of disability) may also change over time, leading to changes in the size of the disabled group, particularly after changes in policy (Kruse and Schur, 2003).

Following the approaches used to examine the validity of self-reported health information (see. for example, Bound, 1991 and Au *et al.*, 2005), a series of studies have used 'more objective' information on health in addition to the 'global' self-reported measure of disability (see for example, Stern, 1989 and Campoletti, 2002). This 'more objective' information ranges from self-reported more specific information such as reporting particular functional limitations to, at the other extreme, true objective information. This may, for example, include measures collected from blood/saliva samples. Examples of 'more objective' measures used in studies concerning the measurement of self-reported disability/health include:

1) Impairment specific information (Burkhauser *et al.*, 2002), for example self-reported deafness.
2) Self-reported activity limitations (Kruse and Schur, 2003), for example functional activity (seeing, hearing, speaking, walking) or daily activities (dressing, preparing meals).
3) Self-reported or physician diagnosed medical conditions or symptoms (Stern, 1989).
4) Subsequent mortality rates (Parsons, 1982) and other objective measures, for example, body mass index (BMI) (Campolieti, 2002) or sick days (Burkhauser, 1979).
5) Health indices based on a range of medical conditions and functional limitations (Au *et al.*, 2005).

Several studies have compared the difference in outcomes that result from different measures of disability or ill-health, since they are subject to different sources of bias (Bound, 1991, Bound *et al.*, 1995). Subjective information is likely to suffer from two sources of bias. Justification bias creates an endogeneity between disability and work and the subjective nature of reporting creates measurement error. This endogeneity, whereby the non-employed are more likely to report disability, will enhance the effect of disability on labour market outcomes and lead to an upward bias on the effect of disability. However, the influence of measurement error will lead to a downward (attenuation) bias on disability and, thus, act in the opposite direction. Overall, the bias associated with self-reported information is ambiguous, but, if the influence of endogeneity outweighs that of measurement error, self-reported information will overestimate the impact of disability. More objective information, although less likely to suffer from justification bias, tends not to be as closely related to work limitations and, thus, may suffer from an alternative source of measurement error (Bound, 1991). This alternative form of measurement error leads only to a downward bias on the effect of disability on labour market outcomes. As a result, studies have identified a range of estimates of the influence of disability on labour market activity, dependent on the type of measure used (Loprest *et al.*, 1995, Kruse and Schur, 2003).

Burkhauser *et al.* (2002), using US data, find there are no differences in the trends over time identified from self-reported and more objective measures. They conclude that, although work-limiting definitions are not ideal, nationally representative data sets (for example, the CPS) are able to monitor trends in labour market outcomes. However, it should be noted that work-limiting disability questions tend to be included in surveys which focus on labour market issues (see for example, the CPS in the US and the LFS in the UK), whilst more detailed and objective health measures traditionally come from surveys focusing on health (for example, the NHIS in the US and the Welsh Health Survey (WHS) in Wales). Hardy and Pavalko (1986) argue the difference in the purpose of the questionnaires may affect responses.

Studies also use more objective health measures to instrument self-reported measures in an attempt to eliminate the endogeneity of disability (see Stern, 1989, Bound, 1991, O'Donnell, 1998, Dwyer and Mitchell, 1999, Campolieti, 2002 and Disney *et al.* 2006). This procedure enables the aspects of ill-health that have most influence on self-reported disability to be identified and, in some cases, measures the extent to which self-reported disability depends on labour market status. Au *et al.* (2005)

include a variable controlling for labour market participation, alongside detailed health measures and individual characteristics, to identify justification bias directly.

Kerkhofs and Lindenboom (1995) and Kreider (1999) adopt an alternative approach in that they use objective health measures to estimate true health on the assumption that workers have no incentive to misreport. However, these studies, which identify a point estimate of the true disability rate, have to impose strong parametric assumptions over the reporting error process. More recent studies, such as Kreider and Pepper (2007) and Kreider and Pepper (forthcoming), estimate bounds on the true disability rate under weaker assumptions (varying the percentage of misreports). Under the assumption that disability is non-decreasing with age, models of participation which assume that self-reported measures correspond with true disability are found to be mis-specified.

The empirical evidence on the bias associated with self-reported disability is mixed. Several authors find that assuming self-reported health coincides with true health leads to biased inferences, with non-workers, or workers with low expected wages, over reporting disabilities (Chirikos and Nestel, 1984, Bowe, 1993, Kerkhofs and Lindeboom 1995, O'Donnell 1998, Kerhofs *et al.* 1999, Kreider 1999, Lindeboom and Kerkhofs, 2002 and Kreider and Pepper, 2007, forthcoming). However, there are also studies that find that labour market status has no effect on misreporting health (Stern 1989, Dwyer and Mitchell 1999, and Benitez-Silva *et al.* 2004). Others suggest that the propensity to misreport depends on individual characteristics, with those receiving disability insurance (Kerkhofs and Lindeboom, 1995), non-working women, high school dropouts, non-whites and former blue-collar workers being more likely to overstate disability (Kreider, 1999). The type of disability reported has also been found to be significant. For example, Baker *et al.* (2004) match self-reported health measures from the Canadian National Population Health Survey with individuals' health records from the Ontario Health Insurance Plan and find that reporting error varies between types of disability. The ratio of the error variance ranges from 30 percent for diabetes to over 80 percent for arthritis.

Kreider (1999) argues the existence of over reporting health problems results in an upward bias of estimates of the effect of disability on employment. This has been supported in a range of empirical studies (Parsons, 1982, Chirikos and Nestel 1984, Anderson and Burkhauser, 1985). However, other studies find that the effect of disability on both employment and wages is consistent across different disability measures (Lambrinos, 1981 and Stern, 1989). This may even be the case when the evidence supports justification bias (Au *et al.*, 2005). In contrast, Campolieti (2002) finds evidence that self-reported disability underestimates the effect of disability on labour force participation, suggesting the effect of measurement error may outweigh justification bias.

In addition to the measurement error criticism associated with more objective health measures (Lindeboom and Kerkhofs, 2002, Campolieti, 2002), the issue of endogeneity may be relevant. In line with the arguments above, any self-reported information, no matter how specific, may be subject to some degree of justification bias. However, even if justification bias is not present, measures of disability are endogenous if work has a direct effect on health or if there are common unobservables which affect work and health, which can lead to biased estimates of the effect of disability on employment (Ettner, 2000). Social interaction through work may have benefits on health, as may the additional income from employment, which may improve housing, diet and healthcare. Consistent with this, Baker *et al.* (2004) find that even objective health measures are more likely to be reported by the non-employed. However, there are also potential negative effects of employment, including stress and risk from hazards at the workplace. Haveman *et al.* (1994) find, using US data, that estimates that do not account for the interdependence of health, work-time and wages are biased, though, when controlling for this, they still find a negative relationship between health limitations and work-time and wages.

The appropriate definition of disability will depend on the issue being examined. Measures of health from survey data have been criticised since they may differ from those used to assess the validity of disability benefit claims and disability as defined by legislation (Kirchner, 1996, Schwochau and Blanck, 2000 and Kruse and Schur, 2003). A measure that is appropriate to analyse labour market outcomes may, therefore, not be as appropriate for specific evaluation of policy. For example, studies that focus on the labour supply effect of disability benefits define the disabled group by application (Bound, 1989) or by receipt of these benefits (Autor and Duggan, 2003).

2.4 Disability and Labour Market Outcomes

2.4.1 International Evidence

In theory, there are many channels through which a disability can affect labour market outcomes. Ill-health or disability may be expected to reduce an individual's productivity in work and thus earnings, though this will vary depending on the requirements of an occupation and the severity of the disability. This reduced capacity for work may also change an individual's preferences away from consumption towards leisure. In addition, the non-work income a person can obtain may increase with the onset of disability, which will have a similar positive influence on the reservation wage. However, it is possible that the observed inferior labour market outcomes of the disabled are due, in part, to employers discriminating on the basis of disability. This may be the result of prejudice (Becker, 1971) or due to imperfect information, where an employer uses the presence of a disability as an indicator of the productivity level of the group (Phelps, 1972). This issue, separating the influence of observable characteristics from discrimination, has received considerable empirical examination. However, it should be acknowledged that the existence and expectation of discrimination may also affect pre-labour market decisions of the disabled and, thus, observable characteristics and employment choices.

Independent of the definition of disability or the data set used, US evidence consistently finds disabled workers earn significantly less than non-disabled workers, even after controlling for differences in human capital and job related characteristics (Baldwin and Johnson, 1994, 1995, 2000; Haveman and Wolfe, 1990, Hale *et al.*, 1998, Acemoglu and Angrist, 2001 and DeLeire, 2000 and Kruse and Schur, 2003).[17]

[17] Studies also consider the impact of disability on poverty, for a UK study see Burchardt (2003b) and for a US study see Kruse (1998). The evidence suggests that disabled individuals are more likely to live in poverty, but this depends on their situation prior to disability. When the costs associated with being disabled are taken into account, the effect is enhanced (Burchardt, 2003b and Zaidi and Burchardt, 2005).

This is typically taken to represent earnings discrimination against the disabled. However, there may be large unmeasured productivity differences between disabled and non-disabled workers in a human capital wage equation, which, without sufficient controls, are likely to contribute to the unexplained proportion of the wage differential. Several studies address this issue directly by attempting to control for the effect of health on productivity, using measures of health and functional limitations (for example, cognitive, mobility and sensory) as additional explanatory variables in the earnings equation; however, an unexplained wage gap is still observed (see Hendricks *et al.*, 1997 and Baldwin and Johnson, 2000 for US studies).

An alternative method to separate the effect of health from the effect of discrimination has been to distinguish between groups of the disabled who are likely to face different degrees of prejudice. Johnson and Lambrinos (1985), using US data from the 1972 Social Security Survey of Disabled and Non-disabled Adults, identify the disabled population as those that are handicapped (defined as visible impairment subject to prejudice rather than by the severity of the disability). They find that, whilst including an index of health problems and controlling for selectivity bias, wage discrimination accounts for between 30 and 40 percent of the offer wage differential. Baldwin and Johnson (1994), using data from the SIPP, also identify disabled individuals who are likely to face little discrimination, but who have health problems that affect productivity and compare the outcomes with those disabled likely to face discrimination. They find that those with impairments that are subject to prejudice suffer lower average wages and employment probabilities than those with impairments that are less subject to prejudice. Approximately 40 percent of the wage gap between those disabled subject to prejudice and the non-disabled is due to discrimination. However, even though the offer wages for the disabled who are less likely to suffer prejudice are nearly the same as the non-disabled, a discriminatory component exists reflecting something other than prejudice (approximately 10 percentage points). The most obvious explanation appears to be the influence of disability on productivity that is not controlled for in the regression. DeLeire (2001) criticises these techniques, suggesting that the prejudice associated with a disability may be related to the severity of the disability itself and is, therefore, correlated with work productivity, making it impossible to separate discrimination from the effect of health problems on productivity. Instead, he splits the population into three groups:

the self-reported work-limited disabled, the disabled who class their disability as non-work-limiting and the non-disabled. The disabled who have a non-work-limiting disability are assumed to have equal productivity to the non-disabled and, therefore, any unexplained gap in wages between these two groups of workers is due to discrimination. The unexplained gap between the work-limited disabled and the non-disabled is a combination of discrimination and productivity differences. Using data from the SIPP (1984, 1992, 1993), he finds that only a small percentage of the earnings gap (5-8 percent) is due to discrimination.

Heterogeneity

Further complicating the analysis of the disabled group, there are differences between disabled individuals on the basis of the type and severity of the disability. Bartel and Taubman (1979) examine four groups of diseases and find that the labour supply effects of ill-health are negative in all cases, with larger effects caused by bronchitis and athsma and psychoses and neuroses than by heart disease and arthritis. Zwerling *et al.* (2002) use data from the NHIS Disability Supplement and find those with cardiovascular, musculoskeletal and respiratory diseases are less likely to work than other disabled individuals. Within psychiatric disease, there is a large variation in the propensity to work, with the lowest employment rates associated with schizophrenia and paranoid delusional disorder. The severity of a disability is more difficult to measure, but, using self-reported classifications from the SIPP, Hale *et al.* (1998) split the disabled group into severely, moderately and not disabled. They find the disabled have lower participation rates, lower rates of full-time work and a greater prevalence in lower paying occupations. These effects are more pronounced as the severity of the disability increases and, although some of these outcomes are explained by the disabled possessing fewer qualifications, increasing education does not eliminate the differences. Hum and Simpson (1996) use Canadian data and confirm that the disabled have lower participation rates, average hours of work and average earnings. They examine the influence of both severity and type (mobility, sensory, mental or multiple impairments) of disability. They find that the severity of the disability is an important influence on all labour market outcomes and that only sensory disability is not associated with any labour market disadvantage. In an Australian study, Wilkins (2004) finds that disability is associated with a 25 percent decrease in employment probability, but this probability is greater for the more severely disabled, those with multiple impairments and those with mental health problems, confirming that the type, severity and number of health problems are important.

The extent to which an impairment will affect an individual's productivity will not only depend on the type and severity of the disability, but also on the specific requirements of a particular job and the interaction between the disability and the requirement (Wolfe, 1984). Schumacher and Baldwin (2000), using data from the SIPP, attempt to control for this by including measures of job demands (verbal, spatial, numerical aptitudes, strength and physical demands of the job) by occupation and by functional limitation, in the wage equation. A significant unexplained wage differential remains for workers with disabilities, consistent with the previous literature.

It may also be the case that an employer can make necessary accommodations to equalize the productivity between a disabled and non-disabled worker. At the most extreme, these accommodations may enable a disabled person to continue working. In a dynamic study, Burkhauser *et al.* (1995) examine the influence of workplace accommodations on labour market exit in the US. They estimate a time hazard model, using Social Security data, and find employer accommodation has a positive effect on job tenure; indeed, they suggest workplace accommodation is as important as the benefit replacement ratio in the participation decision. Since accommodations are costly to firms they may be passed on to disabled workers in the form of a wage gap (Baldwin and Johnson, 2001). This issue has received limited attention, mainly due to data restrictions; however, Gunderson and Hyatt (1996) use a unique data source, the Ontario Workers Compensation Board Survey of Workers with Permanent Impairments, which provides information on workplace accommodation (that is, adjustments made in terms of physical tasks and hours and material modifications of the workplace). In their study of injured workers in Ontario 1979-88, they find that the proportion of the cost of the accommodation passed on to workers through lower pay depends on whether the worker was employed with the same firm prior to injury. In this case, the employer was found to pay for workplace modifications (but not for changing physical demands), whereas, a substantial part of the cost is borne by the employee if he/she is injured at another firm. Campolieti

(2004a), using the same data and accounting for the return to work selection problem, finds that workers who have received training prior to an accident and who return to work with the same employer are more likely to receive accommodation.

The type of injury is also an important influence on accommodation. Zwerling *et al.* (2003), using a nationally representative dataset, examine the relationship between personal characteristics and accommodations in the US. Although 12 percent of disabled people have workplace accommodations, female, more educated, older, full-time workers and the self-employed are more likely to receive accommodations. Provision is also greater for more severe limitations, but is less likely for those with mental health impairments.

Although the literature has considered the influence of unobserved productivity differences in some detail, less attention has been paid to the problem of selection bias that results from non-random assignment of individuals into disability status. One of the few studies in this area is Lechner and Vazquez-Alvares (2004) who use matching techniques and data from the German Socio-Economic Panel (GSOEP) (1984-2001) to overcome this problem. The disabled (treatment group) are individuals who become disabled and remain disabled at the third year. The control group is those who remain non-disabled for the same period. The non-disabled are found to have nearly a 10 percent higher rate of employment and 16 percent higher earnings than their disabled counterparts. Previous studies have focused, instead, on another source of selection bias in earnings equations, the selection bias that results from a non-random sample choosing employment (Johnson and Lambrinos, 1985, Baldwin and Johnson, 1994, 1995) and have controlled for it using the Heckman (1976) two-step procedure.[18]

The effect of disability on labour market outcomes may differ on the basis of other observable characteristics (Baldwin and Johnson, 1995 and Bound *et al.*, 1995). Johnson and Lambrinos (1985) find that the proportion of the wage gap attributed to discrimination is greater for disabled women (nearly fifty percent) than disabled men

[18] The sign and significance of the selection term varies between genders but the negative discrimination wage effect is still identified. For males, taking selection into account increases the non-discriminatory wage difference (Baldwin and Johnson, 1995).

(thirty percent). Madden (2004), using UK data, finds that discrimination is greater for disabled women than disabled men, in terms of both participation and wages. Baldwin and Johnson (1995) examine women and find that, in the US, about 50 percent of the wage differential between disabled and non-disabled women is due to discrimination. Loprest *et al.* (1995) examine gender differences in participation among older workers in the US and find the effect of disability on participation is larger for men and single women than for married women. Particular limitations are also found to affect genders differently, labour market outcomes are more adversely affected for men with mobility and strength limitations, whilst women are more severely affected by ill-health affecting sensory incapacity and appearance (Baldwin *et al.*, 1994). Several of these studies go on to examine the impact of disability on discrimination on the grounds of gender. They find that disabled workers also suffer from gender discrimination (Johnson and Lambrinos, 1985) but the magnitude of this gender discrimination is not increased due to disability (Baldwin and Johnson, 1995).

Employment

Whilst the focus of the literature has been on wage discrimination, the difference in employment probabilities between the two groups is actually more dramatic. Several studies model the probability of employment, using a probit model as part of a Heckman (1976) correction for sample selection (Baldwin and Johnson, 1994, 1995) or in analysis of health conditions on the labour supply of older workers (Loprest *et al.*, 1995 and Disney *et al.*, 2006). Studies consistently identify a negative employment effect from disability and frequently find the influence of health is greater on employment than wages (Baldwin and Johnson 1994, 1995). Baldwin and Johnson (1992) note that the presence of wage discrimination will force some individuals to exit the labour market and may, therefore, explain some of the observed difference in employment rates. Baldwin and Johnson (1994), using data from the 1984 SIPP, find the disincentive effects of wage discrimination account for only 2 of the 29 percentage point difference in employment rates between disabled men subject to prejudice and non-disabled men. In a related study for females, Baldwin and Johnson (1995) find that wage discrimination accounts for less than 1 percentage point of the 26 percentage point gap in employment.

Since the influence of wage discrimination on employment is small, it is important to examine discrimination in hiring which may explain more of the observed employment difference. In the UK, Blackaby *et al.* (1999) and Kidd *et al.* (2000) decompose the employment gap and find less than half is explained by characteristics, suggesting discrimination at this stage is important. More recently, studies have begun to examine whether disability affects the type of employment undertaken. US evidence suggests that the disabled are concentrated in non-standard forms of employment, including independent contracting, part-time and temporary employment (Schur, 2002, 2003 and Hotchkiss, 2004b) which have lower wages and fewer benefits on average. The important question is whether this is the result of discrimination or a voluntary choice for the disabled. Schur (2003) finds that, even when personal characteristics are controlled for, the disabled are significantly more likely to be in temporary and part-time employment. She argues that there are three possible reasons for this: the disability benefit regime, employer discrimination and the flexibility required by the disabled. The evidence suggests that flexibility is the dominant reason and that these forms of employment enable individuals to work who are unable to undertake standard types of employment. Consistent with this, Hotchkiss (2004b) finds that part-time employment among the disabled has increased and there is a higher propensity for disabled people to be employed part-time relative to the non-disabled. She finds this is predominately due to differences in voluntary part-time employment.[19]

In similar research, Presser and Altman (2002) use data from the US Medical Expenditure Panel Survey (MEPS) and do not find a significant relationship between working non-day shifts and disability, about one fifth of each group working late or rotating shifts.[20] However, the disabled face less wage discrimination when working undesirable hours, consistent with employers being less able to discriminate when labour supply is more restricted. Blanck *et al.* (2000) find that workers with disabilities are nearly twice as likely to be self-employed as the non-disabled. In the UK, the rate of self-employment is also higher for the disabled (Boylan and

[19] Part-time employment may be an intermittent step between inactivity and full-time employment with benefits for the employee (training, experience) and employer (information about productivity).
[20] This may be due to two conflicting influences, employers may be more willing to hire the disabled in less desirable jobs where there are greater staff shortages, whilst, relative to the non-disabled, the disabled may suffer greater discomfort from working shifts.

Burchardt, 2002). Again, there appear to be two central explanations. Firstly, discrimination pushes people into self-employment as a last resort and, secondly, the disabled require greater freedom and flexibility to work around their disability. The high rates of self-employment are consistent with the higher rates of home working among the disabled (Schur and Kruse, 2002).

Less attention has been given to the occupational choice of disabled workers, although initial evidence for the US (Hale *et al.*, 1998) and the UK (Meager *et al.*, 1998 and Smith and Twomey, 2002) find disabled workers are concentrated in low skilled jobs such as administrative, secretarial, administrative skilled trades and personal services. Schumacher and Baldwin (2000), using data from the SIPP, find evidence for the quality-sorting hypothesis, where, because disabled workers have a lower amount of unmeasured skill, both disabled and non-disabled workers receive lower wages in occupations with a higher proportion of disabled workers.

Amongst the employed, the impact of disability on measures such as job satisfaction and job mobility has also been examined. Uppal (2005) finds that job satisfaction is lower among the disabled relative to the non-disabled in Canada, and that part of the effect is explained by experience of discrimination and harassment in the last 12 months. Schumacher and Baldwin (2000), using data from the SIPP, find few differences in job mobility between disabled and non-disabled workers. One exception is that workers with disabilities have higher rates of involuntary job change, indicating that there may be discrimination in firing or that job mismatch is greater among workers with disabilities. Baldwin and Schumacher (2002), using data from the US SIPP, find similar results and suggest that either the disabled group are secondary workers, who are less likely to be hired and more likely to be fired, or that the disabled face greater mismatch. There is limited evidence to suggest differences in the wage effect of job changes. In addition, there is no evidence to support the notion that discrimination increases involuntary job turnover, despite increased legal action since ADA.

2.4.2 UK Evidence

Regardless of source, the contrast in labour market outcomes for disabled and non-disabled persons in the UK is stark: the employment rate for the disabled is about half the rate of the non-disabled, whilst for those disabled people in employment, average earnings are substantially lower than for the non-disabled (Smith and Twomey, 2002 and Kidd *et al.*, 2000).

Economic analysis of the disabled in the UK has been far more limited relative to the US or similar studies in the UK on the basis of gender or race. However, the evidence that exists finds that disability has a consistent negative effect on both earnings and employment. Blackaby *et al.* (1999) use data from the 1991 Census, 1992-4 LFS data and the GHS and find, irrespective of data source, that the unemployment probabilities of the disabled are higher than those of the non-disabled, while their earnings are lower.[21] Differences in characteristics account for a maximum of around one half of the difference in employment or earnings. Similarly, Kidd *et al.* (2000) use data from the 1996 LFS, but restrict the analysis to males only. Again, observable productivity differences between the disabled and non-disabled explain around 50 percent of the wage and participation rate differentials between the two groups when they control for selection into employment. They also identify some within group differences in outcomes, with mental health problems having the most adverse impact on labour market outcomes. Using the method of Baldwin and Johnson (1992), they also find the employment effect of wage discrimination to be small.

The UK evidence fails to control for the effect disability has on the productivity of those in work. Madden (2004) uses cross sectional data from the FRS in 1995 to examine the effect of health status on earnings, whilst controlling for selection into health and employment status. In addition to controlling for the endogeneity of health status, he examines the effect of health on productivity by distinguishing between those who have a health problem that is work-limiting and those who have a health problem that is non-work-limiting, in a similar way to DeLeire (2001). Although the self-selection into disability is not found to be important, controlling for the effect of

[21] In a study examining the relationship between ill-health and income, Contoyannis and Rice (2001) use data from the BHPS and find that psychological ill-health reduces earnings for men, whilst excellent self-assessed health leads to higher wages for females. They exploit the panel element of the data to allow for a time lag between the effect of health on wages. The endogeneity of health and earnings is controlled for using instrumental variables, but the efficiency gains are largely accounted for by time-invariant endogenous variables, particularly education.

disability on productivity eliminates the unexplained (discriminatory) wage gap and the participation gap, suggesting there is no discrimination against the disabled.

Berthoud (2003), using data from the Disability Survey attached to the FRS, highlights the variation within the disabled group and finds that the severity of the disability is an important determinant of employment. He also finds that the disabled are more sensitive to other forms of disadvantage such as having poor education or living in a high unemployment region. Interestingly, O'Donnell (1998) argues that some disabled people are unable to work, so that the literature based on the assumption of individual choice may be inappropriate in this situation. Using data from the 1985 British Office of Population Censuses and Surveys (OPCS), O'Donnell models employment as an outcome of two decisions - capacity for work and desire to work - and finds that failure to model the inability to work overestimates the impact of disability on wages.

2.4.3 Dynamic Effects

As Baldwin and Johnson (2001) highlight, disability, unlike gender or race, can be a non-permanent state, with the most common forms of disability, musculoskeletal or cardiovascular and circulatory, often developed during middle age. UK evidence confirms this, since only 11 percent of the disabled adult population are born with their disability, 12 percent aquire it in childhood and the remaining 75 percent become disabled during their working life (Burchardt, 2003b). Baldwin and Johnson (2001) suggest that the disabled population should, therefore, be split into two main groups: those who are disabled during childhood and those who are disabled later in life (after entering work). This distinction appears important since they face very different labour market issues. The first group may face discrimination in education and upon entry in work, whereas the second group are affected by discrimination when returning to work after illness. However, it is rare for cross section studies to contain retrospective information on the date of disability onset.[22] Furthermore, disability may not be sudden, but a gradual deterioration in health (Burchardt, 2003b). Where this information does exist, after controlling for observable characteristics, mature disability onset is found to be associated with poorer labour

[22] Moreover, even when onset is observed in panel data, both the length of the panel and the sample size tend to restrict the analysis (see Jenkins and Rigg, 2004 for an examination of the BHPS).

market outcomes (see Wilkins, 2004, who uses data from the 1998 Australian Bureau of Statistics Survey of Disability, Ageing and Carers and Jones, 2006a, who uses data from an ad-hoc module on disability in the 2002 UK LFS). Similarly, Pelkowski and Berger (2004) who use data from the US Health and Retirement Survey (HRS) find the adverse effects of ill-health depend on the age of onset, with more pronounced effects for males aged in their 40s and females in their 30s. This suggests that individuals disabled at birth or in childhood are more able to adapt to their disability. In addition to the timing of onset, the cause of onset may have important labour market implications. For example, an individual who becomes disabled as a result of an industrial accident may be more likely to receive financial compensation; this is likely to increase an individual's reservation wage relative to other sources of onset. In addition, whether onset is sudden or gradual may have implications for adaptation and, thus, labour market outcomes.

Previous analysis of longitudinal data in the US focuses on the relationship between disability, employment and benefit income (Burkhauser and Daly 1996, 1998). Similar UK studies have investigated transitions in relation to incapacity benefits rather than disability and employment directly.[23] They find that economic incentives (benefit levels, pay, pension rights, local labour market conditions), in addition to personal characteristics, are important determinants of inflows, outflows and the duration of sickness claims (Fenn, 1981, Holmes and Lynch, 1990 and Disney and Webb, 1991). However, more recently, longitudinal data has begun to examine the dynamic impact that disability has on labour market transitions.

In an international study, Bardasi *et al.* (2000) compare the impact of disability on the labour market in Britain, the US and Germany. The onset of disability is associated with a larger outflow from employment in Britain, with 81 percent employed two years prior to the onset of disability and only 36 percent two years after onset compared to 96 percent and 83 percent in Germany. Moving into non-employment, however, is not associated with major reductions in income. The employment rate of disabled men is about 50 percent of the non-disabled group, but disabled men earn 70 percent of the non-disabled wage in Britain. Burchardt (2003a)

[23] A discussion of the impact of disability benefits on labour supply is included in Section 2.5.1.

uses the longitudinal element of the LFS and finds that 2.6 percent of people become disabled (as defined by the DDA) quarter on quarter. As a result of the onset of disability, 5 percent leave employment immediately, whereas after 9-12 months 13 percent have left employment. The probability of exiting employment is higher for those with low levels of human capital and poor employment protection. Jenkins and Rigg (2004) use data from the BHPS to split the effect of disability into three stages i) a selection effect, ii) the effect of disability onset, and iii) the effect of disability post onset. Consistent with self-reporting bias, individuals who experienced disability onset were typically more disadvantaged prior to the disability onset, having fewer qualifications, lower incomes and lower employment rates. Indeed, having no qualifications increased the probability of disability (by over 50 percent); although this is consistent with justification bias, it may, in part, reflect higher rates of disability among low income groups. However, the effect of onset is negative in itself, with the proportion of persons in paid work falling by 26 percent and their median income falling by 10 percent. After the initial onset effect average work income increases, but the probability of being in employment falls with the duration of disability.[24] Gannon (2005) uses data on Ireland from the European Community Household Panel (ECHP) (1995-2000) and controls for the influence of unobserved heterogeneity, past disability and labour market status on current labour market participation. The results suggest that failing to control for these influences results in the impact of disability being over-estimated by 40-60 percent for men and 5-10 percent for females.

Burchardt (2000) also uses the BHPS and focuses on the duration of disability. She finds that, although at any time the long-term disabled account for a large proportion of all disabled people, only a small proportion of those who have ever experienced disability are long-term disabled. Indeed, over half of those who become disabled as adults have a duration of 2 years or less, emphasizing that it is not a permanent state for many, although after four years, the exit rate from disability is severely reduced. The study highlights the heterogeneity of disability in a cross sectional study, which, depending on the definition used, could treat an individual with long-term sickness in

[24] Gannon and Nolan (2007) undertake a similar analysis using Irish data and find that being older and less well educated increases the probability of persistent disability. While disability onset and persistent disability are associated with poverty and social exclusion, part of the disadvantage is found to exist prior to disability onset.

the same way as an individual with a temporary spell of incapacity. Confirming this heterogeneity, Pelkowski and Berger (2004) find that temporary health problems only have limited effect on either hours worked or earnings.

Rigg (2005) examines the labour market progress of the disabled using the annual longitudinal element of the LFS and finds the disabled are also disadvantaged in terms of progression. The disabled have lower rates of earnings growth, are more likely to exit employment, move from full-time to part-time work and have significantly less training. However, there is little evidence of a difference in occupational progression. Interestingly, it is prime age disabled men and disabled individuals in manual occupations that face the least favourable trajectories.

The effect of disability on labour market transitions can be related to the more extensive literature on the impact of health on the retirement decision (Disney *et al.*, 2006 for example), which suggests that poor health encourages retirement (Anderson and Burkhauser, 1985, Sickles and Taubman, 1986, Bound, 1991, Loprest *et al.*, 1995, Campoleiti, 2002 and Hagan *et al.*, 2006). Bound *et al.* (1999) use data from the HRS and emphasise that it is both poor health and deteriorating health conditions that have an important influence on labour market exits. They also suggest that onset of poor health causes some people, who remain employed, to change jobs, consistent with workers adapting their type of employment so that they can remain in the labour force. Recent evidence for the UK (Disney *et al.*, 2006), using the BHPS and instrumenting self-reported health, confirms that it is a deterioration in health that is most closely associated with transitions into non-employment. Kerkhofs *et al.* (1999) take into account the endogeneity of health when modelling the retirement decision and find, when using data from a Dutch survey, that subjective measures overstate the effects of health on retirement, while endogeneity has the reverse effect. Similarly, Dwyer and Mitchell (1999) use self-rated and objective measures of health from the HRS and find that ill-health brings forward retirement by a couple of years, but that the effects differ with the type of health problem; the greatest acceleration in retirement is due to chronic conditions such as functional limitations and circulatory disorders. The impact of disability may also affect the retirement decision of other members in the household. Johnson and Favreault (2001), using data from the HRS, find that, whilst both men and women are more likely to retire if their spouses have already retired, this does not hold for spouses whose partner has exited the labour force due to ill-health, particularly when spouses are not yet eligible for retirement benefits. This may indicate that the incentive to care for a disabled partner is outweighed by the incentive to compensate for the loss in income.

2.5 Policy Evaluation

2.5.1 Disability benefits[25]

The effect of disability benefits on labour supply has been examined extensively and studies consistently find a significant negative relationship (Bound and Waidmann 1992, Harkness 1993, Gruber and Kubik 1997, Bound and Burkhauser 1999, Gruber 2000, Buddelmeyer 2001 and Autor and Duggan, 2003). The impact of benefit levels on participation has been quantified by examining how participation rates vary with the replacement ratio in cross section data (Parsons, 1980, Haveman and Wolfe, 1984, Haveman *et al.*, 1991). The studies confirm large disincentive effects from benefits. Parsons (1980) estimates that the elasticity of non-participation to changes in benefits is between 0.49 and 0.93 in the US; however, subsequent evidence suggests lower values between 0.1-0.2 (Leonard, 1986). A problem with this approach is that the replacement ratio is a decreasing function of past earnings, making it difficult to distinguish between low earnings or generous benefits as the reason for non-participation. More recently, studies have identified ways of examining differences in the replacement ratio that are independent of earnings. Bell and Smith (2004), for example, use the 1995 reform of UK disability benefits to test the effect of benefit generosity on the number of claimants and find an elasticity of 0.26, which increases to 0.63 for the least educated males. Gruber (2000) performs a similar test in Canada, but focuses on differences between types of disability benefits and estimates the elasticity of non-participation to be in the range 0.28 to 0.36. In contrast, Campolieti (2004b), using the same data source, but for an earlier time period than Gruber, finds that a region specific change in the benefit level in Canada did not have a large effect on labour market activity. One suggestion for the difference in results is the more stringent screening used in the earlier period examined by Campolieti.

[25] McVicar (forthcoming) provides an overview of the current disability benefits available in the UK.

Similar studies examine the impact of benefit rejection on participation. Bound (1989) uses those who fail the medical test for disability benefits as a control group. Only half of those who are refused benefits are employed, which suggests claimants have serious health reasons for not working rather than non-participation being entirely due to receipt of benefits. Gruber and Krubik (1997) examine US state variation in benefit rejection rates and find a 10 percent increase in rejection leads to a reduction in non-participation of 2.8 percent among older males. Differences in policy regimes across countries also provide information about the work incentive effect of alternative schemes. Burkhauser and Daly (1998) compare the US and Germany, and although disability rates are similar between the two countries, differences in their welfare systems create large differences in employment probabilities and the number of benefit claimants. In the US, where the policy emphasis has been on transfer payments, the onset of disability is found to be associated with a greater decline in work than in Germany.

The dramatic fall in participation of males in the UK since the 1980s has prompted an increased interest in the possible role that disability benefits might have played in this process (Gregg and Wadsworth, 1999, Bell and Smith, 2004 and McVicar, *forthcoming*). Although most of these studies define the disabled population as those in receipt of benefit income, the impact of changes to the benefit regime provides important information about the incentive structures created by such schemes.[26] Evidence suggests that the rise in disability claimants has been the result of a combination of both an increase in the generosity of disability benefits and the deterioration in the labour market for low skilled workers (Bound and Burkhauser, 1999, Autor and Duggan, 2003 and Bell and Smith, 2004).[27] McVicar (*forthcoming*) argues that the UK, unlike the US, has not experienced falling real earnings at the lower end of the wage distribution and so benefit replacement rates have not grown

[26] Most authors agree that the increase in disability benefit claimants cannot be explained by changes in average health levels (Beatty *et al.*, 2000 and Autor and Duggan, 2003). However, recent evidence does provide support for real increases in disability among younger individuals. Lakdawalla *et al.* (2007) find that disability in the US has increased by 40 percent among those aged in their 40s and this has coincided with an increase in diabetes and asthma. Whilst Bell and Smith (2004) note that self-reported disability has not increased overall in the UK, it has increased dramatically among the least qualified, who are also the group that have had a large rise in benefit uptake.

[27] Earlier studies also concluded that economic factors are important determinants of disability claimants (Molho, 1989, 1991).

in the UK. Bell and Smith (2004), however, find evidence that the decline in participation has been concentrated on unskilled men who have reported long-term illness. Although this supports the disincentive effects of incapacity benefits, job destruction following a negative demand shock offers an alternative explanation for the decline in participation. Beatty *et al.* (2000) model the effect of an adverse demand shock and argue that the sick are the first to lose their jobs and that they are the individuals who have most incentive to move on to disability benefits. Rupp and Stapleton (1995, 1998) examine the determinants of benefit receipt, and suggest that economic contractions create an inflow of new benefit claimants, but that expansions do not create equal outflows, leading to the rising pool of claimants. In the UK there is also a greater incentive to claim disability benefits than unemployment benefits (Beatty *et al.* 2000). This is explained by differential benefit rates between schemes, means testing (Fothergill, 2001) and conditions of receipt (for example, meeting job advisors) associated with job seekers allowance (JSA), and the incentive for job centres to reduce unemployment figures (Nickell and Quintini, 2002).

In analyzing the increase in incapacity benefit in the UK, Moncrieff and Pomerleau (2000) find the largest increase in claimants suffer from musculoskeletal disorders and mental disorders, particularly milder depressive and neurotic disorder (see also Autor and Duggan, 2006). Bell and Smith (2004) find an almost three-fold increase in the proportion of the disabled with mental health and behavioural disorders (1979-2001). This increase in mental health problems may be the result of increasing recognition and diagnosis of these conditions rather than real increases. However, since both recognition and diagnosis of mental health and musculoskeletal limitations are cited by doctors as subjective, it is difficult to explain these increases and to identify true disability (Hiscock and Ritchie, 2001).

2.5.2 Disability Discrimination Acts

Recent changes in legislation relating to the disabled have led to a growing literature evaluating the effects of the ADA in the US. However, there has been little formal evaluation to date of the equivalent legislation in the UK (that is, the DDA). The ADA was introduced in the US in 1990 to eliminate discrimination by employers against individuals with disabilities. DeLeire (2000), using data from the SIPP, finds that, on average, employment of men with disabilities is 7.2 percent lower in the post-ADA period than before the Act was passed. The largest employment declines were observed in manufacturing, managerial and blue collar occupations. There were no observable changes to the wages of disabled men, which remained at 82 percent of the male non-disabled wage. Although other policies could have contributed to the change in employment, DeLeire (2000) argues that the timing and magnitude of the changes were consistent with an ADA effect. In direct support of these findings, Acemoglu and Angrist (2001) document similar results using an alternative dataset, the CPS, particularly for men and women aged between 21 and 39. There is no evidence that the ADA reduces job separations for the disabled, which suggests that the ADA has not acted as a form of employment protection. Furthermore, even though the number of disability transfer payments rose during the same period, this cannot, on its own, explain the decline in employment. Confirming the ADA as the reason for the decline in employment among the disabled, the impact was found to be greater in larger firms (smaller firms being exempt from legislation) and in states with more ADA-related discrimination charges. The important implication of these results is that the legislation reduced the demand for disabled workers by raising the costs of employing such workers.

These results, however, have been questioned on the grounds that the work disability measure used may not accurately reflect coverage under the ADA (Schwochau and Blanck, 2000, 2003 and Kruse and Schur, 2003). Legislation, by removing the stigma of disability, may encourage more individuals to report a disability. In contrast, some, who reported a disability prior to the legislation, may not do so after its introduction if improvements to the workplace change the effect of the disability to non-work-limiting. As Kruse and Schur (2003) conclude, the analysis of the employment effects of disability legislation is confounded by changes in the composition of those reporting disabilities[28], the role of disability income and the relative effects of business cycles on workers with and without disabilities (see, also, Kruse and Hale, 2003). Indeed, they find greater reporting of disability post-ADA. They use data from the SIPP to examine fourteen alternative measures based on differences in self-reported disability, the severity of limitations and receipt of

[28] Over time, the number work-limited is affected by changes in technology and the changing nature of employment regardless of changes in legislation.

disability benefits. Consistent with the previous studies, they find evidence of decreasing employment of the disabled several years after the ADA, but, when more specific disability measures are used relating to the ADA, employment is found to increase.

Neutral evidence with respect to the ADA is presented by Schumacher and Baldwin (2000) who identify very few differences in labour market outcomes for the disabled between 1990 and 1993. Although this suggests that the ADA has had little impact on the labour market, the timing of the study may be important in so far as the effects of the legislation may not have been observable by 1993. Indeed, the wage differential between disabled and non-disabled men was found to increase between 1990 and 1993. Similarly, DeLeire (2001) finds the discriminatory component of the wage gap did not fall after the introduction of the ADA. However, during the period, the negative effect of health on earnings did decline (through the productivity effect), which may have been due to improvements in technology/accommodation by employers for the disabled.

The most recent studies have used state variation in data to evaluate the effects of the ADA. Beegle and Stock (2003) create an experimental framework that generates treatment and comparison groups by using state differences in legislation prior to the introduction of the ADA. Compared with previous research, where evaluation of the ADA only captures the additional effect of the ADA over and above existing legislation, this method allows separation of those who were previously subject to legislation from those who were not, in the same period (that is, in different states), with the advantage of controlling for pre-existing trends in outcomes (that were common across states). They find negative effects of the laws on the relative earnings of the disabled. However, when pre-existing trends in employment are controlled for, there is no discernable effect on relative employment rates.

Jolls and Prescott (2004), also use state level differences in the ADA, but examine the influence of the components (primarily anti-discrimination and reasonable accommodation) of the ADA. By comparing states that, due to their existing legislation, were only subject to one (additional) component of the ADA, they are able to separate the effect of each of the elements. They report two main findings.

Firstly, the negative employment effects were mainly the result of employers having to make reasonable accommodations for disabled employees, rather than the effect of increased firing costs for this group. Secondly, the state level data suggests that the fall in disabled employment, post-ADA, reflects other factors rather than the ADA itself. Jolls (2004) argues that the fall in employment after the ADA may be the result of the ADA increasing the return to education for the disabled and thus increasing educational participation. Using variation in state laws prior to the ADA, she finds that there has been an increase in educational participation amongst the disabled in states where the ADA significantly changed the rights of disabled people relative to states where the impact was more limited.

Hotchkiss (2004a) criticises the evaluation studies, suggesting they fail to control for selection into the labour market. When controlling for this selection effect, the predicted unconditional employment probability for a disabled person increased since the ADA legislation. There is evidence that non-participants moved into disability, which reduced the participation rate of the disabled. Using state level data, the evidence suggests that the impact of the ADA has been limited; she argues this may be due to prior state level legislation crowding out the impact of the ADA.

DeLeire (2000) and Acemoglu and Angrist (2001) suggest disability benefits were not an important influence on the fall in employment post-ADA, since employment fell most for those groups least likely to receive disability benefits.[29] However, Bound and Waidmann (2002) find the growth in the Social Security Disability Insurance (SSDI) programme in the 1990s (which resulted from changes made in the 1980s) explains nearly all of the fall in employment during the 1990s. However, Kruse and Schur (2003) note that the ADA may have contributed to this growth in benefits if, for example, fewer disabled people were hired. Business cycles also generate disproportionate effects on the disabled, given the nature of the jobs they hold in the labour market. The recession of the early 1990s could, therefore, have contributed to the increase in non-employment among the disabled in the post-ADA period. However, Kruse and Schur (2003) account for labour market tightness in

[29] DeLeire (2000) also notes that the change in employment in the post-ADA period was a break rather than a continuation of a trend and that disability benefits did not change significantly during the period.

their evaluation of ADA and this does not change the effect of the ADA on employment.[30]

Analysis of legislation has also occurred in other European countries including the UK. Verick (2004) uses the GSOEP to evaluate the impact of the People with Severe Disabilities Act (PSDA). Previously, a 5 percent quota system was in place to enforce the employment of the disabled, but, due to high unemployment amongst the disabled, the PSDA was reformed in 2001 and an increased penalty introduced for not meeting targets. The government claimed the reform reduced unemployment among the disabled by 24 percent, but Verick's study suggests gains in unemployment were partly met by individuals exiting the labour force, rather than increasing demand for these workers. Lalive *et al.* (2007) consider the Austrian Disability Act, which also consists of a quota type system. Employers face a penalty for non-compliance if they fail to hire one severely disabled worker per 25 workers. Using social security data, the study finds greater employment of the disabled in firms above the threshold than those below it and argues that the legislation has a positive effect on the employment of the disabled. Bell and Heitmueller (2005) apply the methodology of Acemoglu and Angrist (2001) to evaluate the impact of the DDA in the UK.[31] Data from the BHPS and the FRS use a definition of disability which is most consistent with the DDA. Using a difference in difference approach, they find some evidence of a negative impact (or at least no positive effects) of the DDA. They suggest that the lack of awareness of the Act and low levels of take up of financial support by employers and individuals are possible reasons for the absence of a significant impact. Also within the UK, the Department for Work and Pensions (DWP) has undertaken evaluation studies into the New Deal for the disabled, which is a scheme offered to those who claim incapacity benefits to aid their move into employment through a series of job brokers. Adelman *et al.* (2004) outline the characteristics of participants, the service they received and the employment outcomes for those who registered between May and June 2002.[32] One year after registration, 46 percent had entered post-registered employment, of which 38 percent

[30] Schwochau and Blanck (2000) raise several other important issues for the evaluation of the DDA, including controlling for individuals who are not able to work and controlling for the type and severity of the disability, since the impact of the DDA may vary depending on disability itself.
[31] See Goss *et al.* (2000) for a critique of the employment provisions of the DDA.
[32] Ashworth *et al.* (2004) report on the first interview, at approximately 6 months after registration.

moved into employment within six weeks. Poor education and basic skills and those with a negative attitude to employment were found to be least likely to find work. An earlier report (Department for Work and Pensions, 2004), which synthesises the findings from the first 18 months (July 2001-November 2003), found that 32 percent had gained employment, but that only 39 percent of these had found sustained employment up to May 2003.

Summary

This review of the international evidence relating to disability has highlighted several issues which are important for empirical research on disability in the UK. Firstly, it is crucial to acknowledge the influence the definition and method for identifying the disabled has in evaluation of the labour market impact of disability. Since the literature does not provide a consensus over the most appropriate measure of disability, studies continue to use self-reported information on work or activity limitations available in large scale surveys.

Regardless of the definition, data source, country or time period, disability is found to have a negative impact on labour market outcomes. The differences in employment and earnings cannot be entirely explained by differences in characteristics between the two groups, but what remains a contentious issue is estimating the role of discrimination. Without sufficient controls for type of impairment, severity, visibility, work capacity, job demands and employer accommodation, it will be difficult to identify the precise role of discrimination, though varying the assumptions in relation to productivity and discrimination provides useful insights into the problem disability poses for estimation. The dynamic nature of disability also creates additional heterogeneity and the evidence suggests selection, timing and duration effects are all important.

There, initially, appeared to be a consensus in the evaluation studies of the ADA, namely, that the legislation reduced the employment of disabled workers due to the additional cost it imposes on employers. However, more recent evidence appears to question these conclusions and highlights the range of influences that should be considered in evaluation of changes in legislation, most importantly other policy changes, business cycles and changes in the composition of and economic shocks specific to the disabled population. The importance of evaluating the corresponding legislation in Europe has been recognised, but the literature is in its infancy.

CHAPTER THREE

ESTIMATING EARNINGS AND EMPLOYMENT DISCRIMINATION AGAINST THE DISABLED

3.1. Introduction

Empirical analysis which attempts to identify and measure discrimination against minority groups within the labour market represents a significant component of empirical labour economics. Studies, typically, employ a version of the decomposition methodology suggested by Blinder (1973) and Oaxaca (1973). As Chapter 2 demonstrates, the issue of discrimination and the application of this methodology have featured prominently in the literature relating to disability. However, in this context, there have been concerns raised over the accuracy of the estimate of discrimination, since there may be unobserved differences in productivity between disabled and non-disabled groups. This unobservable productivity difference would contribute to the unexplained gap in a decomposition and, thus, result in an overestimation of discrimination against the disabled. This Chapter uses a modification of the original decomposition, suggested by DeLeire (2001), to estimate the contribution of any unobserved productivity difference between the groups to their difference in labour market outcomes. Hence, it attempts to obtain a more accurate estimate of discrimination against the disabled, in terms of both earnings and employment in the UK.

Since previous empirical evidence concerning discrimination is discussed in depth in Section 2.4, it is not repeated here. However, it is worth highlighting that studies in the UK, using the standard decomposition methodology, have found more than 50 percent of the earnings and employment gap is not explained by differences in observable characteristics between the groups. Thus, they attribute a significant proportion of the gap to differences in the returns to these characteristics and, hence, suggest the (potential) contribution of discrimination is substantial (see Blackaby *et* *al.*, 1999 and Kidd *et al.*, 2000). Indeed, the perceived significance of disability discrimination led to the establishment of the Disability Rights Commission in 2000, which promotes equality of opportunity for disabled people.

The second main aim of this Chapter is to identify any change in outcomes, including discrimination, that have occurred since the introduction of the employment component of the DDA in 1996 (*Part II* of the Act) which made it unlawful to discriminate against the disabled. As documented in Section 2.5.2, there has been considerable investigation into the ADA since a negative impact was identified by DeLeire (2000) and Acemoglu and Angrist (2001). In a similar manner, the DDA, which was designed to improve the chances for disabled people, may have had a positive or negative effect, since it, too, imposed additional costs on employers. However, the only direct study of the employment impact of the DDA in the UK is by Bell and Heitmueller (2005), who adopt a similar methodology to Acemoglu and Angrist (2001) and who find no evidence of a positive effect, using data from the BHPS and the FRS.

The analysis in this Chapter, which uses data from the LFS at two points in time, 1997 and 2003, compares the outcomes during the post-DDA period. This evidence will indicate to what extent the position of the disabled has improved (or deteriorated) over time. It is also possible to identify any part in the change that is explained by changes in the characteristics of the disabled. Importantly, any change that is unexplained can, therefore, be identified; it is this component that would be consistent with a change in treatment by employers over time and, thus, may be influenced by the DDA.[33]

Two other themes are investigated during this analysis[34]; the first is the influence of gender. Studies frequently constrain their analysis to males (see Kidd *et al.*, 2000) due to an inaccurate perception that they form the majority of the disabled population. However, Figure 3.1, which traces rates of work-limiting disability amongst the working age population over time, confirms that a similar proportion of

[33] For justification of the choice of years see Section 3.2. This issue is reconsidered in more detail in Chapter 7, using data from the HSE that permits an analysis of the pre and post-DDA period.
[34] Both these issues are also considered throughout the evidence that follows in Chapters 4 to 7.

males and females report themselves as disabled. Moreover, the labour market impact of disability is pronounced for both groups (see Figure 3.3, for example) and, therefore, the empirical analysis undertaken here is conducted separately for each group. Identification of the heterogeneity that exists within the disabled group and examination of its influence on labour market outcomes constitute a second important theme. In particular, information on the type and severity of the disability is used to test if the disadvantage associated with disability is more pronounced for those with more severe disabilities or disabilities of a particular type.[35] Since the severity and type of disability may affect productivity and discrimination, it would seem that understanding differences within the disability group will also inform the understanding of the differences between disability groups.

This chapter is structured as follows. Section 3.2 considers the data and methodology used for the analysis of earnings and employment. Section 3.3 outlines and discusses the main results and considers the validity of the assumptions on which the analysis is based. Section 3.4 concludes.

3.2. Data and Methodology

3.2.1. The Labour Force Survey

The data are obtained from the UK LFS, which is a quarterly survey of 60,000 households.[36] Each quarter is made up of five waves and each wave of individuals remains in the survey for five consecutive quarters, so that in any quarter 20 percent will be having their first interview, 20 percent their second interview and so on. Thus there is an 80 percent sample overlap between quarters. Annual data sets are created separately for two years (1997 and 2003) to increase the sample size relative to the single quarter and to remove the effect of seasonal fluctuation. Observations on individuals from waves 1 and 5 are included from each of the four quarters, which means repeated observations on the same individual are excluded.[37] The motivation for analysing data across time is to consider the influence of the employment

[35] The LFS does not contain information about other aspects of heterogeneity, such as the duration of the disability or the age of disability onset.

[36] The LFS is accessed from the Data Archive www.data-archive.ac.uk where full details and questionnaires are also available.

[37] There is no longitudinal element to the analysis.

component of the DDA, which came into force on the 2nd December 1996. Ideally, data would have been selected in the pre- and post-DDA periods for the comparison. However, it is not possible to undertake a comparison before and after the DDA, since the questions in the LFS prior to Spring 1997 are not consistent with the current series of questions relating to disability.[38] As Cousins *et al.* (1998) note, this simple change identified 24 percent fewer respondents in the UK reporting a long-term disability which affected the kind of work they might do, and of those it did identify, a greater proportion were economically inactive. This makes any attempt to estimate the employment effects of the DDA, on the basis of a before and after study, using the LFS, hazardous.[39] The years of 1997 and 2003 were chosen since, at the time of analysis, this period represented the longest consistent definition of disability in the post-DDA period.[40] Since the focus is on employer discrimination, the self-employed, unpaid family workers and government trainees are all eliminated from the sample. Similarly, observations from Northern Ireland, those not of working age and those with missing information for any of the explanatory variables are excluded from the analysis.

The estimation of discrimination largely follows a methodology outlined by DeLeire (2001). Fundamental to this is the identification of a group of disabled individuals who have no unobserved difference in productivity from the non-disabled. As such, the population is split in to three groups based on their disability status; the work-limited disabled (D_1), the non-work-limited disabled (D_2) and the non-disabled (N). The use of work-limiting disability is standard in the analysis of labour market outcomes and the present definition is consistent with that used by the DWP (see Tibble, 2004). The measure of disability status is based on self-reported responses to

[38] Prior to Spring 1997, individuals are asked 1) *if they had a health problem which would affect the kind of paid work they might do* and (if *yes*) 2) *if the health problem was expected to last more than a year*. This does not allow the disabled population to be split using the DeLeire (2001) definitions.
[39] The LFS recorded 16 percent more disabled in Winter 1997 than in Spring 1997. However, the ONS suggests data for Summer, Autumn and Winter are more reliable and imply a decline of only 10 percent in the number of disabled compared to the results from the earlier question format.
[40] Where possible, the variables used in the analysis are defined in the same way in both periods. One exception is the 2001 change in occupational classifications. Since there is a 75 percent overlap in the occupational groups before and after the change, these variables are included in the analysis. Regressions and decompositions were estimated without occupational groups and the results did not change significantly. In addition, the definition of the variable indicating the number of days off work during the working week also changed. In 1997 *sikday* measured the number of days off sick or injured in the reference week, whilst in 2003 *illdays* only records days of sickness when an employee is both sick and scheduled to work.

the following questions in the LFS and, thus, potentially suffers from the biases common to self-reported measures reviewed in Chapter 2.[41,42] Firstly, the entire sample are asked:

a) Do you have any health problems or disabilities that you expect will last for more than a year?

Those who answer *yes* to question *a)* are asked two additional questions:

b) Does this health problem affect the KIND of paid work that you might do?

c) Does this health problem affect the AMOUNT of paid work that you might do?

An individual who has a long-term health problem (*yes* to *a)*) that does not affect the amount or type of work (*no* to *b)* and *c)*) is non-work-limited disabled (D_2). An individual who has a long-term health problem (*yes* to *a)*), that affects either the amount or type of work they can do (*yes* to either *b)* or *c)*), is work-limited disabled (D_1) and those without a long-term health problem (*no* to *a)*) form the non-disabled group (N).[43] In the present context, the misreporting associated with justification bias could also affect the distinction between work-limited and non-work-limited disabled and, hence, also exaggerate any employment gap within the disabled group.[44]

In 2003, 28 percent of the sample reported a long-term health problem and, of those, 58 percent also say it limits the kind or amount of work. The breakdown of the

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[41] The definitions follow DeLeire (2001) which enables the effect of disability on productivity to be identified; however, this definition does not follow the DDA definition: *A (or multiple) long-term health problem or disability that substantially limits a person's ability to carryout normal day-to-day activities.* The work-limiting definition will exclude individuals who are covered by the DDA (which represent 18 percent of the entire disabled sample) and include those who are not covered by the DDA (17 percent of the entire disabled sample). There is an 80 percent overlap between the two alternative measures in the estimation samples.

[42] As discussed in Chapter 2, the evidence is mixed on the issue of justification bias. However, since no objective health information is available, the issue cannot be examined using the current dataset. Instead the issue is considered in detail in Chapter 6 using data from the HSE.

[43] The non-disabled may, of course, have short-term health problems which may affect their capacity for work.

[44] This would occur if, for example, an individual with a given disability is more likely to report it as non-work-limiting if he/she is in employment. However, the questions are designed so that individuals who are not in employment can be non-work-limited. They refer to the effect of health problems on the kind or amount of work an individual *might do*.

sample into the three groups is illustrated in Table 3.1 and Figure 3.1 traces the concentration across time. Since the DDA there has been a growth in the reporting of disability amongst males and females, which has led to a decline in the size of the non-disabled group. However, the increase in reporting has only occurred among non-work-limiting disability.

3.2.2 The Econometric Model

The offer wage for the *i*th individual, W_{ij}^{O} is modelled separately for each of the *j* disability groups ($j=D_1,D_2,N$) and by gender as follows:

$$W_{ij}^{O} = \beta_j^{O} X_{ij} + \varepsilon_{ij}^{O} \tag{3.1}$$

where, following a traditional human capital approach, X_{ij} contains characteristics which affect an individual's productivity in work and β_j^{O} are the rates of return specific to the *j*th group. The offer wage, however, will only be observed for individuals who are currently employed and, therefore, equation (3.1) can only be estimated on a sample from the population, which is unlikely to be random. In this situation, inferences will be based on the difference between the disabled and non-disabled who work, rather than the entire disabled and non-disabled populations. Since individuals who may have left the labour market as a result of wage discrimination are excluded from the analysis and this may be particularly important for the disabled group, a correction is made for sample selection bias (Heckman, 1976, 1979).

An individual will be observed working if their offer wage exceeds their reservation wage, W_{ij}^{R}. At any offer wage less than the reservation wage the individual will reject a job offer in preference for non-employment.[45] The reservation wage is given by:

$$W_{ij}^{R} = \beta_j^{R} Z_{ij} + \varepsilon_{ij}^{R} \tag{3.2}$$

[45] O'Donnell (1998) notes this is not the case for those who are incapable of work and, therefore, cannot work. No information is available from the LFS to identify this group.

where Z_{ij} includes characteristics which affect an individual's productivity, but also characteristics that will affect the value an individual places on time. An individual's reservation wage is unobserved; however, whether the individual is employed ($E_{ij} = 1$), which implies ($W^O_{ij} > W^R_{ij}$), or non-employed ($E_{ij} = 0$) is observed. Thus the probability that individual i works can be expressed as:

$$\Pr(E_{ij} = 1) = \Pr[W^O_{ij} - W^R_{ij} > 0] = [\beta^O_j X_{ij} - \beta^R_j Z_{ij} > \varepsilon^R_{ij} - \varepsilon^O_{ij}] \qquad (3.3)$$

Since the difference in errors in equation (3.3), $\varepsilon^R_{ij} - \varepsilon^O_{ij}$, denoted, μ_{ij}, is assumed to be normally distributed with mean zero and variance $\sigma_{uj}^{\ 2}$, the probability that an individual works can be written as:

$$\Pr(E_{ij} = 1) \quad = \Pr\left[\frac{\mu_{ij}}{\sigma_{uj}} < \frac{(B^O_j X_{ij} - B^R_j Z_{ij})}{\sigma_{uj}}\right] \qquad (3.4)$$

$$= \Phi\left(\frac{\gamma_j Y_{ij}}{\sigma_{uj}}\right)$$

where Φ is the cumulative normal density function, Y_{ij} combines variables from both X_{ij} and Z_{ij} and γ_j is a vector, combining the parameters of the offer and reservation wage equations, B^O_j and B^R_j. This employment decision can be modelled empirically using a probit model, with the associated equation for the unobserved latent variable E^*_{ij} related to employment being:

$$E^*_{ij} = \gamma_j Y_{ij} + \mu_{ij}' \qquad (3.5)$$

where the observed variable E_{ij} is related to E^*_{ij} as follows:

$$E_{ij} = \begin{cases} 1 & \text{if } E^*_{ij} > 0 \\ 0 & \text{otherwise} \end{cases}$$

An individual is defined as employed ($E_{ij} = 1$) if they are an employee with a positive hourly wage, the non-employed include the inactive and the unemployed.[46] The employment probits are estimated separately for each group, j, and by gender as follows:

$$L = \prod_{i \in E_{ij}=1} \left[\Phi\left(\frac{\gamma_j Y_{ij}}{\sigma_{uj}} \right) \right] \cdot \prod_{i \in E_{ij}=0} \left[1 - \Phi\left(\frac{\gamma_j Y_{ij}}{\sigma_{uj}} \right) \right] \qquad (3.6)$$

The vector of characteristics, Y_{ij}, in equation (3.5), includes variables that influence both the offer and reservation wage. This includes personal characteristics (such as qualifications, marital status, and ethnicity), household related variables (such as housing tenure) and a set of regional dummy variables. The presence of dependent children and an indicator of another earner within the household, which only influence the reservation wage, are also included.[47]

The inclusion of additional variables in the probit equation (3.5) Y_{ij}, relative to the wage offer equation (3.1), X_{ij}, allows identification of the Heckman inverse mills ratio. As is traditional in these models, the presence of dependent children, age and an indicator of the presence of another earner in the household perform this role.[48] This is consistent with these variables affecting the reservation wage (through the value placed on time) and not the offer wage.

Several other studies include measures of health in the participation and wage equations to control, albeit incompletely, for the effect of health on productivity. Although the LFS is a rich source of labour market information, the information on health is more limited; there are no competency based questions and further analysis

[46] Those who are in employment but have missing hourly pay information are, therefore, dropped from the regression analysis. The employment rates presented here, therefore, underestimate the true number employed.
[47] A full list of the definitions of variables is included in Table A3.1.
[48] The amount of non-wage income traditionally used in this role is not available from the LFS.

of health is confined to the long-term disabled only.[49] Instead, the unobserved productivity difference between the groups is considered using the DeLeire (2001) method.

The expected wage of those who are employed is given by:

$$
\begin{aligned}
\mathrm{E}\,(W_{ij}^{O} \mid E_{ij}^{*} > 0) &= \beta_j^{O} X_{ij} + E(\varepsilon_{ij}^{O} \mid \mu_{ij} > -\gamma_j Y_{ij}) \\
&= \beta_j^{O} X_{ij} + \rho_{1j} \sigma_{\varepsilon_j^{o}} \lambda_{ij} \\
&= \beta_j^{O} X_{ij} + \theta_{1j} \lambda_{ij} \qquad (3.7)
\end{aligned}
$$

where $\theta_{1j} = \rho_{1j}\sigma_{\varepsilon_j^{o}}$, $\lambda_{ij} = \dfrac{\phi(\gamma_j Y_{ij})}{\Phi(\gamma_j Y_{ij})}$, ρ_{1j} = corr $(\varepsilon_{ij}^{O}, \mu_{ij}), \phi$ is the standard normal density function and σ_{uj} has been normalised to 1.

Thus, following a Heckman two step procedure, the selectivity corrected wage equation can be estimated by ordinary least squares (OLS) to provide unbiased coefficient estimates for the population as a whole, since the selection variable removes the part of the error term that is correlated with the explanatory variables:

$$
W_{ij}^{O} = \beta_j^{O} X_{ij} + \theta_{1j} \hat{\lambda}_{ij} + \omega_{ij} \qquad (3.8)
$$

W_{ij}^{O} is the log of hourly earnings defined as usual weekly pay divided by usual hours, and λ_{ij} is estimated from the employment probit $\hat{\lambda}_{ij} = \dfrac{\phi(\hat{\gamma}_j Y_{ij})}{\Phi(\hat{\gamma}_j Y_{ij})}$.[50] The vector X_{ij} includes the personal and housing characteristics mentioned above, but also employment related characteristics including industry sector, occupation, experience, tenure, overtime, firm size, firm sector and part-time/full-time status.[51] In theory, all the variables included in X_{ij} should also be in Z_{ij}, but, since some of the

[49] An alternative specification which controls for the heterogeneity within the disabled group is also estimated.

[50] Heckman's (1979) method is used to derive consistent estimates of the coefficient covariance matrix.

[51] Whilst occupational and industry variables will control for some aspects of job demands, no more detailed information is available on the particular demands of employment. No information is available on workplace accommodations which are also expected to affect a disabled individual's productivity.

variables included in the analysis are only observable for those in paid employment, this restriction is not imposed (similar to Baldwin and Johnson, 1994 and Kidd *et al.*, 2000). The more restrictive approach is illustrated in Kidd *et al.* (2003).[52] Job related characteristics are traditionally included to control for compensating wage differentials. However, for the work-limited disabled, the job requirements may also affect their productivity. This specification may adversely influence the correction for selectivity bias in the offer wage equation, but, since the residual from the wage equation forms the measure of discrimination, all variables thought to determine offer wages are included.[53]

Within Group Heterogeneity

The above specifications of the employment and earnings equations examine the impact of disability status on labour market outcomes. Alternative specifications, which control for heterogeneity within the disabled group in terms of the type of health problem, are also computed to examine within group differences and to answer questions such as which types of disability are associated with the greatest labour market disadvantage? The wage (3.8) and employment (3.6) equations are modified to include a series of dummy variables, indicating the type of main health problem and a measure of the number of health problems, which, as Berthoud (2003) shows, is a proxy for the severity of the disability. The more severe any given disability the greater restriction on work and, thus, it is anticipated that those with the most severe disability will have inferior labour market outcomes, all else constant. Theoretically, the influence of the type of disability is more difficult to predict, since labour market outcomes are likely to be the result of an interaction between the type of restriction imposed by the disability and the particular requirements of the job,

[52] Baldwin and Johnson (1994) include worker characteristics (age, education and health) that affect both offer and reservation wages and variables that only affect the reservation wage (income, marital status and children) in the employment probit. However, in addition to the worker characteristics, the offer wage equation also includes variables relating to job characteristics and other working specific influences (part-time, experience, union), which cannot be included in the employment probit. Kidd *et al.* (2003) include only personal characteristics that are observed for the entire sample in the offer wage equation (education, experience, region, race), whereas the reservation wage also includes variables relating to the value of time (children, marital status, non-wage income).

[53] In practice, there may be other influences (including tastes), which are not controlled for in the model, and thus, as is standard in the literature, the unexplained component of the decomposition is an upper bound estimate of the effect of discrimination on wages. Consistent with Baldwin and Johnson (2001), accommodations by employers for the disabled is not captured in the wage equation, which may cause a wage gap between disabled and non-disabled employees. The preference for work may be different between the disabled and non-disabled as a result of the additional difficulty in getting to work and the additional benefit income available.

which themselves are heterogeneous. This issue is examined empirically by including controls for the main type of health problem. Five types are constructed from the seventeen possible categories included in the LFS namely limbs; sight/hearing; skin, breathing and organs; mental health and other.[54]

3.2.3 Employment Decomposition

The difference in the average predicted probability between any two groups can be decomposed into that part due to differences in observed characteristics (explained component) and an unexplained or residual term (see Gomulka and Stern, 1990 and, subsequently, Even and McPherson, 1990, 1993 amongst others). The difference in the average predicted probability of employment ($\hat{P}_N - \hat{P}_{D_1}$) can be expressed as follows:

$$\hat{P}_N - \hat{P}_{D_1} = (1/n_N)\sum_{i=1}^{n_N}\Phi(Y_{iN}\hat{\gamma}_N) - (1/n_{D_1})\sum_{i=1}^{n_{D_1}}\Phi(Y_{iD_1}\hat{\gamma}_{D_1}) \tag{3.9}$$

where the first term on the right hand side is the average prediction for the non-disabled and $\hat{\gamma}_N$ are the estimated coefficients from the employment probit for the non-disabled with sample n_N. Similarly, the second term on the right hand side is the average predicted employment probability for the work-limited disabled group with sample size n_{D_1}. The predicted employment probability for each individual $\Phi(Y_{ij}\hat{\gamma}_j)$ is denoted $\hat{P}_{ij}$, and $\hat{P}_j$ represents the average of the individual predicted probabilities in group *j*.

[54] The groups that comprise the variable limbs are (1) problems or disabilities (including arthritis or rheumatism) connected with arms or hands (2) legs or feet (3) back or neck. The group relating to sight/hearing include (4) difficulty in seeing (while wearing spectacles or contact lenses) (5) difficulty in hearing and (6) speech impediment. Skin, breathing and organs includes (7) severe disfigurement, skin conditions, allergies (8) chest or breathing problems, asthma, bronchitis (9) heart, blood pressure or blood circulation problems, (10) stomach, liver kidney or digestive problems and (11) diabetes. Mental health problems include (12) depression, bad nerves or anxiety (14) severe or specific learning difficulties (mental handicap) and (15) mental illness, or suffer from phobia, panics or other nervous disorders. The other group includes (13) epilepsy (16) progressive illness not included elsewhere (for example, cancer, multiple sclerosis, symptomatic HIV, Parkinson's disease, muscular dystrophy) and (17) other health problems or disabilities.

A generalised description of the decomposition of the average predicted probability, into the explained component (due to differences in endowments) and the unexplained component (due to differences in coefficients), is given by Gomulka and Stern (1990). Where the explained gap, which measures differences in characteristics evaluated at the equal treatment coefficient structure, is given by: [55]

$$(\hat{P}_N - \hat{P}_{D_1})_{\text{explained}} = \left[(1/\mathrm{n_N})\sum_{i=1}^{n_N}\Phi(Y_{iN}\hat{\gamma}^*)\right] - \left[(1/\mathrm{n}_{\mathrm{D}_1})\sum_{i=1}^{n_{D_1}}\Phi(Y_{iD_1}\hat{\gamma}^*)\right] \qquad (3.10)$$

and the unexplained gap, which measures the difference in the coefficient structure from the equal treatment case, is:

$$\begin{aligned}(\hat{P}_N - \hat{P}_{D_1})_{\text{unexp}} = &\left[(1/\mathrm{n}_N)\sum_{i=1}^{n_N}\Phi(Y_{iN}\hat{\gamma}_N) - (1/\mathrm{n}_N)\sum_{i=1}^{n_N}\Phi(Y_{iN}\hat{\gamma}^*)\right] + \\ &\left[(1/\mathrm{n}_{D_1})\sum_{i=1}^{n_{D_1}}\Phi(Y_{iD_1}\hat{\gamma}^*) - (1/\mathrm{n}_{D_1})\sum_{i=1}^{n_{D_1}}\Phi(Y_{iD_1}\hat{\gamma}_{D_1})\right]\end{aligned} \qquad (3.11)$$

where the coefficient vector that would prevail, in the absence of different treatment amongst the groups, is denoted $\hat{\gamma}^*$.

The unexplained gap, equation (3.11), would, typically, be attributed to discrimination; however, the unobserved effect of disability on productivity will contribute to this gap.[56] The DeLeire (2001) decomposition, which considered this issue in the context of earnings, can be applied to the employment gap. Firstly, the same decomposition is computed for the non-work-limited disabled (that is, replacing D_1 with D_2 in equations (3.10) and (3.11)) and the non-disabled. If the non-work-limited disabled are assumed to be as productive as the non-disabled

[55] Differences in endowments due to pre-labour market discrimination or the anticipation of labour market discrimination are clearly included within the explained non-discriminatory part of the model and cannot be separated using this framework. However, as Baldwin and Johnson (2001) note, pre-labour market discrimination will only be important for a section of the disabled sample, those who were disabled from birth/as children.

[56] It may also be the case that having a work-limiting disability not only affects productivity between the two groups but, since the costs of participating will differ, preferences for work and receipt of benefit income. As such, these influences will be contained within the estimate of the unobserved productivity component.

(conditional on characteristics), estimation of equation (3.11) between these groups isolates the role of discrimination. If this measure of discrimination is assumed to be the same for the work-limited disabled, it can be imposed on the work-limited disabled equations and the role of unobserved differences in productivity can be identified as follows:

$$(\hat{P}_N - \hat{P}_{D_1})_{\text{unexplained}} = \textit{discrimination plus unobserved differences in productivity}$$
$$(\hat{P}_N - \hat{P}_{D_2})_{\text{unexplained}} = \textit{discrimination}$$
$$(\hat{P}_N - \hat{P}_{D_1})_{\text{unexplained}} - (\hat{P}_N - \hat{P}_{D_2})_{\text{unexplained}} = \textit{unobserved differences in productivity}$$ [57]

Since the non-disabled group dominates the population, it is often used as the reference or base group ($\hat{\gamma}^* = \hat{\gamma}_N$) in a decomposition such as equations (3.10) and (3.11) (see for example Kidd *et al.*, 2000). However, as noted by Neumark (1988) and Oaxaca and Ransom (1994), unequal treatment implies that the non-disabled group face a discriminatory advantage and, as such, their coefficient structure would not prevail under equal treatment between the groups. The discriminatory component of the employment gap, calculated using the non-disabled base, overestimates the effect of discrimination. A coefficient structure from the pooled model of all the groups in the population is more commonly used. This would impose the same coefficient structure between the work-limited disabled, the non-work-limited disabled and the non-disabled ($\hat{\gamma}^* = \hat{\gamma}^{P3}$). However, in the DeLeire (2001) type approach, the elimination of discrimination does not imply the wage structures are identical in the case of disability, because differences in the wage structure between the groups may be due to the unobserved effect of disability on productivity. As such, the non-discriminatory employment structure is formed by pooling the non-disabled and the non-work-limited disabled ($\hat{\gamma}^* = \hat{\gamma}^{P2}$); this is the structure that would exist if discrimination was zero but that allows unobserved productivity differences to exist.[58]

[57] This is equivalent to $(\hat{P}_{D_2} - \hat{P}_{D_1})_{\text{unexplained}}$.

[58] It is also possible to examine the components of the unexplained gap in the decomposition. The first term in brackets in equation (3.11) can be interpreted as the advantage (difference in the predicted probability of employment) a non-disabled worker experiences when discrimination against the disabled exists. Or, alternatively, it is the fall in predicted employment probability that would occur if discrimination is eliminated. The second term in brackets is the increase in predicted employment probability for the disabled that would result from eliminating discrimination.

To identify differences in the impact of disability on labour market outcomes by gender, each of the equations is estimated by disability group j, but also gender k ($k=M,F$). To analyse the effect of the legislation, the equations are also estimated separately for each year ($t=1997$, 2003) under consideration. This allows similar decompositions to be computed across genders and over time. The following decomposition is performed between genders within the jth disability group where $\hat{\gamma}_j^G *$ are the coefficients from a pooled model of both genders within the same disability group. As before, the equations represent the difference in the predicted employment probability across genders, equation (3.12), the part of the gap that is explained by differences in observable characteristics, equation (3.13) and the unexplained component, equation (3.14).

$$\hat{P}_{Mj} - \hat{P}_{Fj} = (1/n_{Mj})\sum_{i=1}^{n_{Mj}} \Phi(Y_{iMj}\hat{\gamma}_{Mj}) - (1/n_{Fj})\sum_{i=1}^{n_{Fj}} \Phi(Y_{iFj}\hat{\gamma}_{Fj}) \tag{3.12}$$

$$(\hat{P}_{Mj} - \hat{P}_{Fj})_{\text{explained}} = \left[(1/\text{n}_{Mj})\sum_{i=1}^{n_{mj}} \Phi(Y_{iMj}\hat{\gamma}_j^G *)\right] - \left[(1/\text{n}_{Fj})\sum_{i=1}^{n_{Fj}} \Phi(Y_{iFj}\hat{\gamma}_j^G *)\right] \tag{3.13}$$

$$\begin{aligned}(\hat{P}_{Mj} - \hat{P}_{Fj})_{\text{unexp}} = &\left[(1/\text{n}_{Mj})\sum_{i=1}^{n_{Mj}} \Phi(Y_{iMj}\hat{\gamma}_{Mj}) - (1/\text{n}_{Mj})\sum_{i=1}^{n_{Mj}} \Phi(Y_{iMj}\hat{\gamma}_j^G *)\right] + \\ &\left[(1/\text{n}_{Fj})\sum_{i=1}^{n_{Fj}} \Phi(Y_{iFj}\hat{\gamma}_j^G *) - (1/\text{n}_{Fj})\sum_{i=1}^{n_{Fj}} \Phi(Y_{iFj}\hat{\gamma}_{Fj})\right]\end{aligned} \tag{3.14}$$

Similarly, the three equations can be modified to analyse the same group of individuals (j,k) between the two different time periods (t) as follows:

$$\hat{P}_{2003j} - \hat{P}_{1997j} = (1/n_{2003j})\sum_{i=1}^{n_{2003j}} \Phi(Y_{i2003j}\hat{\gamma}_{2003j}) - (1/n_{1997j})\sum_{i=1}^{n_{1997j}} \Phi(Y_{i1997j}\hat{\gamma}_{1997j}) \tag{3.15}$$

$$(\hat{P}_{2003j} - \hat{P}_{1997j})_{\text{explained}} = \left[(1/\text{n}_{2003j}) \sum_{i=1}^{n_{2003j}} \Phi(Y_{i2003j}\hat{\gamma}_j^T *) \right] - \left[(1/\text{n}_{1997j}) \sum_{i=1}^{n_{1997j}} \Phi(Y_{i1997j}\hat{\gamma}_j^T *) \right] \tag{3.16}$$

$$(\hat{P}_{2003j} - \hat{P}_{1997j})_{\text{unexp}} = \left[(1/\text{n}_{2003j}) \sum_{i=1}^{n_{2003j}} \Phi(Y_{i2003j}\hat{\gamma}_{2003j}) - (1/\text{n}_{2003j}) \sum_{i=1}^{n_{2003j}} \Phi(Y_{i2003j}\hat{\gamma}_j^T *) \right] + \left[(1/\text{n}_{1997j}) \sum_{i=1}^{n_{1997j}} \Phi(Y_{i1997j}\hat{\gamma}_j^T *) - (1/\text{n}_{1997j}) \sum_{i=1}^{n_{1997j}} \Phi(Y_{i1997j}\hat{\gamma}_{1997j}) \right] \tag{3.17}$$

where $\hat{\gamma}_j^T *$ is now the pooled model across the two time periods for the same gender and disability group. The explained gap represents the contribution changes in characteristics have had to predicted employment probability over time. The unexplained gap represents the difference in treatment that exists for a given worker after 6 years of legislation, relative to the post implementation year. This difference in treatment over time can arise for several reasons, including changes in preferences, but any change in behaviour as a result of legislation will work through this component.[59]

3.2.4 Earnings Decomposition

A prediction of the offer wage can be calculated for each individual using the estimates from equation (3.8) as follows: $\hat{W}_{ij}^O = \hat{\beta}_j^O X_{ij} + \hat{\theta}_j \hat{\lambda}_{ij}$, where $\hat{\beta}_j^O$ are the coefficients on the productivity related characteristics and $\hat{\theta}_j$ is the coefficient on the selection term for the *j*th group. The mean predicted log offer wage for the *j*th group, with sample size n_j is therefore:

$$\overline{W_j^O} = \frac{1}{n_j} \sum_{i=1}^{n_j} \hat{W}_{ij}^O = \hat{\beta}_j^O \overline{X}_j + \hat{\theta}_j \overline{\lambda}_j \tag{3.18}$$

[59] In April 1995 the main disability benefit for individuals who are unable to work was changed from invalidity to incapacity benefit. The increased stringency of testing that accompanied incapacity benefit may have an influence on employment and hence contribute to the unexplained component.

where $\overline{X}_j$ and $\overline{\lambda}_j$ are the mean values for the explanatory variables and the selection term for the *j*th group. In a similar manner to the probit equation, the difference in the predicted wage between the groups can be decomposed, using the method based on Oaxaca (1973), Reimers (1983) and Cotton (1988), into the part of the difference that is due to differences in characteristics and the part that is unexplained, which includes unobserved productivity differences and differences due to discrimination.

The selectivity corrected offer wage differential can be defined as: [60]

$$\overline{W_N^O} - \overline{W_{D_1}^O} - (\hat{\theta}_N \overline{\lambda_N} - \hat{\theta}_{D_1} \overline{\lambda_{D_1}}) = (\overline{X_N} - \overline{X_{D_1}})\hat{\beta}_{D_1}^O + \overline{X_{D_1}}(\hat{\beta}_N^O - \hat{\beta}_{D_1}^O) + (\overline{X_N} - \overline{X_{D_1}})(\hat{\beta}_N^O - \hat{\beta}_{D_1}^O) \tag{3.19}$$

The first term on the right hand side represents the difference in the selectivity corrected wage due to differences in endowments, the second term represents the difference in coefficients between the groups and the final component is the effect of the interaction between coefficients and endowments.[61] The interaction term can

[60]As Neuman and Oaxaca (2003) note, there are several alternative ways of treating the sample selection term in wage decompositions, depending on the assumptions made about the model. While equation (3.20) provides a decomposition of the selectivity corrected wage equation, it does not provide a decomposition of the observed wage differential. There are several alternative options. The selectivity term ($\hat{\theta}_N \overline{\lambda_N} - \hat{\theta}_{D_1} \overline{\lambda_{D_1}}$) can be included as a separate component of the total wage gap, in addition to the explained and unexplained components. Alternatively, assuming differences in the coefficients from the probit equation between groups are partly the result of discrimination, there are a number of alternative decompositions. Assuming the non-disabled is the base structure, the difference in selection term can be decomposed into:

$$\hat{\theta}_N \overline{\lambda_N} - \hat{\theta}_{D_1} \overline{\lambda_{D_1}} = \hat{\theta}_N (\overline{\lambda_{D_1}^0} - \overline{\lambda_{D_1}}) + \hat{\theta}_N (\overline{\lambda_N} - \overline{\lambda_{D_1}^0}) + (\hat{\theta}_N - \hat{\theta}_{D_1})\overline{\lambda_{D_1}}$$

where $\overline{\lambda_{D_1}^0}$ is the average selection term if the disabled faced the same coefficients from the employment probit as the non-disabled. The first term on the right hand side is the effect that differences in the parameters of the probit due to disability have on the wage differential. The second term captures the effect disability status has on the characteristics that determine employment. The final term captures differences in the wage response to employment by disability status.

A range of alternative decompositions is possible depending on how these three terms are allocated (see Madden, 2004 for a discussion). It may be more appropriate to include the first term (disability differences in the parameters of the probit) in the discriminatory component of the wage differential and the remaining two components into the endowment effect. However, a wider definition of discrimination may include both the first term and the third term (disability differences in the impact of selectivity on wages) in the discriminatory component, leaving the second term to form part of the endowment.

[61] Differences in earnings caused by differences in the distribution of employment across occupations and industries will form part of the explained component of the wage gap. This is only valid,

contribute to the explained or unexplained component, depending on the structure that is assumed for the non-discriminatory group. A more general form of the decomposition is:

$$\overline{W_N^O} - \overline{W_{D_1}^O} - (\hat{\theta}_N \overline{\lambda_N} - \hat{\theta}_{D_1} \overline{\lambda_{D_1}}) = (\overline{X_N} - \overline{X_{D_1}})[\Omega\hat{\beta}_N^O + (I-\Omega)\hat{\beta}_{D_1}^O] + [\overline{X_N}(I-\Omega) + \overline{X_{D_1}}\Omega](\hat{\beta}_N^O - \hat{\beta}_{D_1}^O) \tag{3.20}$$

where I is the identity matrix and Ω is a vector representing the relationship between the observed and the non-discriminatory wage structure. Oaxaca (1973) suggests that either the low or high group should form the non-discriminatory structure and, thus, Ω is a null or an identity matrix. Reimers (1983) alternatively suggests the mean of the coefficients between the two models and Cotton (1988) suggests a weighted mean of the coefficients, based on the size of the group. The alternative, as in the employment decompositions, is to use a pooled structure (Neumark, 1988); this leads to the following decomposition where $\hat{\beta}_P^O$ is the column vector of coefficients from the pooled model.

$$\overline{W_N^O} - \overline{W_{D_1}^O} - (\hat{\theta}_N \overline{\lambda_N} - \hat{\theta}_{D_1} \overline{\lambda_{D_1}}) = (\overline{X_N} - \overline{X_{D_1}})\hat{\beta}_P^O + [\overline{X_N}(\hat{\beta}_N^O - \hat{\beta}_P^O) + \overline{X_{D_1}}(\hat{B}_P^O - \hat{\beta}_{D_1}^O)] \tag{3.21}$$

Using the same reasoning as before, the non-work-limited disabled and the non-disabled are pooled to form the wage structure that would occur if discrimination was eliminated but that allows health to have an unobserved effect on productivity

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theoretically, if individuals are free to choose their occupation and industry; if there is any discrimination in entry to certain occupations the amount of discrimination identified will be under-estimated in the model. For the work-limited disabled, occupational choice may be constrained by their disability, however as long as this is a result of productivity differences and is not the result of discrimination or employer preferences it can be included within the explained gap. Alternatively, Brown *et al.* (1980), Miller (1987) and Reilly (1991) separate the effect of occupational segregation from either endowments or wage discrimination. Since occupational segregation has not featured in the literature relating to disability and following other authors, no attempt is made to isolate this effect. Confirming the similarity in the occupational distribution between disability groups, the Duncan and Duncan (1955) index of occupational segregation is 0.12 (for male work-limited disabled and non-disabled) and 0.03 (for male non-work-limited disabled and non-disabled). For women the corresponding figures are 0.09 and 0.03. The same measures of segregation are even lower by industry. These figures are put into context when you consider the index value between genders is nearly 0.4. The issue of the choice of employment type is considered separately in Chapters 4 and 5.

$(\hat{\beta}_P^O = \hat{B}_{P2}^O)$.[62] Following DeLeire (2001), the unexplained component of a decomposition of the work-limited group (D_1) and the non-disabled group (N) represents the combined influence of discrimination and unobserved differences in productivity.[63] The unexplained wage gap from a comparison of the non-work-limited group (D_2) and the non-disabled group (N) represents discrimination, since the productivity difference is zero by assumption. Hence, in a similar manner to employment when discrimination is assumed to be equal across the two disabled groups, discrimination can be separated from the unobservable effect of disability on productivity.

3.2.5 Gender and Timewise Decompositions

As with the employment decompositions, the wage decompositions can also be computed across genders and across time. Gender wage decompositions can be computed for each of the j disability groups as follows:

$$\overline{W_{Mj}^O} - \overline{W_{Fj}^O} - (\hat{\theta}_{Mj}\overline{\lambda_{Mj}} - \hat{\theta}_{Fj}\overline{\lambda_{Fj}}) = (\overline{X_{Mj}} - \overline{X_{Fj}})[\Omega\hat{\beta}_{Mj}^O + (I-\Omega)\hat{\beta}_{Fj}^O] + [\overline{X_{Mj}}(I-\Omega) + \overline{X_{Fj}}\Omega](\hat{\beta}_{Mj}^O - \hat{\beta}_{Fj}^O) \tag{3.22}$$

The left hand side of the equation now refers to the selectivity corrected gender difference specific to the jth group; thus averages are constructed using all individuals in the kth gender and jth disability group. In the same manner as before, the selectivity difference in wages between males and females is decomposed into an explained part and an unexplained part. Again, coefficients from the pooled model are used as the non-discriminatory base, which, in this case, is formed using a pooled regression of men and women in the jth group; thus, only discrimination between genders is eliminated.

[62] Sensitivity analysis for the basic wage decompositions is reported in Appendix Table A3.5.

[63] DeLeire (2001) actually performs the decomposition on the basis of results from a tobit model where earnings of the non-employed are treated as censored observations. The tobit model is actually a special case of the Heckman model, where the selection and the outcome decisions are assumed to be identical. The main advantage of the tobit is that the employment equation is not modelled explicitly and identifying variables are not required. However, since the selection decision is itself of interest and is determined by variables which affect the value of time, the Heckman model, which is applied more widely in the literature, is used here. In doing so, the employment decision can also be decomposed.

In addition to comparing how the amount of discrimination against the disabled changes over time, by comparing the unexplained component from equation (3.21) between 1997 and 2003, it is possible to examine the factors that have caused a change in the real wages in each of the j groups over time.[64] The following timewise decomposition is computed:

$$\overline{W^{O}_{2003j}} - \overline{W^{O}_{1997j}} - (\hat{\theta}_{2003j}\overline{\lambda_{2003j}} - \hat{\theta}_{1997j}\overline{\lambda_{1997j}}) = (\overline{X_{2003j}} - \overline{X_{1997j}})[\Omega\hat{\beta}^{O}_{2003j} + (I-\Omega)\hat{\beta}^{O}_{1997j}] + [\overline{X_{2003j}}(I-\Omega) + \overline{X_{1997j}}\Omega](\hat{\beta}^{O}_{2003j} - \hat{\beta}^{O}_{1997j}) \tag{3.23}$$

The left hand side is now the selectivity corrected real wage gap between 2003 and 1997 for workers in the jth group and kth gender. Again, a pooled model is constructed, such that there are no differences in the way the same group of individuals is treated over time (1997 and 2003 are pooled), but the coefficients are still allowed to vary by j and k. The change in the real wage of an individual with the same characteristics can, thus, be attributed to changes in the rewards to work, for the jth group, over time.

3.2.6 Employment Effects of Earnings Discrimination

The existence of wage discrimination against the disabled will, given the presence of an upward sloping labour supply schedule, also reduce the employment rate of the disabled group.[65] Baldwin and Johnson (1992) develop a three stage procedure to quantify the effect of wage discrimination on employment. In the first stage, the probit model equation (3.6), is used to estimate the average employment probability for each of the j groups ($\hat{P}_j$). In the second stage, equation (3.8) is used to estimate the average offer wage for each of the j groups ($\overline{W}_j^{O}$). The average non-discriminatory offer wage is also predicted for each of the j groups using the non-discriminatory wage structure. Finally, the probability of employment that would exist in the absence of wage discrimination can be estimated.

[64] Earnings are deflated using ONS Retail Price Index series CHAW.

[65] Conversely the wage premium received by non-disabled workers due to discrimination will increase their relative employment.

This procedure is more routinely employed for a standard decomposition, since it assumes that the non-discriminatory wage structure only eliminates discrimination. It is complicated by the use of the DeLeire (2001) decomposition of the unexplained component into discrimination and unobserved productivity differences. However, it is possible to use the assumptions of the DeLeire (2001) decomposition to identify the employment effect of eliminating discrimination and unobserved productivity differences separately for the work-limited disabled.

For the standard case, where the entire unexplained gap represents discrimination, equation (3.3) can be modified to show, in the absence of discrimination, the probability an individual would work is:

$$\hat{P}_{ij} * = \Pr\,[W_{ij}^{O} * - W_{ij}^{R} > 0] \tag{3.24}$$

where the non-discriminatory offer wages, $(\hat{W}_{ij}^{O}*)$, are predicted using an individual's own characteristics and the non-discriminatory wage structure. Equation (3.24) can alternatively, be written as:

$$\hat{P}_{ij} * = \Pr\,[W_{ij}^{O} * - W_{ij}^{R} + W_{ij}^{O} - W_{ij}^{O} > 0] \tag{3.25}$$

$$\hat{P}_{ij} * = \Pr\,[\gamma_j Y_{ij} + W_{ij}^{O} * - W_{ij}^{O} > \mu_{ij}] \tag{3.26}$$

$$\hat{P}_{ij} * = \Phi \left[\frac{\gamma_j Y_{ij}}{\sigma_{uj}} + \left(\frac{W_{ij}^{O} * - W_{ij}^{O}}{\sigma_{uj}} \right) \right] \tag{3.27}$$

By substituting the estimated difference in offer wages between the discriminatory and non-discriminatory cases in equation (3.27), the probability of employment for each individual in the absence of discrimination, $\hat{P}_{ij}*$, can be calculated. Baldwin and Johnson (1992) use the average offer wages to create the predicted employment probability for group j in the absence of discrimination ($\hat{P}_j *$) as follows: [66]

$$\hat{P}_j * = \Phi\left[\frac{\hat{\gamma}_j \overline{Y}_{ij}}{\sigma_{uj}} + \left(\frac{(\overline{W}_j^O * - \overline{W}_j^O}{\sigma_{uj}}\right)\right] \qquad (3.28)$$

The non-discriminatory wage, as before, is formed by pooling the non-disabled and the non-work-limiting disabled.[67] Equation (3.28) is also modified, by replacing the value of the non-discriminatory wage, to separate the effect of discrimination from unobserved differences in productivity for the work-limited disabled. To capture the change in earnings of eliminating the unobserved productivity effect, the earnings for the work-limited disabled are predicted using the non-work-limited disabled wage structure.[68] The difference between this prediction and the prediction from the non-discriminatory wage structure, which eliminates both discrimination and unobserved differences in productivity, provides the positive wage effect eliminating discrimination would have. This is added to the work-limited disabled own predicted wage to calculate the wage which is purely a result of removing the DeLeire (2001) discrimination component. Thus, $\hat{P}_{D_1} *$ can be estimated separately in the absence of discrimination and unobserved productivity effects.

The method requires σ_{uj} to be known or estimated. The coefficient estimates from the reduced form probit, equation (3.6), are $\frac{\hat{\gamma}_j}{\sigma_{uj}}$, but this does not isolate σ_{uj}. One way of identifying σ_{uj} is to exclude one variable (n) from the reservation wage equation (3.2) that is present in the offer wage equation (3.8). The offer wage equation would provide an estimate of β_j^{On}, whilst the employment probit gives an

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[66] This is the approach employed here, although the average of $\hat{P}_{ij} *$ over the individuals in the jth group can be used as an alternative method for calculating $\hat{P}_j *$. The main results are not sensitive to this.

[67] This differs from Baldwin and Johnson (1992) and Kidd *et al.*, (2003), who both use Cotton style weights.

[68] Since discrimination is assumed to be equal between the groups the change in earnings is due to unobserved productivity effects alone.

estimate of $\dfrac{\beta_j^{On}}{\sigma_{uj}}$ and, thus, σ_{uj} can be identified.[69] Kidd *et al.* (2003) outline an alternative method for identifying σ_{uj}, that can be applied if more than one exclusion restriction is imposed. They estimate the structural form equivalent of equation (3.4) as follows:

$$\Pr(E_{ij}=1)=\Pr\left[E(W_{ij}^{O})-B_j^R Z_{ij}>\mu_{ij}\right]=\Phi\left[\frac{E(W_{ij}^{O})-B_j^R Z_{ij}}{\sigma_{uj}}\right] \tag{3.29}$$

where $E(W_{ij}^{O})$ is the expectation of the offer wage. The prediction from equation (3.29) is an alternative expression for $\hat{P}_{ij}$ in equation (3.4). In the absence of wage discrimination, $W_{ij}^{O}*$ replaces W_{ij}^{O} and equation (3.29) can be rewritten as:

$$\Pr(E_{ij}=1)*=\Pr\left[E(W_{ij}^{O}*)-B_j^R Z_{ij}>\mu_{ij}\right]=\Phi\left[\frac{E(W_{ij}^{O}*)-B_j^R Z_{ij}}{\sigma_{uj}}\right] \tag{3.30}$$

where, as before, $\hat{P}_{ij}*$ is the predicted value or the probability of employment that would prevail if discrimination was eliminated.[70] Estimation of equations (3.29) and (3.30) utilise a standard probit model, where the variables that are included in Z_{ij} need to be specified explicitly:

$$L=\prod_{i\in E_{ij}=1}\left[\Phi\left(\frac{E(W_{ij}^{O})-B_j^R Z_{ij}}{\sigma_{uj}}\right)\right]\cdot\prod_{i\in E_{ij}=0}\left[1-\Phi\left(\frac{E(W_{ij}^{O})-B_j^R Z_{ij}}{\sigma_{uj}}\right)\right] \tag{3.31}$$

The predicted log offer wage (from equation (3.8)) is used, instead of the expected wage, in estimation and $E(W_{ij}^{O*})$ replaces $E(W_{ij}^{O})$ for the non-discriminatory case.

[69] The choice of a single variable is arbitrary and Kidd *et al.* (2003) examine the variation in employment probabilities that results from changing the exclusion restriction. The impact on the employment probability is small.

[70] This is equivalent to equation (3.27).

The coefficient on the expected wage in equation (3.31) provides an estimate of $\frac{1}{\sigma_{uj}}$, as long as at least one variable in the offer wage is excluded from the reservation wage. However, this procedure will uniquely identify σ_{uj} even if more than one exclusion restriction is imposed. The above methods for identifying σ_{uj} require that Y_{ij} contains all the variables in X_{ij} and Z_{ij}, which restrict variables to be observable for all workers (E_{ij}=1 and E_{ij}=0). Thus, X_{ij} cannot include employment related variables.[71]

Baldwin and Johnson (1992) do not impose this restriction and the offer wage equation contains employment related variables which cannot be included in the probit equation. They, instead, estimate σ_{uj} using a Heckman labour supply model, where the number of hours worked (h_i) is assumed to be proportional ($1/v_j$) to the difference between the offer and reservation wage.

Heckman (1976) shows that if $E_{ij}*$ were observed, a regression of $E_{ij}*$ on the predicted difference between the offer and reservation wages for the employed sample, with a sample selection bias correction, can provide an estimate of σ_{uj}.[72]

$$E_{ij}* = \gamma_j Y_{ij} + \frac{\sigma_{uj}^2}{\sigma_{uj}} \lambda_{ij} + \upsilon_{ij} \tag{3.32}$$

An alternative representation is:

$$E_{ij}* = \sigma_{uj} \left[\frac{\hat{\gamma}_j Y_{ij}}{\sigma_{uj}} + \lambda_{ij} \right] + \upsilon_{ij}' \tag{3.33}$$

where the predicted difference between the offer and reservation wage from the probit model, equation (3.4), is used. However $E_{ij}*$ is not observed, even if $E_{ij} = 1$.

[71] The predicted log offer wage cannot be constructed if X_{ij} contains employment related variables.
[72] Equations 12b, 13b and 13b'.

Hours of work h_i are, however, observed if $E_{ij}=1$ and are assumed to be proportional to $E_{ij}*$. Hence Baldwin and Johnson (1992) estimate σ_{uj}/ν_j from a regression of hours worked on the predicted difference between the offer and reservation wage from equation (3.6) and the sample selection term:

$$h_{ij}=\frac{\sigma_{uj}}{\nu_j}\left[\frac{\hat{\gamma}_j Y_{ij}}{\sigma_{uj}}+\lambda_{ij}\right]+\upsilon_{ij}'' \tag{3.34}$$

Baldwin and Johnson (1992) assume one variable (experience) affects the offer (and not the reservation) wage. Given exact identification, an estimate of ν_j, which is the factor of proportionality relating the gap in offer and reservation wages to hours worked, can be calculated by dividing the coefficient on experience in the wage equation (3.8) by the coefficient on experience in a regression of hours worked on all variables that determine either the offer or reservation wage:

$$\mathrm{E}(h_{ij} \mid E_{ij}^{*}>0)=\frac{1}{\nu_j}\left[B_j^O X_{ij}-B_j^R Z_{ij}\right]+\delta_j\lambda_{ij} \tag{3.35}$$

Since h_i is only observed when (E_{ij}=1), variables can be included in X_{ij} that are specific to the employed; this means that X_{ij} is equivalent in equations (3.8) and (3.35), so ν_j can be identified. However, if equation (3.35) is over-identified, which is a more realistic assumption given the presence of employment related variables in X_{ij}, multiple estimates of ν_j will be produced.[73] An alternative procedure can then be employed where the predicted offer wage can be substituted into equation (3.35) to give:

$$\mathrm{E}(h_{ij} \mid E_{ij}^{*}>0)=\frac{1}{\nu_j}\left[E(W_{ij}^O \mid E_{ij}*>0)-B_j^R Z_{ij}\right]+\delta_j\lambda_{ij} \tag{3.36}$$

[73] Baldwin and Johnson (1992) actually include three experience related variables in the offer wage equation that are not present in the probit, but still assume exact identification.

and the coefficient on the offer wage is $\frac{1}{v_j}$ as long as at least one variable is excluded from the reservation wage. While this seems the most appropriate approach, given the presence of employment related variables in the wage offer equation and the resultant exclusion of groups of variables in the probit, there is one issue. When employment related variables are included in X_{ij}, the specification used to calculate $\frac{1}{v_j}$, equation (3.36), will differ from equation (3.34) used to estimate $\frac{\sigma_{uj}}{v_{ij}}$ and, as such, estimates of v_j may differ. The sensitivity of v_j to the difference in specification is examined by comparing the results from the original wage specification to a restricted specification which excludes the employment related variables. The estimate of $\hat{v}_j$ can be used to isolate an estimate of $\hat{\sigma}_{uj}$ which can, then, be used to calculate the employment probabilities that would exist for each group in the absence of wage discrimination, $\hat{P}_j$ *.[74]

3.3 Results

3.3.1 Descriptive Statistics

The labour market disadvantaged, associated with work-limiting disability, is evident in Table 3.1. Disabled male (female) relative employment rates (as a ratio of the non-disabled) are 40 percent (46 percent) and, for hourly earnings, the corresponding figures are 83 percent (89 percent). Thus, when measured relative to their non-disabled counterparts, disabled females only perform slightly better than males. In contrast, both employment rates and average hourly earnings are far more similar between the non-work-limited and the non-disabled (consistent with DeLeire, 2001 and Madden, 2004). Indeed, the employment rate is, actually, significantly greater for the non-work-limited disabled than the non-disabled, indicating their fundamental difference from the work-limited disabled. It is also interesting to note that, despite the work-limited disabled being slightly more likely to be unemployed than the non-disabled, this does not explain the gap in employment rates between the work-limited

[74] A reduction in hours due to discrimination cannot be identified from this model. In addition, failure to hire because of wage floors, for example the minimum wage, is not included in the estimates.

disabled and non-disabled. It is differences in the economic activity rate of the work-limited disabled that are the predominate cause of their low employment rate.

The relativities in employment and earnings between the three groups are evident throughout the period since the DDA (see Figures 3.2 and 3.3). Importantly, given the anticipated positive impact of the DDA, there is little evidence indicating convergence or divergence between the disability groups in terms of earnings. There is evidence of an increase in the work-limited disabled employment rates across time, particularly between 1997 and 1998, which contribute to a narrowing of the employment disadvantage associated with disability. For example, the employment rate for work-limited disabled males increases from 35.6 percent to 42.9 percent between 1997 and 2004.

Prior to the econometric analysis, it is also informative to consider differences between the groups in terms of observable characteristics that may contribute to the gap in employment and earnings. As such, the variable means are presented in Tables 3.2 (a) and (b) for males and females respectively.[75] Several differences among the disability groups are worthy of note. Given the significance of education for labour market outcomes, it is important to recognise the extent of the average gap in qualifications between the disabled groups. The work-limited disabled are less than half as likely as the non-disabled to hold a degree and are particularly concentrated among the other and no qualification groups.

In addition, and consistent with the existing literature, disabled persons are also typically older, by an average of 10 years for men (reflecting the fact that many disabilities exhibit age-related onset), and, possibly for this reason, have greater average experience, tenure and are also more likely to own their own home. They are also, however, more likely to be in public housing, which is consistent with their economic disadvantage. Moreover, the disabled are, on average, less likely to be in a household where another individual has a source of earned income, suggesting that they cannot rely on this as a means to ameliorate their own disadvantage in the labour market. Interestingly, on average, the disabled have a greater number of days

[75] Given the gender differences in characteristics are well established, they are not considered here.

off work due to illness, supporting the suggestion that there may be differences in the productivity between the groups. Note, also, that this effect is greater for the work-limited than the non-work-limited disabled, who again are more similar to the non-disabled.

For those who are in employment, there are also differences between the work-limited disabled and the non-disabled. These differences are most marked in the proportions working in certain occupational groups, the public sector and small firms. There is evidence to suggest the disabled are more concentrated amongst the less skilled occupations, consistent with their lower level of average education. The non-disabled work more overtime hours than the disabled; this is inversely correlated with the proportions working part-time, as would be expected.

It is interesting to note that, in almost every case, the differences in characteristics are more marked between the work-limited disabled and the non-disabled relative to the non-work-limited disabled. Indeed, a consideration of the nature of disability between these groups again highlights how distinct they are. On average, non-work-limited disabled have slightly more than half as many different health problems as the work-limited disabled and they have a concentration of health problems affecting skin, breathing and organs, rather than problems affecting limbs or mental health.[76]

While there are relatively few significant changes in the variable means over time (1997-2003), there is evidence of a general upskilling of the workforce in terms of educational qualifications for both men and women.

3.3.2 Employment Probabilities

The Heckman selectivity corrected wage equations in 2003 are presented in Tables 3.3 and 3.4 for males and females, respectively. In this sub-section, estimates from the selection equation, which estimates the probability of employment using a probit model, are considered.[77] In all cases, Likelihood Ratio tests unambiguously reject the null hypothesis that the coefficients in each regression are jointly insignificant. While

[76] See Section 3.3.8 for further discussion.

[77] The results for 1997 are qualitatively similar and are, therefore, presented in the Appendix to the Chapter, Tables A3.3 and A3.4 respectively.

qualitatively similar, χ^2 tests of parameter equality among the different comparator sub-groups unambiguously reject the null hypothesis of homogeneity in each case.[78]

Most findings are in accordance with the literature and are qualitatively similar amongst the three disability groups. For example, the results show that both men and women with educational qualifications are significantly more likely to be in employment than those without any qualifications. However, the marginal effect of having qualifications is considerably stronger for the work-limited disabled, indicating the particular importance of obtaining an education among this group.[79] There are, in addition, strong age effects, with positive and negative signs on the linear and quadratic terms, respectively, observed in all cases, and conforming to the usual pattern, although the probability of employment is maximised at a lower age for the work-limited disabled. Married men, whether disabled or not, are more likely to be employed than single men, while the reverse applies to women, reflecting conventional household roles. In a similar vein, the presence of children, generally, has a negative effect on employment for females. The presence of an earned source of income by another household member has a positive effect on employment, which is consistent with polarisation of households as being either dual income or no income types (Dickens *et al.* 2000) and, for men, it is considerably stronger for the disabled. Possession of a mortgage also has a positive effect, while habitation of social housing works in the opposite direction. Being white increases the probability of employment, consistent with previous evidence relating to ethnic minorities (see, for example, Blackaby *et al.*, 2002) and the regional controls indicate lower employment rates in regions typically associated with slacker labour markets, such as Wales, Scotland and the North West. The significance of age and another earner in the household, and, for females, the number of dependent children, provide identification for the model.

[78] For example, testing the pooling restriction across disability groups results in a χ^2 test statistic of 4246.58 for males and 3425.16 for females; with 54 degrees of freedom, both are clearly significant.
[79] In terms of the highest qualification, the marginal effect is 0.35 for work-limited disabled males and 0.09 for non-disabled males. A full set of marginal effects for the probit equations in Tables 3.3 and 3.4 are provided in the Appendix Table A3.2.

3.3.3 Earnings Equations

Selectivity corrected earnings equations are also presented for males and females in Tables 3.3 and 3.4 respectively. Earnings are also determined in a qualitatively similar fashion for all disability groups, although F tests of parameter equality are rejected. The selection term lambda is not significant for males but is positive for disabled females, indicating that unobservables that are positively correlated with employment also have a positive influence on earnings, whilst for non-disabled females the term is negative.

In terms of specific coefficient estimates, these once again conform to priors. Thus, wages are higher for those with qualifications relative to those without qualifications in each of the sub-group regressions, with the coefficients, generally, increasing in magnitude in progression up the qualifications' hierarchy. Interestingly, for men, the return to education is similar across the disability groups, whereas for females the return is higher for the disabled. Other human capital variables, such as experience and tenure with the current employer, are always positive and significant, and, in all cases, there is evidence of decreasing returns. For males, the lower return from experience for the disabled may reflect their intermittent work histories, which are not captured by the potential measure of experience available from the LFS. Turning to other variables, wages are higher for married men than for single men, but this influence is not significant for the work-limited disabled. For females, being married has no influence on earnings. The housing status variables are largely in accordance with expectations: being in social housing is negatively related to earnings, while the reverse is true for those in possession of a mortgage, though not always significantly so.

As might be expected given the omitted category (London and the South East), all regional dummies have negative coefficients. Being employed in a small firm (fewer than 20 employees) is associated with lower earnings for all of the sub-groups. The occupational group dummies, which are included to capture employment heterogeneity, are, generally, significantly negative, as would be anticipated given the omitted category of managers and senior officials; the only notable exception is females in professional occupations, whose earnings are higher than the base group.[80] Similarly, the industry dummies also have a fairly consistent effect across disability groups and gender, with higher earnings in banking and finance, energy and water, construction, manufacturing and transport and communications. Interestingly, being employed in the public sector confers a significant wage advantage for women and also seems to offer a greater return for the work-limited disabled relative to the other groups.

3.3.4 Employment Decompositions

The results from the decompositions of the employment equations on the basis of disability status are presented in Table 3.5. The difference in predicted employment probability between the work-limited disabled and the non-disabled is substantial at about 0.50 for men and 0.40 for women, although the difference does fall for both groups between 1997 and 2003. In all cases, the majority of this difference (over 75 percent) cannot be explained in terms of differences in characteristics, and this is slightly higher for females.[81] These results are slightly greater than Kidd *et al.* (2000) and Madden (2004) who find 50 percent and 65 percent of the participation gap is unexplained, respectively. If the unobserved productivity difference between the work-limited disabled and the non-disabled were assumed to be zero, the upper bound on the discrimination would account for 0.37 (79 percent) and 0.33 (86 percent) of the gap in employment probabilities in 2003, for males and females, respectively. However, when the non-work-limited disabled are considered, the employment gap is effectively zero, actually being negative, indicating the non-work-limited disabled have a slightly higher employment probability than the non-disabled (consistent with DeLeire, 2001 and Madden, 2004). The decomposition of this gap isolates a small unexplained component in absolute terms, although representing the majority of the employment gap in most cases.

In Table 3.6, the DeLeire (2001) decompositions are applied, where the discriminatory component is identified from the decompositions of the non-work-

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[80] Differences in the influence of occupation on earnings between the disability groups may reflect differences in the ability to accommodate disability between occupations, since accommodations may have a positive influence on productivity.

[81] For simplicity, the pooled base $\hat{\alpha}^{P2}$ has been used throughout. Alternative definitions of the equal treatment case were examined, but the results do not change significantly.

limited disabled and the gap due to unobserved productivity differences can, therefore, be isolated from the work-limited disabled decomposition. The discriminatory component is negative, indicating the non-work-limited disabled actually receive favourable treatment in the labour market; thus the entire unexplained gap from the work-limited decomposition is attributed to unobservable productivity differences between the two groups. Moreover, this accounts for more than 80 percent of the overall gap in all cases. Over time, the raw gap has narrowed, as have the contributions of characteristics and discrimination; but, while falling in absolute terms, the productivity difference still explains the vast majority of the employment gap in 2003.

The traditional decomposition would suggest 79 percent of the employment gap is due to unequal treatment, or that the employment probability for a disabled individual would increase by 37 percentage points for males in 2003, if discrimination were eliminated. The DeLeire (2001) procedure, which takes into account that the work-limited disabled may be less productive than the non-disabled, suggests that discrimination is not significant and that efforts should be concentrated on raising the productivity of the disabled, through, for example, workplace accommodations.

Table 3.7 considers gender decompositions for each of the disabled groups in 1997 and 2003. The gender gap in employment probabilities is narrower for the work-limited disabled (actually being negative), but around 10 percentage points for the non-work-limited disabled and the non-disabled. For the work-limited disabled, the small gender gap is explained by differences in the characteristics between males and females, whereas, for the other groups, the gap is largely (approximately 90 percent) unexplained. Employment discrimination against females, as measured by the unexplained component of the decomposition, seems to be more prevalent amongst the non-disabled and non-work-limited disabled groups than the work-limited disabled.

The results from the timewise decompositions are presented in Table 3.8 and are again split by gender and disability status. Consistent with Figure 3.3, the largest changes in employment probability are experienced by the work-limited disabled, where employment increased by about 4 percentage points between 1997 and 2003. The change over time for the other groups ranges from 0.6 to -1.4 percentage points, indicating this improvement was not common across groups, as would be expected if the growth was part of a cyclical effect. For the work-limited disabled, the increase in employment probability is largely unexplained or due to changes in parameters between the two periods; this is particularly the case for men, where 82 percent is unexplained. This is consistent with the positive effects of policy change over the period and indicates there have been improvements in the treatment of the disabled in the labour market over time. In contrast, the majority of the change for the non-disabled was explained by changes in the characteristics of the group. This evidence is in contrast to Bell and Heitmueller (2005), who find no evidence of a positive employment effect of the DDA, albeit with a different methodology and dataset to this analysis.

3.3.5 Earnings Decompositions

Table 3.9 presents the wage decompositions by disability status for each gender and time period.[82] As with the employment probabilities, the work-limited disabled earn considerably less (between 16 and 29 log points) than the non-disabled, regardless of gender or period. This is in contrast to the non-work-limited disabled, where the gap is very small (less than 5 log points).[83] For both men and women, the percentage explained, typically, constitutes less than half the differential between the non-disabled and the work-limited disabled (similar to the 50 percent identified by Kidd *et al.* 2000). Thus, if there were no unobserved productivity difference between groups, the unexplained or discriminatory component would account for over 50 percent of the wage gap. In 1997, the wage gap is larger for males than females (consistent with Madden, 2004) but, by 2003, the situation has been largely reversed, with the differential now being larger for women, and the unexplained component for this group having increased to approximately three quarters of the differential, in comparison to around half for men. Thus the relative earnings position of work-limited disabled women, compared to the non-disabled, has worsened over the

[82] The results are only presented for the baseline pooled specification ($\hat{B}^{O}_{P2}$), consistent with the DeLeire (2001) decomposition. Decompositions were also computed using alternative base structures and the results are reported in Table A3.5.

[83] In the case of males, the offer wage for the disabled actually exceeds that of the non-disabled in 2003, albeit the gap is tiny (0.003), and is wholly explained by characteristics.

period. Considering the non-work-limited disabled, differentials are very small in both years and the small unexplained component, by assumption, captures discrimination. On this basis, there is little to suggest substantial discrimination against the disabled, at least where disability is not work-limiting in nature, and its absolute magnitude has fallen over time for both men and women.

Table 3.10 follows the decompositions suggested by DeLeire (2001) and identifies the contributions of observed and unobserved productivity differences and discrimination. Since the non-work-limited disabled are assumed to have no unobserved productivity difference, the entire unexplained component of the wage differential between the non-work-limited and the non-disabled reflects discrimination. In contrast, for the work-limited disabled, the unexplained component captures both discrimination and unobserved productivity differences, but, by using the two decompositions, it is possible to isolate these two effects. Discrimination accounts for about 10 percent of the disability earnings gap in 2003, which is considerably less than the 50 percent calculated when unobserved productivity differences are assumed to be zero. DeLeire (2001), when using US data, similarly attributes only 8 percent of the earnings differential to discrimination, although unobserved productivity differences account for over 75 percent. In the UK, the unobserved productivity effects are slightly lower, accounting for 44 percent (66 percent) of the male (female) gap.

Over time, the discriminatory component of the wage gap has fallen for both groups, consistent with an improvement in the treatment of the work-limited disabled. For males, the earnings differential has fallen overall and is the consequence of decreases in the absolute sizes of the unobserved and discriminatory components; these might, therefore, be taken as evidence of the beneficial impact of the legislation for men, the reduction in the unobserved health effect being consistent with disability having less impact on work. For females, in contrast, the raw differential has increased over time, primarily due to a large rise in the contribution of unobserved effects. While the legislation may have had a positive effect by reducing discrimination, the evidence does not support the view that the legislation has significantly improved the relative earnings of the female work-limited disabled. As such, it would appear that the legislation may have impacted in an unforeseen, gender-specific manner.

The gender decompositions in Table 3.11 compare the earnings of men and women within each of the disability categories (work-limited disabled, non-work-limited disabled and non-disabled) to assess if gender discrimination varies by disability status. The gender differential is larger for each of the two disabled groups in 2003 compared to 1997, which confirms the worsening position of disabled women, and, in particular, those whose disability is work-limiting, relative to disabled men.[84] Indeed, in 2003, the percentage unexplained is greatest for those whose disability is work-limiting at 58.4 percent of the wage gap, compared to 26.1 percent for the non-disabled, consistent with gender wage discrimination being greater for disabled females. This contrasts with the results for the employment decompositions and with Baldwin and Johnson (1995), who find gender discrimination in the US is no worse for the disabled relative to the non-disabled.

In order to examine the factors contributing to changes over time, time-wise decompositions are presented in Table 3.12, using deflated wages for 2003 for each of the 6 sub-groups. As can be seen, very different patterns emerge for men and women, as might be expected given the preceding discussion. For men, the biggest gain over time occurred for the work-limited disabled and the lowest for the non-disabled. In contrast, for women, the improvement is greater for the non-work-limited disabled and the non-disabled, both of whom have a very similar gain in real terms. For work-limited women, the gain is, however, very modest (0.047), confirming the previous discussion. For work-limited disabled men, the majority of the improvement is unexplained by variables in the model, which leaves room for the potentially positive role of legislation. However, the majority of the improvement, albeit smaller in absolute terms, is also unexplained for non-disabled and non-work-limited disabled men. In the case of women, while only about a quarter of the improvement can be explained for the non-work-limited disabled and non-disabled, for the work-limited disabled the improvement is fully explained by variables in the model. This implies that the legislation is unlikely to have played any part in the wage gains of work-limited disabled women.

[84] The differential due to the selection term changes dramatically over the period for work-limited women.

3.3.6 Employment Effects of Earnings Discrimination

The results of the Baldwin and Johnson (1992) procedure, used to estimate the employment effect of wage discrimination, or, more accurately in this context, the unexplained component of a wage decomposition, are set out, using data for 2003, in Table 3.13. The first specification follows Baldwin and Johnson and uses experience to identify σ_{uj}. The second specification assumes an over-identified model and the final specification tests the sensitivity of this method, by using a restricted model where employment related variables are excluded from the earnings equation. The typical non-discriminatory wage structure eliminates both the discrimination and unobserved productivity differences identified using the DeLeire (2001) method. This means that, for the non-work-limited disabled and the non-disabled, the estimated employment effects are a result of discrimination alone, whereas, for the work-limited disabled the employment effect is a combination of discrimination and unobserved productivity effects. However, for the work-limited disabled the employment effect is decomposed into the effect of discrimination separately from the effect of the unobserved productivity differences.

The earnings of the non-disabled and the non-work-limited disabled are relatively unaffected by the elimination of discrimination; this is expected given the construction of the non-discriminatory wage. As such, the employment response to removing discrimination is minimal for these groups. However, consistent with the evidence of discrimination from the earnings decompositions, the earnings and employment probabilities rise for the non-work-limited and fall for the non-disabled. As would be anticipated, applying the non-discriminatory wage structure to the work-limited disabled has a positive effect on earnings. The rise in earnings causes an increase in the average employment probability of a maximum of 5 percentage points for men and a maximum of 7 percentage points for women. However, consistent with the earnings decompositions, the dominant cause of the increase in employment is the elimination of the influence of unobserved differences in productivity. Indeed, the elimination of discrimination alone increases the probability of employment by less than 1 percentage point.

The results are not sensitive to the exact form of the method used, although the employment response using the restricted specification is more modest. However, in all cases the employment effect is considerably greater than the estimates of Kidd *et al.*, (2000) and, although the non-discriminatory wage structure differs between the studies, this evidence suggests that the labour supply of the work-limited disabled may be more elastic than previously estimated. However, given the modest employment effects, particularly when discrimination, rather than the unexplained wage gap, is removed, there is a more important role for the direct effect of unobserved productivity differences on employment.

3.3.7. Within Group Heterogeneity

In Table 3.14, the preceding model of employment and earnings is estimated for the disabled, with additional controls for the type of main health problem and the number of health problems reported. The employment probits indicate that those with each of the broad types of disability are significantly more likely to be in employment than the omitted category of mental health, regardless of whether the disability is work-limiting. For the work-limited disabled men, those with health problems related to limbs, sight/hearing or skin, breathing and organs are 25 percent more likely to be employed than those with health problems related to mental health.[85] The earnings equations also show that, for work-limited disabled men, those with all types of disability earn significantly more than those with mental health problems, but, for women, only the skin, breathing and organs variable is significant. Therefore, the evidence confirms previous studies that have identified those with mental health problems as particularly disadvantaged (Blackaby *et al.*, 1999, Kidd *et al.*, 2000 and Meager *et al.*, 1998). Mental health is more problematical both for gaining entry into the labour market and in obtaining earnings comparable to those of other workers. In contrast, for the non-work-limited disabled, the type of health problem has no significant effect on earnings.

The reasons for the disadvantage faced by those with mental health problems are difficult to determine, but two factors seem likely to be important. The first is that employers may, for various reasons, be more reluctant to hire those with mental

[85] A full set of marginal effects are reported in Appendix Table A3.8.

health problems than with other forms of disability, and, consequently, when this group does find work, it does so at a lower wage. However, discrimination may, in many cases, reflect not prejudice, but rather misconceptions of the nature and consequences of mental health problems. The second is that employers may have a tendency to interpret disability in terms of "physically obvious, or particularly severe, impairments" (Aston *et al.* 2003, p.5), and hence to focus on the physical adaptations to premises required under the DDA, rather than adjustments to working arrangements. This implies that employers may, therefore, inadvertently, not be as accommodating to the needs of those with mental health problems.

As anticipated, the number of health problems has a negative effect on both employment and earnings for the work-limited disabled, consistent with it being a proxy for severity. For this group, each additional health problem reduces the probability of employment by about 6 percent and earnings by 2 percent. This is consistent with Berthoud (2003), who argues that controlling for the severity of a disability is fundamental to understanding labour market outcomes. The effect on the non-work-limited disabled is far less significant, although it is still negative for males on earnings and on both employment and earnings for females at the 10 percent level.

The significance of the within group characteristics has important implications for policymakers and future research. It suggests that policies which aim to improve the labour market outcomes of the disabled may be more effective if they can be differentiated to take into account the different needs of individuals within the disabled group. Future research needs to consider a more comprehensive set of controls including type, severity, cause, age of onset and duration to reduce the problem of omitted variable bias. Moreover, identifying the influence of each of these measures may also provide useful information about the channels of disadvantage faced by the entire disabled group.

3.3.8 Validity of the Assumptions

The DeLeire (2001) decomposition relies on two main assumptions. Firstly, there is no unobservable productivity difference between the non-work-limited disabled and the non-disabled. Secondly, discrimination against the disabled will be equal against the work-limited and non-work-limited disabled.

It is not possible to test the assumptions directly, since productivity and discrimination are not observable. However, the results in Table 3.14 show that the inclusion of a measure of severity of the disability to proxy productivity is strongly significant and negative for the work-limited disabled, but has a far smaller effect on the non-work-limiting disabled. This certainly supports a greater productivity effect for the work-limited disabled than the non-work-limited disabled. Moreover, the descriptive statistics also identify that the work-limited disabled have a higher incidence of multiple health problems, with 36 percent of the work-limited disabled having only one type of health problem compared to 71 percent of the non-work-limited disabled. This confirms that it is the most severely disabled, or those with lowest productivity, that are concentrated amongst the work-limited group.

The second assumption is likely to be more contentious. If the non-work-limited disabled have less obvious health problems and/or the distribution of type of health problems is biased towards those that are likely to face less prejudice, then the second assumption will not hold. Similarly, if discrimination is related to the severity of the disability, then the discriminatory component will not be equal across the two disabled groups.[86] In the most extreme case, employers may not be aware that their employee is disabled with certain types of non-work-limiting disabilities and, as such, there will be no discrimination effect.[87]

In an attempt to consider these issues, Table 3.15 (a) and (b) report the composition of the disabled by the type of main health problem. The distribution of the main health problem differs considerably between the work-limited and non-work-limited disabled as might be expected. For both genders and time periods, the work-limited disabled are more likely to suffer from a health problem that affects limbs (arms, hands, legs, feet, back or neck) or a mental health problem (depression, phobia, learning difficulties). Health problems with hearing and skin, chest and breathing,

[86] Discrimination against the work-limited disabled will be underestimated in this case.
[87] However, individuals are currently requested to supply information about disability status on application forms as part of disability monitoring.

heart, blood, digestion or diabetes are more likely to be reported by the non-work-limited disabled. If health problems are subject to different amounts of prejudice, the discriminatory component cannot be assumed to be constant between the two groups. Since, by assumption, the non-work-limited disabled have no unobserved productivity difference, decompositions between the type of disability within this group provide a test for variations in discrimination alone. The unexplained gap in the employment disability type decompositions are small, with the exception of individuals with mental health problems, who have a lower employment rate relative to all other types of health problem that is not explained by differences in observable characteristics, consistent with variations in discrimination.[88, 89]

Even within types of impairment, if discrimination is positively related to the work-limiting nature of the disability, the second assumption will not hold. The influence of the work-limiting nature on discrimination cannot be isolated in this framework, since it will also influence the unobserved productivity effect.[90] If, as this suggests, discrimination is larger for the work-limited disabled, the DeLeire (2001) estimates will overestimate the influence of unobserved productivity differences by the difference in discrimination between the two groups. In this situation, the measure of discrimination identified must be interpreted as a lower bound[91], but can still be used to contrast with the estimates from the traditional decomposition, which represent an upper bound on discrimination.

In an attempt to shed further light on this issue, the recent module on disability in the 2005 British Social Attitudes Survey (BSA) is used to consider perceptions of prejudice against the disabled.[92] Table 3.16 contains responses from the working age population to the following question: *Generally speaking, do you think there is a lot of prejudice in Britain against disabled people in general, a little, hardly any or*

[88] For example, the unexplained component between problems with limbs and mental health is 0.18 or 73 percent of the overall gap.
[89] Individuals with mental health problems are concentrated in the work-limited group (14 percent) relative to the non-work-limited disabled (3 percent).
[90] For example, the unexplained gap from a decomposition within the work-limited disabled on the grounds of severity would capture any difference in discrimination, but also any difference in productivity.
[91] More specifically, it is the discriminatory component that would exist if the work-limited disabled face the same discrimination as the non-work-limited.
[92] Data are available from the Data Archive.

nonè?. Importantly, the responses are split between definitions of disability that map as closely as possible with DeLeire (2001). Under the assumption that perceptions are, at least in part, formed on the basis of own experience, this information can be used to test the second assumption. As may be anticipated, the disabled report a higher perception of prejudice; however, what is more interesting for the current analysis is that perceptions also differ depending on whether a disability limits activities.[93] Those who are activity-limited disabled report a greater amount of prejudice among the population. This analysis supports the interpretation of the estimates of discrimination as a lower bound.

3.4 Conclusion

Despite the DDA being in place for over 6 years, significant differences in the raw employment rates and average hourly earnings remain between the work-limited disabled and the non-disabled. Indeed, in 2003, the work-limited disabled earn 86 percent of the non-disabled and their probability of employment is only 43 percent of the non-disabled. Moreover, despite significant differences in characteristics, particularly education, the characteristic effect of a decomposition accounts for less than 25 percent of the employment gap and 50 percent of the wage gap. This leaves a significant unexplained gap and, therefore, a potentially important role for labour market discrimination against the disabled.

Quantifying the effect of discrimination against the disabled depends, crucially, on the assumptions made regarding the effect of disability on productivity. In terms of employment, if the unobserved productivity difference between the work-limited disabled and the non-disabled groups is assumed to be zero, eliminating discrimination would increase employment for the work-limited disabled by 37 and 33 percentage points for males and females respectively. However, when the unobserved effect is controlled for, there is no evidence of employment

[93] The non-disabled answer no to the following: *Do you have a long-standing physical or mental health condition or disability? By long-standing, I mean anything that has lasted at least 12 months or that is likely to last at least 12 months?* Whilst the non-activity-limited disabled answer yes to the above but no to the following: *Does this condition or disability have a substantial adverse effect on your ability to carry out normal day-to-day activities?* Being activity-limited is consistent with a positive response to both.

discrimination against the disabled. This has major implications for the design of effective policies to increase the employment rate of the disabled. If unobserved productivity differences are important, policies aimed at eliminating discrimination will not be effective. Instead, policymakers should consider if, and how, the influence of unobservables between the groups can be reduced.

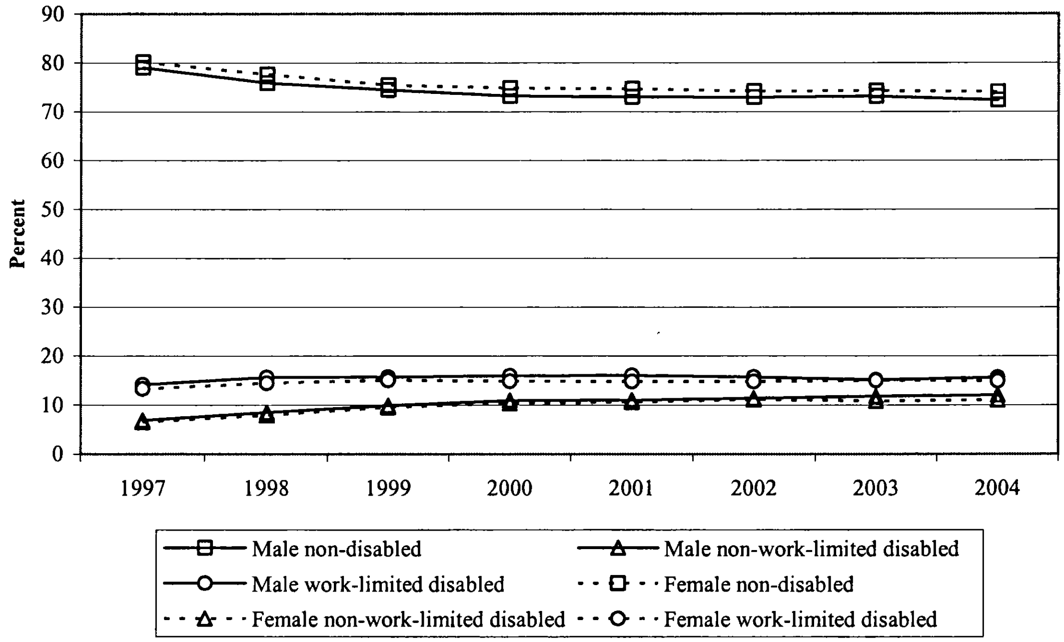
In terms of earnings, the conclusions are similar. Accounting for unobserved differences in productivity reduces the estimate of discrimination from 52 percent to 8 percent for men and 76 percent to 10 percent for women. Thus, even if discrimination was eliminated, the majority of the wage gap will remain, unless unobserved productivity differences are simultaneously reduced. Hence, this analysis illustrates the potential problems created by ignoring the effect of unobservables in a decomposition analysis.

Whenever possible, the analysis considers the validity of the two key assumptions on which the decomposition analysis is based. While there is some support for the first assumption in the data, the second assumption is more difficult to test. However, acknowledging this issue, the estimate of discrimination is interpreted as a lower bound. It is also important to acknowledge that the decomposition has been performed at the mean and, thus, it is the average effect of disability that is identified. The analysis could be naturally extended to identify how the earnings gap differs across the earnings distribution, using quantile regression methods. In a similar manner to the distinction made between 'glass ceilings' and 'sticky floors' in the context of gender, this type of analysis may shed light on the determinants of the discriminatory and unobserved productivity components.

Over time, the gap in employment between the disabled groups has narrowed for both sexes, consistent with a positive effect of the legislation on employment. The reduction in the productivity component of the employment gap is consistent with a positive influence of the workplace accommodation component of the DDA. Moreover, timewise decompositions confirm that the improvement in the disabled employment rate is not explained by changes in the (observable) composition of the group. This evidence, therefore, adds to that of Bell and Heitmueller (2005) in assessing the employment impact of the DDA, although the present evidence is more sanguine concerning the impact of the legislation. In terms of earnings, there is some evidence of an improvement, at least for men. The selectivity corrected earnings gap has fallen for men and there is evidence of a fall in the estimate of wage discrimination for both males and females. Moreover, the improvement in earnings for males is not explained by changes in the characteristics of the disabled, indicating legislation may have helped in this regard. For women, in contrast, not only has the wage gap between the disabled and non-disabled grown, but, also, any improvement in their position in the post-DDA period is the consequence of changes in characteristics, leaving little scope for the role of legislation. It should, however, be acknowledged that this evaluation of the influence of the DDA is restricted by the absence of comparable data pre and post the introduction of the legislation. The comparison made here between 1997 and 2003 will identify an incremental influence of the DDA; however, any immediate impact of the DDA (prior to and during 1997) will not be captured in these estimates.

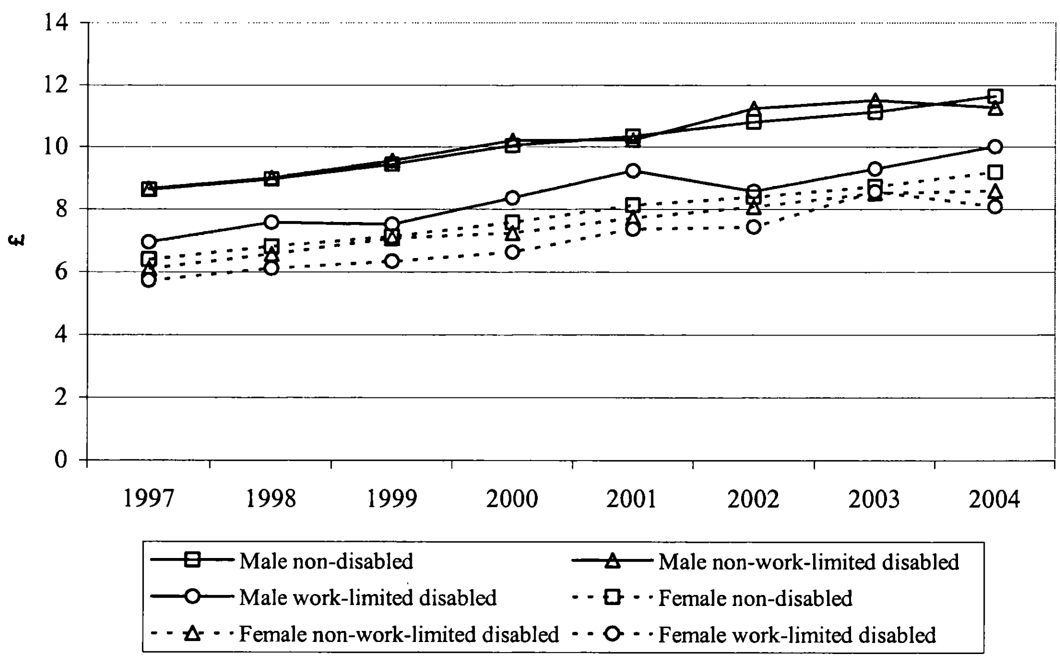
Significant heterogeneity within the disabled group is also identified, with the type and number of health problems having an important influence on employment and earnings. The evidence suggests that those suffering from mental health forms of disability fare particularly badly, and indicates that future efforts may need to be directed towards assisting this particular group. Although the data do not permit investigation of the reasons for the particularly extreme degree of disadvantage faced by this group, part of the answer may reside in improving employers' access to information concerning the various types of mental illness and their implications for work. It may also be helpful to emphasise the reasonable adjustments that can be made for workers with this type of disability; the popular conception of such adjustments is perhaps more with the physical environment.

Figure 3.1. Disability Rates in Great Britain 1997-2004



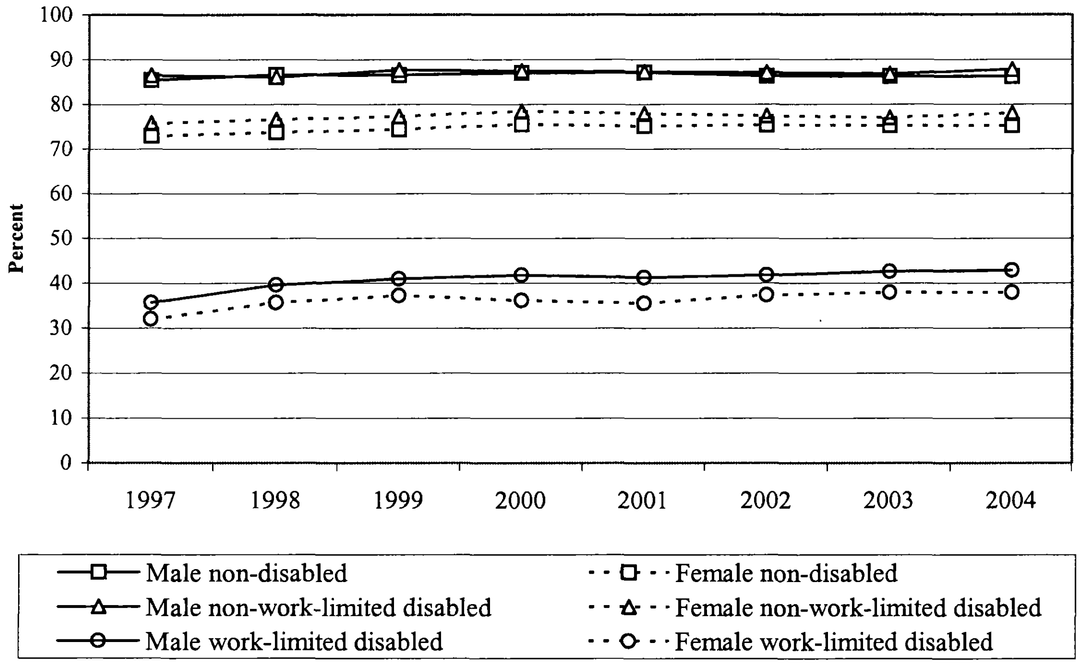
Notes: Based on UK LFS, Summer quarter.

Figure 3.2. Average Hourly Pay in Great Britain 1997-2004



Notes: Based on UK LFS, Summer quarter.

Figure 3.3. Employment Rates in Great Britain 1997-2004



Notes: Based on UK LFS, Summer quarter

Table 3.1. Descriptive Statistics, 2003

	Male			Female		
	Work-limited disabled	Non-work-limited disabled	Non-disabled	Work-limited disabled	Non-work-limited disabled	Non-disabled
% in working age population	16.98	12.08	70.94	15.68	11.35	72.97
Employment (%)	31.39***	80.78***	78.57	31.47***	71.21***	68.72
Unemployment (%)	5.69***	3.78***	4.98	3.31	3.07	3.38
Average hourly earnings	9.70***	11.48	11.63	7.93***	8.57***	8.91

Notes: Sample is restricted to individuals of working age in Great Britain and excludes the self-employed, unpaid family workers and those on government training schemes. ***,** and * denote differences from the relevant non-disabled comparator group at the 1%, 5% and 10% significance level respectively.

Table 3.2. Variable Means

(a) Male variable means

Variable	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	1997	2003	1997	2003	1997	2003
Log hourly pay	1.822	2.109	2.013	2.280	2.001	2.275
Summer	0.247	0.246	0.243	0.260	0.251	0.246
Autumn	0.256	0.250	0.263	0.240	0.248	0.250
Winter	0.256	0.247	0.273	0.250	0.246	0.246
North	0.080	0.079	0.065	0.058	0.055	0.056
Yorkshire&Humberside	0.106	0.100	0.087	0.103	0.089	0.098
East Midlands	0.070	0.075	0.081	0.077	0.071	0.074
East Anglia	0.032	0.033	0.045	0.039	0.040	0.034
South West	0.070	0.080	0.081	0.091	0.082	0.086
West Midlands	0.090	0.093	0.101	0.090	0.098	0.097
North West	0.133	0.122	0.096	0.105	0.104	0.095
Wales	0.074	0.069	0.048	0.047	0.047	0.047
Scotland	0.115	0.102	0.092	0.091	0.099	0.096
Professional	0.083	0.110	0.119	0.131	0.116	0.144
Associate professional	0.086	0.118	0.089	0.133	0.093	0.142
Administrative	0.090	0.064	0.074	0.054	0.076	0.052
Skilled trades	0.181	0.168	0.179	0.154	0.171	0.154
Personal service	0.085	0.034	0.072	0.026	0.072	0.022
Sales & customer services	0.045	0.040	0.054	0.038	0.055	0.046
Process, plant & machine	0.187	0.154	0.159	0.144	0.147	0.122
Elementary	0.107	0.173	0.065	0.123	0.075	0.120
Agriculture & fishing	0.016	0.012	0.012	0.011	0.013	0.010
Energy & Water	0.016	0.020	0.015	0.024	0.020	0.019
Manufacturing	0.295	0.229	0.299	0.252	0.288	0.234
Construction	0.075	0.072	0.082	0.080	0.080	0.087
Distribution	0.178	0.176	0.147	0.151	0.166	0.174
Transport& communication	0.085	0.109	0.088	0.102	0.093	0.099
Banking & finance	0.110	0.129	0.126	0.140	0.139	0.153
Public administration	0.180	0.196	0.184	0.192	0.159	0.182
Days illness	0.579	0.200	0.180	0.081	0.122	0.057
Married	0.619	0.561	0.642	0.643	0.563	0.519
Experience	30.932	30.794	25.351	27.360	19.523	19.307
Age	46.840	47.088	42.213	44.589	36.802	37.030
Degree	0.056	0.077	0.136	0.175	0.162	0.204
Other higher education	0.048	0.057	0.081	0.095	0.084	0.084
A level	0.277	0.263	0.314	0.324	0.297	0.288
O level	0.109	0.132	0.174	0.161	0.196	0.195
Other	0.169	0.161	0.157	0.131	0.140	0.124
Small firm	0.261	0.264	0.218	0.235	0.231	0.236
Part-time	0.123	0.128	0.068	0.073	0.068	0.079
White	0.945	0.929	0.960	0.952	0.939	0.917
Tenure	9.143	8.915	9.958	10.249	8.336	8.087
Public sector	0.218	0.205	0.223	0.216	0.198	0.199
Employment	0.267	0.310	0.812	0.807	0.794	0.783
Dependent children	0.465	0.442	0.545	0.504	0.647	0.616

Hourly pay	7.468	9.704	8.971	11.512	8.861	11.653
Overtime	4.179	3.633	4.934	4.305	4.828	4.092
Social housing	0.349	0.331	0.140	0.109	0.135	0.108
Home owned	0.226	0.248	0.181	0.233	0.137	0.163
Home mortgaged	0.348	0.334	0.599	0.579	0.622	0.614
Other earner	0.412	0.416	0.643	0.636	0.665	0.675
Limbs		0.382		0.194		
Sight/hearing		0.038		0.058		
Skin, breathing and organs		0.314		0.633		
Other		0.125		0.084		
Number of health problems		2.669		1.424		

(b) Female variable means

Variable	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	1997	2003	1997	2003	1997	2003
Log hourly pay	1.588	1.913	1.707	2.014	1.720	2.033
Summer	0.250	0.256	0.262	0.249	0.251	0.250
Autumn	0.257	0.259	0.262	0.245	0.248	0.246
Winter	0.254	0.241	0.259	0.255	0.247	0.246
North	0.071	0.073	0.061	0.058	0.056	0.057
Yorkshire&Humberside	0.097	0.100	0.097	0.106	0.089	0.097
East Midlands	0.065	0.075	0.077	0.074	0.071	0.073
East Anglia	0.034	0.031	0.041	0.032	0.038	0.035
South West	0.069	0.082	0.089	0.092	0.082	0.085
West Midlands	0.099	0.102	0.089	0.086	0.095	0.092
North West	0.130	0.110	0.093	0.099	0.105	0.100
Wales	0.074	0.068	0.049	0.047	0.050	0.048
Scotland	0.110	0.099	0.083	0.094	0.099	0.096
Professional	0.079	0.081	0.095	0.101	0.097	0.117
Associate professional	0.089	0.131	0.114	0.137	0.113	0.147
Administrative	0.242	0.212	0.255	0.246	0.263	0.230
Skilled trades	0.029	0.019	0.024	0.019	0.022	0.016
Personal service	0.162	0.146	0.168	0.131	0.159	0.129
Sales & customer services	0.126	0.137	0.109	0.122	0.120	0.123
Process, plant & machine	0.058	0.037	0.051	0.026	0.041	0.024
Elementary	0.131	0.158	0.091	0.119	0.081	0.115
Agriculture & fishing	0.007	0.003	0.006	0.003	0.006	0.003
Energy & Water	0.004	0.004	0.003	0.005	0.005	0.005
Manufacturing	0.120	0.077	0.117	0.073	0.117	0.082
Construction	0.013	0.012	0.011	0.017	0.013	0.015
Distribution	0.241	0.240	0.213	0.208	0.232	0.221
Transport& communication	0.032	0.031	0.028	0.039	0.036	0.037
Banking & finance	0.125	0.122	0.141	0.141	0.145	0.146
Public administration	0.401	0.453	0.426	0.469	0.390	0.436
Days illness	0.718	0.207	0.263	0.092	0.174	0.071
Married	0.593	0.557	0.596	0.599	0.599	0.551
Experience	27.362	27.279	22.666	24.039	18.903	18.911
Age	43.337	43.641	39.428	41.151	36.027	36.471
Degree	0.041	0.068	0.091	0.130	0.114	0.162
Other higher education	0.068	0.079	0.107	0.106	0.095	0.097
A level	0.109	0.128	0.140	0.174	0.160	0.184
O level	0.195	0.220	0.274	0.271	0.292	0.281
Other	0.168	0.158	0.172	0.154	0.153	0.133
Small firm	0.356	0.319	0.299	0.295	0.308	0.289
Part-time	0.503	0.518	0.399	0.409	0.440	0.432
White	0.934	0.915	0.944	0.943	0.935	0.909
Tenure	6.924	7.089	7.493	8.043	6.253	6.600
Public sector	0.351	0.371	0.386	0.389	0.345	0.370
Employment	0.274	0.312	0.724	0.709	0.679	0.685
Dependent children	0.610	0.645	0.689	0.703	0.872	0.880
Hourly pay	5.799	7.934	6.429	8.567	6.569	8.910
Overtime	2.468	2.044	2.684	2.403	2.444	2.261

Social housing	0.360	0.342	0.198	0.170	0.168	0.147
Home owned	0.175	0.198	0.148	0.199	0.131	0.150
Home mortgaged	0.391	0.377	0.562	0.545	0.598	0.595
Other earner	0.506	0.510	0.681	0.682	0.725	0.722
Limbs		0.401		0.181		
Sight/hearing		0.035		0.032		
Skin, breathing and organs		0.252		0.565		
Other		0.156		0.184		
Number of health problems		2.681		1.473		

Notes: In all cases figures relate to the estimation samples used.

Table 3.3. Male Heckman Corrected Earnings Equations, 2003

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Earnings	Employ	Earnings	Employ	Earnings	Employ
Constant	1.833***	-3.372***	1.912***	-4.834***	1.879***	-5.068***
	(14.55)	(16.56)	(23.76)	(18.82)	(51.58)	(51.73)
Summer	0.008	0.109**	0.014	-0.023	0.001	0.034
	(0.33)	(2.29)	(0.81)	(0.35)	(0.09)	(1.22)
Autumn	-0.009	-0.001	0.018	0.015	0.010	-0.010
	(0.37)	(0.03)	(0.99)	(0.22)	(1.27)	(0.37)
Winter	0.025	0.119**	0.036**	0.033	0.014*	0.009
	(1.02)	(2.52)	(2.04)	(0.49)	(1.86)	(0.33)
North	-0.163***	-0.278***	-0.151***	-0.267**	-0.207***	-0.131***
	(4.21)	(3.96)	(5.11)	(2.50)	(16.04)	(2.98)
Yorkshire &	-0.156***	-0.124**	-0.157***	0.016	-0.194***	0.030
Humberside	(4.81)	(2.00)	(6.94)	(0.17)	(19.30)	(0.83)
East Midlands	-0.096***	-0.095	-0.144***	0.079	-0.187***	0.046
	(2.66)	(1.37)	(5.70)	(0.77)	(16.72)	(1.11)
East Anglia	0.024	-0.107	-0.167***	0.069	-0.159***	-0.020
	(0.49)	(1.11)	(5.00)	(0.51)	(10.16)	(0.35)
South West	-0.087***	0.103	-0.109***	0.048	-0.163***	0.129***
	(2.75)	(1.57)	(4.56)	(0.52)	(15.76)	(3.26)
West Midlands	-0.076**	-0.080	-0.126***	-0.104	-0.157***	0.114***
	(2.27)	(1.25)	(5.22)	(1.16)	(15.56)	(3.08)
North West	-0.110***	-0.230***	-0.123***	-0.260***	-0.187***	-0.081**
	(3.33)	(3.82)	(5.20)	(3.12)	(18.16)	(2.26)
Wales	-0.120***	-0.458***	-0.158***	-0.129	-0.198***	-0.130***
	(2.58)	(5.99)	(4.92)	(1.11)	(14.19)	(2.72)
Scotland	-0.073**	-0.219***	-0.138***	-0.120	-0.177***	-0.007
	(2.11)	(3.42)	(5.65)	(1.33)	(17.26)	(0.19)
Professional	0.001		-0.076***		-0.051***	
	(0.02)		(3.16)		(5.05)	
Associate	-0.173***		-0.159***		-0.154***	
professional	(4.90)		(6.82)		(15.42)	
Administrative	-0.358***		-0.371***		-0.382***	
	(8.25)		(11.71)		(27.46)	
Skilled trades	-0.375***		-0.379***		-0.392***	
	(11.12)		(16.38)		(38.84)	
Personal service	-0.405***		-0.533***		-0.468***	
	(7.24)		(11.99)		(22.97)	
Sales & customer	-0.526***		-0.463***		-0.437***	
services	(10.19)		(12.10)		(28.14)	
Process, plant &	-0.517***		-0.496***		-0.473***	
machine	(14.91)		(20.32)		(42.46)	
Elementary	-0.582***		-0.579***		-0.526***	
	(16.73)		(22.32)		(45.97)	
Agriculture &	0.071		-0.168**		-0.053*	
fishing	(0.80)		(2.43)		(1.74)	
Energy & water	0.320***		0.210***		0.197***	
	(4.42)		(4.05)		(8.14)	
Manufacturing	0.225***		0.085**		0.098***	
	(5.19)		(2.52)		(6.40)	
Construction	0.280***		0.123***		0.157***	

	(5.58)		(3.25)		(9.33)	
Distribution	0.148***		-0.039		-0.016	
	(3.38)		(1.13)		(1.06)	
Transport &	0.242***		0.106***		0.100***	
communication	(5.22)		(2.93)		(6.12)	
Banking &	0.313***		0.182***		0.212***	
finance	(6.94)		(5.23)		(13.63)	
Public admin	0.121***		0.032		0.070***	
	(2.66)		(0.93)		(4.36)	
Days illness	-0.023**		-0.008		-0.025***	
	(2.38)		(0.64)		(4.02)	
Married	0.037	0.212***	0.082***	0.176***	0.070***	0.201***
	(1.50)	(4.83)	(4.91)	(2.63)	(10.11)	(7.02)
Experience	0.017***		0.027***		0.032***	
	(5.02)		(8.58)		(22.93)	
Experience	-0.031***		-0.049***		-0.060***	
squared/100	(4.23)		(7.98)		(20.18)	
Degree	0.343***	0.946***	0.374***	0.170*	0.399***	0.433***
	(6.61)	(14.09)	(12.11)	(1.89)	(27.63)	(11.68)
Other higher	0.200***	0.860***	0.166***	0.013	0.203***	0.452***
education	(3.89)	(11.49)	(5.20)	(0.13)	(13.44)	(9.58)
A level	0.138***	0.587***	0.094***	0.323***	0.135***	0.437***
	(3.57)	(12.32)	(3.68)	(4.22)	(10.77)	(13.19)
O level	0.120***	0.620***	0.039	0.218**	0.066***	0.481***
	(2.88)	(10.96)	(1.42)	(2.49)	(5.10)	(13.66)
Other	0.103***	0.421***	0.020	0.310***	0.069***	0.434***
	(2.70)	(7.77)	(0.70)	(3.39)	(5.11)	(11.27)
Small firm	-0.120***		-0.113***		-0.144***	
	(5.78)		(7.27)		(21.13)	
Part-time	-0.144***		-0.057**		-0.049***	
	(4.99)		(2.09)		(4.19)	
White	0.016	0.388***	0.034	0.602***	0.073***	0.578***
	(0.36)	(5.52)	(0.96)	(5.96)	(5.60)	(17.36)
Tenure	0.012***		0.011***		0.011***	
	(4.13)		(5.53)		(10.96)	
Tenure	-0.016*		-0.013**		-0.015***	
squared/100	(1.87)		(2.14)		(5.03)	
Public sector	0.062*		-0.006		-0.019*	
	(1.84)		(0.25)		(1.68)	
Overtime	0.003**		0.006***		0.005***	
	(1.98)		(5.60)		(10.10)	
Social housing	-0.088**	-0.509***	-0.034	-0.323***	-0.074***	-0.349***
	(1.96)	(7.89)	(1.00)	(3.19)	(5.09)	(9.32)
Home owned	0.042	0.028	0.052*	-0.305***	0.017	-0.104***
	(1.16)	(0.43)	(1.74)	(3.23)	(1.43)	(2.88)
Home mortgaged	0.084**	0.360***	0.090***	0.328***	0.061***	0.383***
	(2.32)	(5.81)	(3.46)	(3.71)	(6.18)	(12.46)
Age		0.118***		0.252***		0.256***
		(12.75)		(20.62)		(51.06)
Age squared/100		-0.160***		-0.299***		-0.314***
		(14.64)		(20.19)		(49.11)
Dependent		0.017		-0.024		-0.034**
children		(0.84)		(0.67)		(2.53)
Other earner		0.462***		0.500***		0.345***
		(12.40)		(9.44)		(15.47)

Lambda	0.010 (0.18)		0.041 (0.74)		0.029 (1.16)	
Observations	2409	7780	3899	4834	21389	27302
F test	41.47		88.04		533.57	
(p-value)	(0.00)		(0.00)		(0.00)	
Adj R^2	0.447		0.517		0.545	
Log Likelihood		-3685.03		-1761.43		-10410.35
LR χ^2 (k)		2258.67		1225.54		7712.18
(p-value)		(0.00)		(0.00)		(0.00)
Pseudo R^2		0.235		0.258		0.270

Notes: Z statistics reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The χ^2 statistic is a test that all slope coefficients are zero in the probit model. The F statistic performs the same test on the earnings equation. Pseudo-R^2 is McFadden's measure, defined as 1 minus the ratio of the maximised log-likelihood from the regression to that from a regression including the optimal constant only (Maddala, 1983).

Table 3.4. Female Heckman Corrected Earnings Equations, 2003

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Earnings	Employ	Earnings	Employ	Earnings	Employ
Constant	1.464***	-3.208***	2.029***	-4.819***	2.007***	-4.814***
	(12.59)	(14.80)	(27.37)	(18.86)	(68.85)	(50.61)
Summer	0.037*	-0.003	0.031*	-0.024	0.010	-0.035
	(1.66)	(0.06)	(1.94)	(0.43)	(1.38)	(1.58)
Autumn	0.025	-0.015	0.045***	0.000	0.026***	-0.033
	(1.12)	(0.32)	(2.76)	(0.00)	(3.75)	(1.47)
Winter	0.059***	-0.009	0.048***	-0.030	0.036***	-0.051**
	(2.62)	(0.20)	(2.97)	(0.53)	(5.12)	(2.29)
North	-0.174***	-0.138**	-0.140***	-0.018	-0.164***	0.093**
	(4.86)	(1.98)	(5.30)	(0.20)	(14.41)	(2.56)
Yorkshire& Humberside	-0.155***	-0.075	-0.115***	0.114	-0.162***	0.136***
	(5.33)	(1.25)	(5.65)	(1.60)	(17.60)	(4.65)
East Midlands	-0.150***	-0.052	-0.125***	-0.001	-0.152***	0.179***
	(4.78)	(0.77)	(5.26)	(0.01)	(15.01)	(5.43)
East Anglia	-0.034	-0.176*	-0.094***	0.212*	-0.121***	0.037
	(0.72)	(1.83)	(2.88)	(1.76)	(8.67)	(0.86)
South West	-0.122***	0.003	-0.094***	0.105	-0.140***	0.164***
	(4.29)	(0.04)	(4.41)	(1.37)	(14.82)	(5.28)
West Midlands	-0.126***	-0.079	-0.103***	0.073	-0.154***	0.135***
	(4.29)	(1.31)	(4.65)	(0.96)	(16.40)	(4.55)
North West	-0.146***	-0.217***	-0.123***	0.138*	-0.135***	0.081***
	(4.81)	(3.63)	(5.92)	(1.88)	(14.69)	(2.80)
Wales	-0.162***	-0.261***	-0.117***	0.055	-0.156***	0.123***
	(4.23)	(3.63)	(4.09)	(0.55)	(12.75)	(3.15)
Scotland	-0.162***	-0.225***	-0.106***	0.023	-0.139***	0.178***
	(5.04)	(3.61)	(4.96)	(0.31)	(15.22)	(5.92)
Professional	0.073*		0.094***		0.059***	
	(1.75)		(3.35)		(5.09)	
Associate professional	-0.067*		-0.072***		-0.117***	
	(1.84)		(2.90)		(11.05)	
Administrative	-0.279***		-0.251***		-0.322***	
	(8.27)		(11.02)		(32.32)	
Skilled trades	-0.343***		-0.426***		-0.489***	
	(5.34)		(9.16)		(22.54)	
Personal service	-0.385***		-0.427***		-0.477***	
	(10.41)		(16.02)		(40.80)	
Sales & customer services	-0.365***		-0.350***		-0.458***	
	(9.57)		(12.82)		(38.13)	
Process, plant & machine	-0.454***		-0.413***		-0.558***	
	(8.23)		(9.27)		(28.66)	
Elementary	-0.460***		-0.469***		-0.539***	
	(12.26)		(17.00)		(44.45)	
Agriculture & fishing	0.156		-0.041		0.037	
	(1.06)		(0.39)		(0.84)	
Energy & water	0.117		0.256***		0.233***	
	(0.93)		(3.07)		(6.29)	
Manufacturing	0.142***		0.072*		0.153***	
	(3.00)		(1.96)		(10.30)	

Construction	0.326*** (4.15)		0.114** (2.21)		0.147*** (6.33)	
Distribution	0.011 (0.28)		-0.097*** (3.09)		-0.010 (0.77)	
Transport & communication	0.180*** (3.30)		0.173*** (4.33)		0.170*** (10.10)	
Banking & finance	0.206*** (5.10)		0.142*** (4.52)		0.204*** (15.82)	
Public admin	0.054 (1.46)		0.013 (0.46)		0.047*** (3.92)	
Days illness	-0.035*** (3.93)		-0.012 (1.18)		-0.005 (1.03)	
Married	-0.004 (0.20)	-0.113*** (2.84)	0.001 (0.04)	-0.235*** (4.43)	0.005 (0.79)	-0.235*** (10.86)
Experience	0.018*** (6.47)		0.019*** (8.27)		0.018*** (20.19)	
Experience squared/100	-0.039*** (6.44)		-0.037*** (8.19)		-0.039*** (19.43)	
Degree	0.483*** (9.25)	1.030*** (15.27)	0.338*** (10.83)	0.722*** (9.19)	0.327*** (24.06)	0.720*** (23.41)
Other higher education	0.310*** (6.44)	0.960*** (15.33)	0.210*** (7.20)	0.739*** (9.12)	0.184*** (13.74)	0.842*** (23.91)
A level	0.207*** (4.99)	0.763*** (14.10)	0.047* (1.83)	0.638*** (9.17)	0.094*** (8.23)	0.544*** (19.24)
O level	0.171*** (4.62)	0.664*** (14.02)	0.042* (1.77)	0.640*** (10.25)	0.034*** (3.20)	0.561*** (21.72)
Other	0.137*** (3.78)	0.538*** (10.38)	0.017 (0.73)	0.422*** (6.24)	0.030*** (2.65)	0.402*** (13.69)
Small firm	-0.061*** (3.41)		-0.084*** (6.33)		-0.082*** (14.09)	
Part-time	-0.036** (2.05)		-0.064*** (4.77)		-0.025*** (4.29)	
White	0.064 (1.52)	0.498*** (7.32)	-0.093*** (2.88)	0.530*** (6.40)	-0.007 (0.60)	0.515*** (18.49)
Tenure	0.014*** (4.52)		0.012*** (5.68)		0.016*** (15.24)	
Tenure squared/100	-0.012 (1.07)		-0.017** (2.23)		-0.025*** (6.54)	
Public sector	0.103*** (4.32)		0.045** (2.52)		0.047*** (5.93)	
Overtime	0.003 (1.31)		0.005*** (3.80)		0.005*** (7.75)	
Social housing	-0.044 (1.08)	-0.441*** (6.92)	-0.032 (1.16)	-0.096 (1.20)	-0.028** (2.31)	-0.141*** (4.52)
Home owned	0.065* (1.90)	0.023 (0.34)	0.022 (0.84)	-0.077 (0.93)	-0.004 (0.33)	-0.032 (0.99)
Home mortgaged	0.110*** (3.45)	0.319*** (5.24)	0.020 (0.85)	0.444*** (6.09)	0.009 (0.98)	0.405*** (15.36)
Age		0.108*** (10.21)		0.227*** (17.26)		0.233*** (44.42)
Age squared/100		-0.146*** (10.95)		-0.270*** (15.95)		-0.281*** (40.10)
Dependent children		-0.164*** (8.41)		-0.370*** (15.39)		-0.377*** (41.03)
Other earner		0.425***		0.363***		0.292***

		(11.14)		(7.52)		(14.55)
Lambda	0.156***		-0.022		-0.058***	
	(3.00)		(0.57)		(3.83)	
Observations	2478	7938	3764	5309	22627	33023
F test	45.52		86.68		533.63	
(p-value)	(0.00)		(0.00)		(0.000	
Adj R^2	0.446		0.522		0.531	
Log Likelihood		-3983.83		-2635.48		-16575.36
LR χ^2 (k)		1888.56		1132.30		7989.08
(p-value)		(0.00)		(0.00)		(0.00)
Pseudo R^2		0.192		0.177		0.194

Notes: See notes to Table 3.3.

Table 3.5. Decomposition of Employment Probabilities by Disability Status

	1997		2003	
	Work-limited	Non-work-limited	Work-limited	Non-work-limited
Males				
Predicted difference	0.527	-0.018	0.473	-0.023
Difference due to characteristics	0.127 (24%)	0.010 (-53%)	0.101 (21%)	-0.003 (12%)
Difference in parameters	0.400 (76%)	-0.028 (153%)	0.372 (79%)	-0.020 (88%)
Females				
Predicted difference	0.404	-0.044	0.372	-0.024
Difference due to characteristics	0.063 (16%)	-0.001 (2%)	0.046 (12%)	-0.020 (83%)
Difference in parameters	0.341 (84%)	-0.044 (98%)	0.326 (88%)	-0.004 (17%)

Notes: Predicted difference calculated using equation (3.9). Difference in characteristics and parameters given by equations (3.10) and (3.11) respectively. The non-discriminatory structure is formed by pooling the non-work-limited disabled and the non-disabled ($\hat{\alpha}^{P2}$).

Table 3.6. DeLeire (2001) Decomposition of Employment Probabilities

	1997	2003	Change
Males			
Predicted difference	0.527	0.473	-0.054
Difference due to observable characteristics	0.127 (24%)	0.101 (21%)	-0.026
Difference due to unobservable health characteristics	0.427 (81%)	0.392 (83%)	-0.035
Discrimination	-0.028 (-5%)	-0.020 (-4%)	0.008
Females			
Predicted difference	0.404	0.372	-0.032
Difference due to observable characteristics	0.062 (16%)	0.046 (12%)	-0.017
Difference due to unobservable health characteristics	0.385 (95%)	0.331 (88%)	-0.054
Discrimination	-0.044 (-11%)	-0.004 (-1%)	0.039

Notes: Figures relate to the difference between the work-limited disabled and the non-disabled. Predicted difference calculated using equation (3.9). Difference in characteristics given by equation (3.10). Discrimination is given by $(\hat{P}_N - \hat{P}_{D_2})_{\text{unexp}}$. Unobserved productivity difference is given by $(\hat{P}_N - \hat{P}_{D_1})_{\text{unexp}}$ - $(\hat{P}_N - \hat{P}_{D_2})_{\text{unexp}}$. The non-discriminatory structure is formed by pooling the non-work-limited disabled and the non-disabled ($\hat{\alpha}^{P2}$).

Table 3.7. Gender Decompositions of Employment Probabilities

	1997	2003
Work-limited		
Predicted difference	-0.007	-0.002
Difference due to characteristics	-0.036 (542%)	-0.038 (2305%)
Difference in parameters	0.029 (-442%)	0.037 (-2205%)
Non-work-limited		
Predicted difference	0.090	0.098
Difference due to characteristics	0.010 (11%)	0.005 (5%)
Difference in parameters	0.080 (89%)	0.093 (95%)
Non-disabled		
Predicted difference	0.116	0.099
Difference due to characteristics	0.008 (7%)	0.008 (8%)
Difference in parameters	0.108 (93%)	0.090 (92%)

Notes: Predicted difference calculated using equation (3.12). Difference in characteristics and parameters given by equations (3.13) and (3.14) respectively. The non-discriminatory structure is formed by pooling across genders.

Table 3.8. Timewise Decompositions of Employment Probabilities

	Male	Female
Work-limited		
Predicted difference	0.043	0.038
Difference due to characteristics	0.008 (18%)	0.017 (45%)
Difference in parameters	0.036 (82%)	0.021 (55%)
Non-work-limited		
Predicted difference	-0.006	-0.014
Difference due to characteristics	-0.005 (72%)	0.016 (-109%)
Difference in parameters	-0.002 (27%)	-0.030 (209%)
Non-disabled		
Predicted difference	-0.011	0.006
Difference due to characteristics	-0.007 (67%)	0.006 (89%)
Difference in parameters	-0.004 (32%)	0.001 (10%)

Notes: Predicted difference calculated using equation (3.15). Differences in characteristics and parameters given by equations (3.16) and (3.17) respectively. The non-discriminatory structure is formed by pooling across time periods.

Table 3.9. Earnings Decompositions by Disability Status

	1997		2003	
	Work-limited	Non-work-limited	Work-limited	Non-work-limited
Males				
Predicted difference	0.278	0.048	0.166	-0.003
Difference due to characteristics	0.095 (34%)	-0.011 (-23%)	0.080 (48%)	-0.017 (591%)
Difference in parameters	0.184 (66%)	0.059 (123%)	0.086 (52%)	0.014 (-491%)
Females				
Predicted difference	0.155	0.036	0.286	0.035
Difference due to characteristics	0.068 (44%)	0.003 (8%)	0.069 (24%)	0.007 (20%)
Difference in parameters	0.087 (56%)	0.033 (92%)	0.216 (76%)	0.028 (80%)

Notes: Figures relate to decomposition of selectivity corrected offer wage in equation (3.8). The non-discriminatory structure is formed by pooling the non-work-limited disabled and the non-disabled $(\hat{B}^O_{P2})$.

Table 3.10. DeLeire (2001) Earnings Decompositions

	1997	2003	Change
Males			
Predicted difference	0.278	0.166	-0.112
Difference due to observable characteristics	0.095 (34%)	0.080 (48%)	-0.015
Difference due to unobservable health characteristics	0.124 (45%)	0.073 (44%)	-0.052
Discrimination	0.059 (21%)	0.014 (8%)	-0.045
Females			
Predicted difference	0.155	0.286	0.130
Difference due to observable characteristics	0.068 (44%)	0.069 (24%)	0.001
Difference due to unobservable health characteristics	0.054 (35%)	0.189 (66%)	0.135
Discrimination	0.033 (21%)	0.028 (10%)	-0.006

Notes: Figures relate to the difference between the work-limited disabled and non-disabled. The contribution of observable characteristics is given by $(\overline{X_N}-\overline{X_{D_2}})\hat{B}^O_{P2}$. Discrimination is given by $[\overline{X_N}(\hat{\beta}^O_N-\hat{\beta}^O_{P2})+\overline{X_{D_2}}(\hat{B}^O_{P2}-\hat{\beta}^O_{D_2})]$ and the difference due to the unobservable effect of health on productivity is given by $[\overline{X_N}(\hat{\beta}^O_N-\hat{\beta}^O_{P2})+\overline{X_{D_1}}(\hat{B}^O_{P2}-\hat{\beta}^O_{D_1})]-[\overline{X_N}(\hat{\beta}^O_N-\hat{\beta}^O_{P2})+\overline{X_{D_2}}(\hat{B}^O_{P2}-\hat{\beta}^O_{D_2})]$.

Table 3.11. Gender Earnings Decompositions

	1997	2003
Work-limited		
Predicted difference	0.133	0.329
Difference due to characteristics	0.159 (119.7%)	0.137 (41.6%)
Difference in parameters	-0.026 (-19.7%)	0.192 (58.4%)
Non-work-limited		
Predicted difference	0.243	0.247
Difference due to characteristics	0.188 (77.1%)	0.178 (71.7%)
Difference in parameters	0.056 (22.9%)	0.070 (28.3%)
Non-disabled		
Predicted difference	0.256	0.210
Difference due to characteristics	0.168 (65.9%)	0.155 (73.9%)
Difference in parameters	0.087 (34.1%)	0.055 (26.1%)

Notes: The non-discriminatory structure is formed by pooling across genders.

Table 3.12. Timewise Earnings Decompositions

	Male	Female
Work-limited		
Predicted difference	0.244	0.047
Difference due to characteristics	0.044 (18.1%)	0.061 (129.2%)
Difference in parameters	0.200 (81.9%)	-0.014 (-29.2%)
Non-work-limited		
Predicted difference	0.183	0.179
Difference due to characteristics	0.041 (22.4%)	0.047 (26.2%)
Difference in parameters	0.142 (77.6%)	0.132 (73.8%)
Non-disabled		
Predicted difference	0.132	0.177
Difference due to characteristics	0.031 (23.3%)	0.046 (26.2%)
Difference in parameters	0.101 (76.7%)	0.131 (73.8%)

Notes: The non-discriminatory structure is formed by pooling across time periods.

Table 3.13. Employment Effects of the Unexplained Earnings Gap

	Baldwin and Johnson (1992)		Modification of Baldwin and Johnson (1992)			
X_{ij}	Unrestricted		Unrestricted		Restricted	
Identification	Experience assumed to identify		Over-identified		Over-identified[94]	
	Male	Female	Male	Female	Male	Female
Work-limited disabled						
$\hat{P}_{D_1}$	0.259	0.268	0.259	0.268	0.260	0.269
$\hat{P}_{D_1}*$	0.310	-[a]	0.302	0.346	0.296	0.278
$\hat{P}_{D_1}*_{\text{discrimination}}$	0.265	-[a]	0.265	0.275	0.263	0.269
$\hat{P}_{D_1}*_{\text{unobserved productivity}}$	0.303	-[a]	0.309	0.338	0.293	0.278
$\hat{W}^O_{D_1}$	2.101	1.771	2.101	1.771	2.105	1.804
$\hat{W}^O_{D_1}*$	2.184	1.982	2.184	1.982	2.224	2.076
$\hat{W}^O_{D_1}*_{\text{discrimination}}$	2.112	1.793	2.112	1.793	2.117	1.819
$\hat{W}^O_{D_1}*_{\text{unobserved productivity}}$	2.173	1.960	2.173	1.960	2.212	2.061
Non-work-limited disabled						
$\hat{P}_{D_2}$	0.871	0.741	0.871	0.741	0.871	0.741
$\hat{P}_{D_2}*$	0.871	0.745	0.875	0.753	0.874	0.749
$\hat{W}^O_{D_2}$	2.270	2.022	2.270	2.022	2.262	2.075
$\hat{W}^O_{D_2}*$	2.280	2.044	2.280	2.044	2.274	2.093
Non-disabled						
$\hat{P}_N$	0.846	0.716	0.846	0.716	0.847	0.718
$\hat{P}_N*$	0.846	0.716	0.845	0.713	0.846	0.716
$\hat{W}^O_N$	2.267	2.057	2.267	2.057	2.261	2.114
$\hat{W}^O_N*$	2.264	2.051	2.264	2.051	2.259	2.109

Notes: Data relate to 2003. The employment effects are calculated using equation (3.28). In column 1 and 2 σ_{uj} is estimated following Baldwin and Johnson (1992). In columns 3 and 4, σ_{uj} is estimated using equations (3.34), (3.35) and (3.36). In columns 5 and 6 the sensitivity of the estimates are tested to excluding employment related variables from X_{ij}. [a] Result is not reported since the estimate of σ_{uj} is negative due to a negative coefficient on experience in the hours of work equation.

[94] Experience and experience squared are assumed to affect the offer but not the reservation wage. Their inclusion in the probit model changes the overall specification slightly.

Table 3.14. Within Group Heterogeneity Heckman Corrected Earnings Equations, 2003

	Male				Female			
	Work-limited disabled		Non-work-limited disabled		Work-limited disabled		Non-work-limited disabled	
	Earnings	Employ	Earnings	Employ	Earnings	Employ	Earnings	Employ
Constant	1.672***	-3.681***	1.959***	-5.245***	1.495***	-3.616***	2.032***	-5.167***
	(11.77)	(16.92)	(20.14)	(18.54)	(12.40)	(15.82)	(23.31)	(18.55)
Summer	0.014	0.128***	0.013	-0.024	0.038*	-0.015	0.032**	-0.020
	(0.57)	(2.60)	(0.75)	(0.35)	(1.71)	(0.31)	(1.96)	(0.35)
Autumn	-0.009	-0.012	0.019	0.019	0.025	-0.008	0.044***	0.006
	(0.35)	(0.24)	(1.05)	(0.28)	(1.15)	(0.18)	(2.73)	(0.10)
Winter	0.028	0.103**	0.037**	0.037	0.058***	-0.009	0.051***	-0.029
	(1.14)	(2.10)	(2.09)	(0.55)	(2.58)	(0.19)	(3.15)	(0.51)
North	-0.171***	-0.235***	-0.150***	-0.286***	-0.166***	-0.085	-0.140***	-0.017
	(4.39)	(3.20)	(5.06)	(2.66)	(4.69)	(1.18)	(5.31)	(0.19)
Yorkshire & Humberside	-0.157***	-0.075	-0.156***	0.013	-0.147***	-0.029	-0.115***	0.118
	(4.86)	(1.16)	(6.87)	(0.14)	(5.11)	(0.47)	(5.64)	(1.64)
East Midlands	-0.100***	-0.054	-0.138***	0.075	-0.145***	-0.013	-0.123***	0.009
	(2.78)	(0.75)	(5.48)	(0.73)	(4.64)	(0.19)	(5.16)	(0.11)
East Anglia	0.010	-0.200**	-0.169***	0.059	-0.043	-0.235**	-0.093***	0.225*
	(0.20)	(2.01)	(5.05)	(0.44)	(0.91)	(2.37)	(2.85)	(1.86)
South West	-0.082***	0.158**	-0.112***	0.038	-0.112***	0.046	-0.097***	0.113
	(2.60)	(2.28)	(4.72)	(0.41)	(3.93)	(0.72)	(4.54)	(1.47)
West Midlands	-0.079**	-0.073	-0.125***	-0.106	-0.125***	-0.067	-0.103***	0.080
	(2.36)	(1.09)	(5.17)	(1.17)	(4.29)	(1.09)	(4.61)	(1.05)
North West	-0.122***	-0.259***	-0.123***	-0.253***	-0.147***	-0.227***	-0.124***	0.136*
	(3.65)	(4.15)	(5.20)	(3.03)	(4.89)	(3.67)	(5.93)	(1.85)
Wales	-0.132***	-0.397***	-0.154***	-0.113	-0.150***	-0.206***	-0.116***	0.055
	(2.86)	(4.92)	(4.81)	(0.96)	(4.00)	(2.77)	(4.08)	(0.55)
Scotland	-0.077**	-0.156**	-0.134***	-0.124	-0.150***	-0.140**	-0.105***	0.027
	(2.28)	(2.33)	(5.48)	(1.37)	(4.77)	(2.16)	(4.89)	(0.36)
Professional	-0.005		-0.079***		0.065		0.095***	

	(0.12)		(3.33)		(1.55)		(3.37)	
Associate professional	-0.170***		-0.158***		-0.070*		-0.070***	
	(4.82)		(6.75)		(1.94)		(2.81)	
Administrative	-0.355***		-0.370***		-0.278***		-0.250***	
	(8.15)		(11.72)		(8.27)		(10.98)	
Skilled trades	-0.373***		-0.377***		-0.349***		-0.419***	
	(11.02)		(16.31)		(5.44)		(8.96)	
Personal service	-0.402***		-0.531***		-0.387***		-0.426***	
	(7.16)		(11.91)		(10.48)		(15.98)	
Sales & customer services	-0.522***		-0.461***		-0.370***		-0.343***	
	(10.11)		(12.08)		(9.70)		(12.56)	
Process, plant & machine	-0.513***		-0.496***		-0.457***		-0.412***	
	(14.77)		(20.33)		(8.30)		(9.25)	
Elementary	-0.573***		-0.578***		-0.464***		-0.464***	
	(16.44)		(22.31)		(12.37)		(16.84)	
Agriculture & fishing	0.078		-0.182***		0.161		-0.040	
	(0.89)		(2.62)		(1.09)		(0.37)	
Energy & water	0.322***		0.213***		0.097		0.252***	
	(4.46)		(4.11)		(0.77)		(3.02)	
Manufacturing	0.226***		0.081**		0.139***		0.061*	
	(5.23)		(2.41)		(2.94)		(1.65)	
Construction	0.287***		0.118***		0.320***		0.105**	
	(5.72)		(3.13)		(4.09)		(2.04)	
Distribution	0.148***		-0.041		0.011		-0.109***	
	(3.37)		(1.19)		(0.28)		(3.46)	
Transport & communication	0.243***		0.101***		0.182***		0.157***	
	(5.24)		(2.81)		(3.35)		(3.91)	
Banking & finance	0.319***		0.181***		0.202***		0.133***	
	(7.08)		(5.21)		(5.03)		(4.21)	
Public admin	0.131***		0.027		0.050		0.007	
	(2.87)		(0.79)		(1.37)		(0.23)	
Days illness	-0.020**		-0.006		-0.033***		-0.011	
	(2.09)		(0.54)		(3.72)		(1.04)	

Married	0.042*	0.177***	0.079***	0.170**	-0.013	-0.167***	-0.002	-0.234***
	(1.76)	(3.88)	(4.78)	(2.53)	(0.71)	(4.05)	(0.16)	(4.39)
Experience	0.018***		0.026***		0.019***		0.019***	
	(5.26)		(8.37)		(6.64)		(8.27)	
Experience squared/100	-0.034***		-0.048***		-0.038***		-0.037***	
	(4.60)		(7.69)		(6.35)		(8.08)	
Degree	0.365***	0.885***	0.372***	0.153*	0.475***	0.992***	0.344***	0.727***
	(7.12)	(12.55)	(12.08)	(1.70)	(9.52)	(14.26)	(11.00)	(9.22)
Other higher education	0.229***	0.839***	0.169***	0.003	0.292***	0.928***	0.213***	0.747***
	(4.43)	(10.69)	(5.31)	(0.03)	(6.40)	(14.29)	(7.29)	(9.17)
A level	0.155***	0.512***	0.094***	0.308***	0.193***	0.726***	0.052**	0.653***
	(4.12)	(10.28)	(3.69)	(4.01)	(4.90)	(12.94)	(2.00)	(9.34)
O level	0.135***	0.554***	0.038	0.213**	0.157***	0.621***	0.047**	0.649***
	(3.30)	(9.37)	(1.39)	(2.42)	(4.49)	(12.66)	(1.97)	(10.35)
Other	0.120***	0.391***	0.020	0.313***	0.126***	0.514***	0.026	0.432***
	(3.15)	(6.93)	(0.71)	(3.40)	(3.60)	(9.63)	(1.06)	(6.37)
Small firm	-0.121***		-0.116***		-0.060***		-0.085***	
	(5.84)		(7.46)		(3.35)		(6.37)	
Part-time	-0.138***		-0.065**		-0.034*		-0.067***	
	(4.77)		(2.40)		(1.94)		(4.99)	
White	0.034	0.463***	0.033	0.610***	0.065	0.561***	-0.092***	0.540***
	(0.74)	(6.34)	(0.90)	(6.02)	(1.56)	(8.02)	(2.83)	(6.48)
Tenure	0.012***		0.012***		0.014***		0.013***	
	(4.17)		(5.68)		(4.41)		(5.79)	
Tenure squared/100	-0.016*		-0.014**		-0.010		-0.017**	
	(1.91)		(2.25)		(0.92)		(2.32)	
Public sector	0.059*		-0.007		0.104***		0.042**	
	(1.75)		(0.29)		(4.36)		(2.37)	
Overtime	0.003**		0.006***		0.003		0.005***	
	(1.99)		(5.71)		(1.27)		(3.72)	
Social housing	-0.101**	-0.448***	-0.033	-0.317***	-0.026	-0.386***	-0.031	-0.095
	(2.28)	(6.62)	(1.00)	(3.11)	(0.68)	(5.84)	(1.13)	(1.19)
Home owned	0.049	0.049	0.053*	-0.313***	0.068**	0.021	0.021	-0.083

	(1.33)	(0.71)	(1.77)	(3.30)	(2.01)	(0.30)	(0.80)	(1.00)
Home mortgaged	0.096***	0.372***	0.087***	0.312***	0.106***	0.320***	0.022	0.436***
	(2.67)	(5.73)	(3.36)	(3.53)	(3.40)	(5.09)	(0.94)	(5.95)
Limbs	**0.120****	**0.765*****	**-0.002**	**0.501*****	**0.043**	**0.599*****	**0.011**	**0.389*****
	(2.42)	**(12.31)**	**(0.04)**	**(3.89)**	**(1.18)**	**(10.60)**	**(0.29)**	**(3.58)**
Sight/hearing	**0.169*****	**0.734*****	**-0.026**	**0.540*****	**0.031**	**0.616*****	**-0.040**	**0.434*****
	(2.84)	**(7.36)**	**(0.51)**	**(3.49)**	**(0.60)**	**(6.22)**	**(0.86)**	**(2.92)**
Skin, breathing and organs	**0.127****	**0.774*****	**-0.010**	**0.475*****	**0.086****	**0.680*****	**0.015**	**0.380*****
	(2.57)	**(12.19)**	**(0.23)**	**(3.97)**	**(2.20)**	**(11.41)**	**(0.43)**	**(3.75)**
Other	**0.132*****	**0.319*****	**-0.018**	**0.423*****	**0.017**	**0.334*****	**0.008**	**0.280*****
	(2.82)	**(4.30)**	**(0.37)**	**(2.98)**	**(0.46)**	**(5.15)**	**(0.23)**	**(2.59)**
Number of health problems	**-0.027****	**-0.204*****	**-0.017****	**0.006**	**-0.032*****	**-0.167*****	**-0.013***	**-0.040***
	(2.45)	**(17.52)**	**(2.11)**	**(0.19)**	**(3.97)**	**(15.77)**	**(1.96)**	**(1.77)**
Age		0.126***		0.251***		0.123***		0.230***
		(13.02)		(20.49)		(11.23)		(17.34)
Age squared/100		-0.169***		-0.300***		-0.161***		-0.274***
		(14.77)		(20.12)		(11.70)		(16.04)
Dependent children		-0.012		-0.026		-0.205***		-0.371***
		(0.57)		(0.71)		(10.18)		(15.40)
Other earner		0.405***		0.489***		0.382***		0.351***
		(10.46)		(9.19)		(9.71)		(7.22)
Lambda	0.060		0.029		0.138		-0.017	
	(0.98)		(0.52)		(2.77)		(0.44)	
Observations	2399	7725	3886	4817	2470	7892	3741	5281
F test	38.04		79.95		39.14		79.77	
(p-value)	(0.00)		(0.00)		(0.00)		(0.00)	
Adj R^2	0.450		0.519		0.445		0.523	
Log Likelihood		-3371.31		-1747.93		-3880.13		-2612.75
LR χ^2 (k)		2829.28		1233.80		2048.87		1149.60
(p-value)		(0.00)		(0.00)		(0.00)		(0.00)
Pseudo R^2		0.296		0.261		0.209		0.180

Notes: See notes to Table 3.3. The controls for within group differences are highlighted in **bold.**

Table 3.15. Distribution of Health Problems by Type.

a) Males

	1997		2003	
	Work-limited	Non-work-limited	Work-limited	Non-work-limited
Arms, hands	6.91	3.93	5.39	3.41
Legs, feet	12.79	8.77	13.48	8.25
Back, neck	20.61	9.74	19.02	7.7
Difficulty in seeing	2.97	1.81	1.92	1.84
Difficulty in hearing	1.99	5.63	1.67	3.76
Speech impediment	0.37	0.23	0.21	0.12
Skin conditions/allergies	1.50	4.84	1.5	4.57
Chest, breathing problems	10.44	24.09	8.93	20.23
Heart, blood pressure, circulation	13.38	14.83	12.24	23.46
Stomach, kidney, liver, digestion	3.38	5.92	4.28	7.26
Diabetes	3.00	8.75	4.27	7.53
Depression, bad nerves	5.40	1.56	6.93	1.74
Epilepsy	2.10	1.5	2.35	1.01
Learning difficulties	2.77	0.71	3.55	1.14
Mental illness, phobia, panics	3.82	0.59	3.51	0.29
Progressive illness	3.15	1.16	4.24	1.26
Other	5.24	5.86	5.81	6.06

Notes: Figures relate to estimation samples used.

b) Females

	1997		2003	
	Work-limited	Non-work-limited	Work-limited	Non-work-limited
Arms, hands	9.30	3.96	7.36	3.26
Legs, feet	11.23	6.1	11.43	6.67
Back, neck	23.86	10.05	21.1	8.08
Difficulty in seeing	1.46	1.13	1.54	0.9
Difficulty in hearing	1.86	3.43	1.78	2.35
Speech impediment	0.20	0.11	0.15	0.02
Skin conditions/allergies	1.99	4.29	1.49	4.69
Chest, breathing problems	12.42	28.65	9.27	23.07
Heart, blood pressure, circulation	6.98	11.4	6.37	16.24
Stomach, kidney, liver, digestion	4.08	6.46	5.10	7.1
Diabetes	2.08	5.27	2.77	5.07
Depression, bad nerves	6.77	2.39	9.20	2.92
Epilepsy	2.36	1.98	2.05	1.07
Learning difficulties	1.78	0.33	2.36	0.45
Mental illness, phobia, panics	3.26	0.80	4.03	0.40
Progressive illness	3.98	1.92	5.13	1.71
Other	6.18	11.68	8.30	15.46

Notes: Figures relate to estimation samples used.

Table 3.16. Perceptions of Prejudice, British Social Attitudes Survey, 2005.

	Non-disabled	Disabled (long-term health problem)	Disabled (limiting long-term health problem)
A lot	24.67	28.35	37.69
A little	52.31	53.62	43.05
Hardly any	16.57	13.25	13.55
None	6.45	4.78	5.71

Notes: Working age population.

CHAPTER THREE

APPENDIX

Table A3.1. Variable Definitions

Dependent variables	
(Log) hourly wages	Log of gross weekly earnings divided by usual hours worked per week
Employment	Dummy variable equal to 1 if individual has a positive hourly wage, 0 if unemployed or inactive
Human capital variables	
Experience[95]	Years of (potential) labour market experience (age minus school-leaving age)
Tenure	Years in present job
Degree	Dummy variable, equals 1 if highest qualification is university degree or higher degree, 0 otherwise
Other Higher Education	Dummy variable, equals 1 if highest qualification is other degree or equivalent, 0 otherwise
A level	Dummy variable, equals 1 if highest qualification is A level or equivalent, 0 otherwise
O Level	Dummy variable, equals 1 if highest qualification is O level or equivalent, 0 otherwise
Other	Dummy variable, equals 1 if highest qualification is other qualification, 0 otherwise
None (base group)	Dummy variable, equals 1 if no qualifications, 0 otherwise
Industry variables	
Agriculture & fishing	Dummy variable, equals 1 if industry of current employment is agriculture and fishing, 0 otherwise
Energy & water	Dummy variable, equals 1 if industry of current employment is energy and water, 0 otherwise
Manufacturing	Dummy variable, equals 1 if industry of current employment is manufacturing, 0 otherwise
Construction	Dummy variable, equals 1 if industry of current employment is construction, 0 otherwise
Distribution	Dummy variable, equals 1 if industry of current employment is distribution, hotels and restaurants, 0 otherwise
Transport & communication	Dummy variable, equals 1 if industry of current employment is transport and communication, 0 otherwise

[95] While potential experience is used as standard, this may be inappropriate for disabled workers who may have intermittent work histories. Actual experience is not available from LFS data.

Banking & finance	Dummy variable, equals 1 if industry of current employment is banking, finance and insurance, 0
	otherwise
Public administration	Dummy variable, equals 1 if industry of current employment is public administration, education and health, 0 otherwise
Other (base group)	Dummy variable, equals 1 if industry of current employment is other services, 0 otherwise
Occupation variables	
Managers & senior officials (base)	Dummy variable, equals 1 if current occupation is managers and senior officials, 0 otherwise
Professional	Dummy variable, equals 1 if current occupation is professional , 0 otherwise
Associate professional	Dummy variable, equals 1 if current occupation is associate professional and technical, 0 otherwise
Administrative	Dummy variable, equals 1 if current occupation is administrative and secretarial, 0 otherwise
Skilled trades	Dummy variable, equals 1 if current occupation is skilled trades, 0 otherwise
Personal service	Dummy variable, equals 1 if current occupation is personal services, 0 otherwise
Sales & customer service	Dummy variable, equals 1 if current occupation is sales and customer services, 0 otherwise
Process, plant & machine operatives	Dummy variable, equals 1 if current occupation is process, plant and machine operatives, 0 otherwise
Elementary occupations	Dummy variable, equals 1 if current occupation is elementary, 0 otherwise
Region variables	
North	Dummy variable, equals 1 if region of residence is North, 0 otherwise
Yorkshire & Humberside	Dummy variable, equals 1 if region of residence is Yorkshire and Humberside, 0 otherwise
East Midlands	Dummy variable, equals 1 if region of residence is East Midlands, 0 otherwise
East Anglia	Dummy variable, equals 1 if region of residence is East Anglia, 0 otherwise
South East & London (base)	Dummy variable, equals 1 if region of residence is South East and London, 0 otherwise
South West	Dummy variable, equals 1 if region of residence is South West, 0 otherwise
West Midlands	Dummy variable, equals 1 if region of residence is West Midlands, 0 otherwise
North West	Dummy variable, equals 1 if region of residence is North West, 0 otherwise
Wales	Dummy variable, equals 1 if region of residence is Wales, 0 otherwise
Scotland	Dummy variable, equals 1 if region of residence is Scotland, 0 otherwise
Health variables	
Days illness	Number of days off sick in the reference week (0-7)
Number of health problems	Number of individual self-reported health problems.
Limbs	Dummy variable, equals 1 if main health problem affects limbs, 0 otherwise
Sight/hearing	Dummy variable, equals 1 if main health problem affects sight/hearing, 0 otherwise

Skin, breathing & organs	Dummy variable, equals 1 if main health problem affects skin, breathing and organs, 0 otherwise
Mental health (base)	Dummy variable, equals 1 if main health problem is mental health, 0 otherwise
Other	Dummy variable, equals 1 if main health problem is other, 0 otherwise
Housing status variables	
Social housing	Dummy variable, equals 1 if renting from non-private sector, 0 otherwise
Home owned	Dummy variable, equals 1 if home owned outright, 0 otherwise
Home mortgaged	Dummy variable, equals 1 if home mortgaged, 0 otherwise
Private rent (base)	Dummy variable, equals 1 if renting from private sector, 0 otherwise
Other variables	
Age	Age (in years)
Married	Dummy variable denoting marital status, equals 1 if married, 0 otherwise
Dependent children	Number of dependent children in household if head of household or spouse, 0 otherwise
Other earner	Dummy variable, equals 1 if there is another individual in household who has a labour market income, 0 otherwise
White	Dummy variable denoting ethnic group, equals 1 if white, 0 otherwise
Small firm	Dummy variable denoting firm size in which employed, equals 1 if less than 20 employees in firm, 0 otherwise
Public	Dummy variable, equals 1 if individual is employed in the public sector, 0 otherwise
Part-time	Dummy variable, equals 1 if employed part-time, 0 otherwise
Overtime	Amount of usual overtime hours

Table A3.2. Employment Probit Marginal Effects

	Male			Female		
	Work-limited disabled	Non-work-limited disabled	Non-disabled	Work-limited disabled	Non-work-limited disabled	Non-disabled
Summer	0.036**	-0.005	0.008	-0.001	-0.008	-0.012
	(2.26)	(0.34)	(1.23)	(0.06)	(0.43)	(1.57)
Autumn	0.000	0.003	-0.002	-0.005	0.000	-0.011
	(0.03)	(0.22)	(0.37)	(0.32)	(0.00)	(1.46)
Winter	0.039**	0.007	0.002	-0.003	-0.010	-0.017**
	(2.48)	(0.50)	(0.33)	(0.20)	(0.53)	(2.28)
Degree	0.353***	0.034**	0.090***	0.388***	0.189***	0.205***
	(13.80)	(2.02)	(13.47)	(15.48)	(11.96)	(29.18)
Other higher education	0.322***	0.003	0.087***	0.361***	0.189***	0.221***
	(11.08)	(0.13)	(12.13)	(15.24)	(12.28)	(33.81)
A level	0.203***	0.064***	0.094***	0.281***	0.176***	0.164***
	(11.86)	(4.49)	(14.51)	(13.54)	(11.08)	(22.09)
O level	0.223***	0.042***	0.098***	0.238***	0.185***	0.175***
	(10.34)	(2.73)	(16.12)	(13.52)	(11.59)	(23.89)
Other	0.147***	0.057***	0.087***	0.193***	0.123***	0.124***
	(7.37)	(3.91)	(13.67)	(9.87)	(7.05)	(15.35)
Age	0.038***	0.053***	0.061***	0.036***	0.073***	0.079***
	(12.81)	(19.86)	(49.52)	(10.24)	(17.34)	(44.59)
Age squared/100	-0.052***	-0.063***	-0.075***	-0.048***	-0.087***	-0.095***
	(14.74)	(19.58)	(47.92)	(10.98)	(16.03)	(40.26)
Married	0.068***	0.038**	0.048***	-0.037***	-0.075***	-0.079***
	(4.88)	(2.57)	(7.03)	(2.83)	(4.51)	(10.98)
North	-0.082***	-0.064**	-0.033***	-0.044**	-0.006	0.031***
	(4.36)	(2.24)	(2.82)	(2.07)	(-0.20)	(2.63)
Yorkshire&Humberside	-0.039**	0.003	0.007	-0.024	0.036*	0.045***
	(2.07)	(0.18)	(0.84)	(1.28)	(1.65)	(4.82)

East Midlands	-0.030	0.016	0.011	-0.017	0.000	0.058***
	(1.41)	(0.80)	(1.14)	(0.79)	(0.01)	(5.73)
East Anglia	-0.033	0.014	-0.005	-0.055*	0.064*	0.013
	(1.15)	(0.53)	(0.35)	(1.95)	(1.90)	(0.86)
South West	0.034	0.010	0.029***	0.001	0.033	0.053***
	(1.53)	(0.53)	(3.46)	(0.04)	(1.41)	(5.53)
West Midlands	-0.025	-0.023	0.026***	-0.025	0.023	0.044***
	(1.27)	(1.11)	(3.24)	(1.33)	(0.98)	(4.72)
North West	-0.070***	-0.061***	-0.020**	-0.067***	0.043*	0.027***
	(4.09)	(2.82)	(2.19)	(3.87)	(1.95)	(2.85)
Wales	-0.127***	-0.029	-0.033**	-0.079***	0.017	0.040***
	(7.21)	(1.04)	(2.57)	(3.97)	(0.56)	(3.27)
Scotland	-0.067***	-0.027	-0.002	-0.070***	0.007	0.058***
	(3.66)	(1.26)	(0.19)	(3.86)	(0.31)	(6.21)
White	0.111***	0.166***	0.170***	0.140***	0.193***	0.191***
	(6.40)	(4.91)	(14.85)	(8.87)	(5.96)	(17.51)
Dependent children	0.005	-0.005	-0.008**	-0.054***	-0.120***	-0.128***
	(0.84)	(0.67)	(2.53)	(8.43)	(15.45)	(41.20)
Other earner	0.152***	0.114***	0.087***	0.139***	0.122***	0.102***
	(12.28)	(8.85)	(14.68)	(11.32)	(7.28)	(14.15)
Social housing	-0.154***	-0.078***	-0.094***	-0.138***	-0.032	-0.049***
	(8.54)	(2.83)	(8.33)	(7.36)	(1.18)	(4.41)
Home owned	0.009	-0.070***	-0.026***	0.008	-0.025	-0.011
	(0.43)	(2.97)	(2.79)	(0.34)	(0.92)	(0.99)
Home mortgaged	0.120***	0.071***	0.095***	0.107***	0.145***	0.140***
	(5.65)	(3.62)	(12.04)	(5.15)	(6.09)	(15.23)

Notes: Marginal effects accompany probit estimates presented in Tables 3.3 and 3.4 respectively. Z statistics reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level.

Table A3.3. Male Heckman Corrected Earnings Equations, 1997

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Earnings	Employ	Earnings	Employ	Earnings	Employ
Constant	1.167***	-2.335***	1.444***	-3.967***	1.515***	-4.484***
	(9.04)	(11.82)	(13.55)	(13.69)	(45.00)	(52.41)
Summer	0.013	0.073	-0.037	0.093	0.015**	0.004
	(0.45)	(1.55)	(1.49)	(1.14)	(2.06)	(0.15)
Autumn	0.077***	0.022	-0.043*	0.028	0.015**	0.014
	(2.75)	(0.47)	(1.77)	(0.35)	(2.02)	(0.60)
Winter	0.032	0.025	-0.018	-0.033	0.027***	0.054**
	(1.16)	(0.54)	(0.75)	(0.42)	(3.81)	(2.25)
North	-0.088*	-0.371***	-0.224***	-0.091	-0.185***	-0.146***
	(1.91)	(5.38)	(6.01)	(0.78)	(15.20)	(3.74)
Yorkshire &	-0.072*	-0.231***	-0.166***	-0.136	-0.197***	-0.072**
Humberside	(1.92)	(3.83)	(4.95)	(1.31)	(20.04)	(2.25)
East Midlands	-0.128***	-0.221***	-0.084**	0.053	-0.173***	0.031
	(3.00)	(3.15)	(2.51)	(0.47)	(16.39)	(0.86)
East Anglia	-0.087*	-0.023	-0.168***	-0.095	-0.121***	-0.033
	(1.69)	(0.26)	(3.86)	(0.69)	(8.88)	(0.73)
South West	-0.113***	0.049	-0.121***	-0.048	-0.161***	0.042
	(3.11)	(0.73)	(3.60)	(0.42)	(16.23)	(1.23)
West Midlands	-0.172***	-0.077	-0.155***	0.041	-0.165***	0.088***
	(4.66)	(1.23)	(4.97)	(0.40)	(17.65)	(2.77)
North West	-0.165***	-0.431***	-0.162***	-0.106	-0.206***	-0.174***
	(4.12)	(7.45)	(5.02)	(1.03)	(21.89)	(5.81)
Wales	-0.180***	-0.469***	-0.203***	-0.075	-0.201***	-0.154***
	(3.45)	(6.40)	(4.80)	(0.54)	(15.58)	(3.77)
Scotland	-0.097**	-0.387***	-0.202***	-0.172*	-0.175***	-0.062**
	(2.34)	(6.25)	(6.12)	(1.66)	(18.43)	(1.99)
Professional	-0.054		-0.099***		-0.091***	
	(1.18)		(2.89)		(8.89)	
Associate	-0.128***		-0.145***		-0.112***	
professional	(2.91)		(4.17)		(10.74)	
Administrative	-0.373***		-0.372***		-0.384***	
	(8.47)		(10.08)		(33.73)	
Skilled trades	-0.330***		-0.343***		-0.336***	
	(8.70)		(11.68)		(36.38)	
Personal	-0.386***		-0.419***		-0.349***	
service	(8.34)		(10.77)		(28.49)	
Sales &	-0.312***		-0.333***		-0.235***	
customer	(5.59)		(7.73)		(17.73)	
services						
Process, plant	-0.424***		-0.474***		-0.412***	
& machine	(10.98)		(15.04)		(41.49)	
Elementary	-0.469***		-0.522***		-0.449***	
	(10.54)		(12.83)		(36.29)	
Agriculture &	0.025		-0.158*		-0.066**	
fishing	(0.27)		(1.82)		(2.48)	
Energy & water	0.279***		0.190**		0.220***	
	(3.05)		(2.43)		(9.79)	
Manufacturing	0.108**		0.061		0.118***	
	(2.07)		(1.38)		(8.27)	

Construction	0.136**		0.058		0.082***	
	(2.31)		(1.17)		(5.15)	
Distribution	0.036		-0.132***		-0.053***	
	(0.67)		(2.85)		(3.60)	
Transport & communication	0.094		-0.027		0.078***	
	(1.62)		(0.55)		(5.08)	
Banking & finance	0.162***		0.136***		0.195***	
	(2.95)		(2.96)		(13.32)	
Public admin	-0.015		-0.009		0.048***	
	(0.29)		(0.20)		(3.17)	
Days illness	-0.017***		-0.025***		-0.011***	
	(3.25)		(2.98)		(3.53)	
Married	0.128***	0.170***	0.122***	0.190**	0.080***	0.359***
	(4.62)	(3.82)	(5.24)	(2.39)	(11.31)	(14.64)
Experience	0.021***		0.037***		0.034***	
	(6.18)		(8.96)		(28.33)	
Experience squared/100	-0.041***		-0.069***		-0.066***	
	(5.47)		(8.34)		(25.42)	
Degree	0.596***	0.885***	0.424***	0.124	0.443***	0.419***
	(10.58)	(12.29)	(10.29)	(1.16)	(33.87)	(12.76)
Other higher education	0.382***	0.671***	0.267***	0.140	0.242***	0.397***
	(6.95)	(8.70)	(6.34)	(1.10)	(18.09)	(10.06)
A level	0.271***	0.512***	0.144***	0.222***	0.165***	0.338***
	(6.96)	(11.33)	(4.56)	(2.59)	(15.55)	(12.46)
O level	0.201***	0.570***	0.144***	0.247**	0.094***	0.354***
	(4.60)	(10.02)	(4.16)	(2.55)	(8.44)	(12.21)
Other	0.153***	0.437***	0.084**	0.229**	0.059***	0.344***
	(3.83)	(8.67)	(2.45)	(2.40)	(5.21)	(11.17)
Small firm	-0.202***		-0.116***		-0.158***	
	(8.52)		(5.49)		(24.54)	
Part-time	-0.173***		-0.028		-0.102***	
	(5.26)		(0.79)		(8.83)	
White	0.166***	0.213***	0.045	0.404***	0.079***	0.518***
	(3.37)	(2.82)	(0.92)	(3.24)	(5.92)	(16.12)
Tenure	0.019***		0.019***		0.016***	
	(5.90)		(7.27)		(18.04)	
Tenure squared/100	-0.030***		-0.029***		-0.025***	
	(3.12)		(3.81)		(8.67)	
Public sector	0.096***		0.042		0.040***	
	(2.61)		(1.30)		(3.86)	
Overtime	0.004***		0.004***		0.004***	
	(2.88)		(3.11)		(9.28)	
Social housing	-0.063	-0.294***	-0.052	-0.169	-0.084***	-0.154***
	(1.38)	(4.48)	(1.22)	(1.55)	(6.76)	(4.97)
Home owned	-0.004	0.033	0.070*	0.048	0.016	0.099***
	(0.08)	(0.47)	(1.75)	(0.45)	(1.36)	(3.08)
Home mortgaged	0.110***	0.360***	0.147***	0.524***	0.073***	0.520***
	(2.67)	(5.67)	(3.99)	(5.41)	(7.27)	(19.45)
Age		0.080***		0.211***		0.226***
		(9.07)		(15.67)		(52.50)
Age squared/100		-0.124***		-0.259***		-0.286***
		(11.78)		(15.65)		(52.38)
Dependent children		0.009		0.012		-0.055***
		(0.46)		(0.31)		(4.95)
Other earner		0.489***		0.446***		0.432***

		(13.80)		(7.35)		(23.10)
Lambda	0.111* (1.84)		0.261*** (3.34)		0.024 (1.04)	
Observations	2254	8446	2871	3534	29129	36684
F test	39.59		52.60		591.95	
(p-value)	(0.00)		(0.00)		(0.00)	
Adj R^2	0.451		0.463		0.4934	
Log Likelihood		-3850.36		-1328.42		-14144.76
LR $\chi^2(k)$		2098.71		755.13		9020.94
(p-value)		(0.00)		(0.00)		(0.00)
Pseudo R^2		0.214		0.221		0.242

Notes: See notes to Table 3.3.

Table A3.4. Female Heckman Corrected Earnings Equations, 1997

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Earnings	Employ	Earnings	Employ	Earnings	Employ
Constant	1.561***	-2.426***	1.517***	-4.199***	1.595***	-4.500***
	(12.24)	(11.18)	(17.73)	(14.01)	(60.05)	(53.90)
Summer	0.033	-0.009	0.017	0.027	0.010	-0.020
	(1.25)	(0.20)	(0.77)	(0.39)	(1.57)	(1.04)
Autumn	0.052**	0.090**	0.033	0.035	0.031***	0.003
	(1.99)	(1.98)	(1.50)	(0.50)	(4.70)	(0.16)
Winter	0.034	0.015	0.043*	0.040	0.036***	-0.035*
	(1.29)	(0.33)	(1.94)	(0.56)	(5.45)	(1.83)
North	-0.066	-0.318***	-0.161***	0.006	-0.178***	0.053*
	(1.46)	(4.47)	(4.73)	(0.06)	(16.20)	(1.70)
Yorkshire &	-0.140***	-0.147**	-0.193***	0.008	-0.149***	0.059**
Humberside	(4.06)	(2.39)	(6.89)	(0.09)	(16.47)	(2.27)
East Midlands	-0.082**	-0.069	-0.117***	0.229**	-0.142***	0.061**
	(2.12)	(1.01)	(3.87)	(2.22)	(14.53)	(2.16)
East Anglia	-0.172***	-0.034	-0.162***	-0.051	-0.136***	0.031
	(3.63)	(0.39)	(3.99)	(0.41)	(10.62)	(0.85)
South West	-0.112***	0.139**	-0.106***	-0.011	-0.141***	0.026
	(3.32)	(2.12)	(3.70)	(0.12)	(15.32)	(0.98)
West Midlands	-0.179***	-0.069	-0.137***	0.051	-0.151***	0.037
	(5.33)	(1.15)	(4.68)	(0.55)	(16.93)	(1.46)
North West	-0.116***	-0.320***	-0.101***	-0.035	-0.162***	0.040
	(3.20)	(5.61)	(3.50)	(0.38)	(18.94)	(1.63)
Wales	-0.166***	-0.435***	-0.203***	0.054	-0.143***	0.076**
	(3.48)	(6.08)	(5.48)	(0.46)	(12.48)	(2.32)
Scotland	-0.102***	-0.318***	-0.135***	-0.047	-0.145***	0.075***
	(2.59)	(5.19)	(4.47)	(0.50)	(16.71)	(2.97)
Professional	0.136***		0.114***		0.099***	
	(2.71)		(2.90)		(8.34)	
Associate	-0.073		-0.077**		-0.097***	
professional	(1.58)		(2.15)		(9.00)	
Administrative	-0.244***		-0.241***		-0.257***	
	(6.36)		(7.96)		(28.31)	
Skilled trades	-0.553***		-0.472***		-0.467***	
	(8.10)		(8.03)		(24.86)	
Personal service	-0.355***		-0.410***		-0.418***	
	(8.24)		(11.85)		(39.66)	
Sales & customer services	-0.382***		-0.374***		-0.350***	
	(8.36)		(9.65)		(30.53)	
Process, plant	-0.484***		-0.430***		-0.450***	
& machine	(8.69)		(9.19)		(29.38)	
Elementary	-0.461***		-0.478***		-0.471***	
	(10.16)		(12.08)		(37.98)	
Agriculture &	0.191		0.133		0.065**	
fishing	(1.60)		(1.29)		(1.97)	
Energy & water	0.270*		0.271*		0.245***	
	(1.88)		(1.91)		(7.23)	

Manufacturing	0.157*** (2.91)		0.223*** (4.97)		0.151*** (11.07)	
Construction	0.188** (2.06)		0.191** (2.39)		0.117*** (5.04)	
Distribution	0.011 (0.24)		0.064 (1.64)		0.002 (0.17)	
Transport & communication	0.090 (1.37)		0.218*** (3.88)		0.135*** (8.30)	
Banking & finance	0.180*** (3.75)		0.234*** (5.81)		0.206*** (16.68)	
Public admin	0.045 (1.02)		0.085** (2.35)		0.047*** (4.09)	
Days illness	-0.024*** (5.12)		-0.010 (1.57)		-0.008*** (3.38)	
Married	-0.001 (0.03)	-0.113*** (2.78)	-0.025 (1.35)	-0.215*** (3.28)	-0.002 (0.37)	-0.226*** (11.91)
Experience	0.016*** (4.79)		0.024*** (8.88)		0.021*** (24.31)	
Experience squared/100	-0.031*** (4.36)		-0.048*** (8.40)		-0.046*** (23.49)	
Degree	0.415*** (7.13)	0.939*** (11.83)	0.402*** (9.71)	0.813*** (7.18)	0.373*** (29.84)	0.534*** (19.19)
Other higher education	0.329*** (6.60)	0.734*** (11.56)	0.274*** (7.39)	0.680*** (6.87)	0.251*** (21.07)	0.669*** (22.81)
A level	0.166*** (4.26)	0.444*** (8.05)	0.138*** (4.40)	0.344*** (3.99)	0.128*** (13.17)	0.286*** (12.06)
O level	0.111*** (3.09)	0.495*** (10.66)	0.151*** (5.53)	0.394*** (5.38)	0.074*** (8.48)	0.404*** (19.48)
Other	0.052 (1.47)	0.434*** (9.12)	0.067** (2.43)	0.335*** (4.35)	0.043*** (4.65)	0.276*** (11.97)
Small firm	-0.099*** (4.72)		-0.106*** (5.99)		-0.101*** (18.50)	
Part-time	-0.021 (0.95)		-0.053*** (2.85)		-0.049*** (8.60)	
White	-0.095* (1.83)	0.379*** (5.08)	-0.091** (2.20)	0.453*** (4.29)	-0.011 (0.83)	0.459*** (16.74)
Tenure	0.027*** (7.41)		0.016*** (5.28)		0.020*** (19.27)	
Tenure squared/100	-0.059*** (4.24)		-0.024** (2.17)		-0.035*** (8.73)	
Public sector	0.073** (2.56)		0.115*** (4.74)		0.109*** (14.12)	
Overtime	0.003 (1.62)		0.005*** (3.22)		0.004*** (6.51)	
Social housing	-0.076* (1.70)	-0.218*** (3.21)	-0.037 (1.08)	0.084 (0.88)	-0.036*** (3.21)	-0.013 (0.49)
House owned	-0.032 (0.72)	0.111 (1.52)	0.011 (0.32)	0.064 (0.63)	0.013 (1.19)	0.122*** (4.25)
House mortgaged	-0.002 (0.05)	0.414*** (6.31)	0.027 (0.89)	0.499*** (5.82)	0.030*** (3.21)	0.475*** (20.66)
Age		0.074*** (6.94)		0.214*** (13.70)		0.227*** (49.45)
Age squared/100		-0.110*** (8.11)		-0.265*** (12.92)		-0.286*** (46.67)

Dependent		-0.163***		-0.448***		-0.376***
		(8.05)		(14.93)		(48.14)
Other earner		0.446***		0.413***		0.460***
		(11.83)		(7.09)		(26.88)
Lambda	0.004		0.012		-0.044***	
	(0.07)		(0.25)		(3.26)	
Observations	2225	8112	2634	3640	29551	43533
F test	36.79		58.37		574.31	
(p-value)	(0.00)		(0.00)		(0.00)	
Adj R^2	0.436		0.511		0.482	
Log Likelihood		-3970.61		-1746.28		-22676.7
LR $\chi^2(k)$		1589.97		798.96		9302.88
(p-value)		(0.00)		(0.00)		(0.00
Pseudo R^2		0.167		0.186		0.1702

Notes: See notes to Table 3.3.

Table A3.5. Earnings Decomposition by Disability Status - Sensitivity Analysis

(a) Work-limited disabled and non-disabled, 1997

	Male				Female			
Mean prediction non-disabled	1.994				1.739			
Mean prediction disabled	1.716				1.584			
Raw differential	0.278				0.155			
- due to endowments	0.117				0.076			
- due to coefficients	0.183				0.087			
- due to interaction	-0.022				-0.008			
Ω:	0	1	0.5	0.928	0	1	0.5	0.93
Unexplained	0.161	0.183	0.172	0.182	0.079	0.087	0.083	0.087
Explained	0.117	0.095	0.106	0.096	0.076	0.068	0.072	0.069
% unexplained	58.0	65.9	62.0	65.4	51.0	56.2	53.6	55.8
% explained	42.0	34.1	38.0	34.6	49.0	43.8	46.4	44.2
Differential due to selection variable	-0.100				-0.023			

(b) Work-limited disabled and non-disabled, 2003

	Male				Female			
Mean prediction non-disabled	2.267				2.057			
Mean prediction disabled	2.101				1.771			
Raw differential	0.166				0.286			
- due to endowments	0.094				0.082			
- due to coefficients	0.086				0.216			
- due to interaction	-0.013				-0.013			
Ω:	0	1	0.5	0.899	0	1	0.5	0.901
Unexplained	0.072	0.086	0.079	0.084	0.203	0.216	0.21	0.215
Explained	0.094	0.081	0.087	0.082	0.082	0.069	0.076	0.071
% unexplained	43.5	51.4	47.5	50.6	71.1	75.7	73.4	75.3
% explained	56.5	48.6	52.5	49.4	28.9	24.3	26.6	24.7
Differential due to selection variable	-0.001				-0.165			

(c) Non-work-limited disabled and non-disabled, 1997

	Male				Female			
Mean prediction non-disabled	1.994				1.739			
Mean prediction disabled	1.946				1.703			
Raw differential	0.048				0.036			
- due to endowments	-0.010				-0.001			
- due to coefficients	0.065				0.033			
- due to interaction	-0.007				0.004			
Ω:	0	1	0.5	0.090	0	1	0.5	0.918
Unexplained	0.058	0.065	0.061	0.059	0.037	0.033	0.035	0.033
Explained	-0.010	-0.017	-0.013	-0.011	-0.001	0.003	0.001	0.003
% unexplained	120.7	135.3	128.0	122.0	101.7	91.6	96.7	92.4
% explained	-20.7	-35.3	-28.0	-22.0	-1.7	8.4	3.3	7.6
Differential due to selection variable	-0.061				-0.023			

(d) Non-work-limited disabled and non-disabled, 2003

	Male				Female			
Mean prediction non-disabled	2.267				2.057			
Mean prediction disabled	2.270				2.022			
Raw differential	-0.003				0.035			
- due to endowments	-0.015				0.005			
- due to coefficients	0.019				0.028			
- due to interaction	-0.006				0.002			
Ω:	0	1	0.5	0.154	0	1	0.5	0.857
Unexplained	0.013	0.019	0.016	0.014	0.03	0.028	0.029	0.028
Explained	-0.015	-0.021	-0.018	-0.016	0.005	0.007	0.006	0.007
% unexplained	449.9	668.4	559.1	483.6	86.1	79.5	82.8	80.4
% explained	-549.9	-768.4	-659.1	-583.6	13.9	20.5	17.2	19.6
Differential due to selection variable	-0.002				-0.016			

Table A3.6. Gender Earnings Decompositions - Sensitivity Analysis

(a) 1997

	Work-limited disabled					Non-work-limited disabled					Non-disabled				
Mean prediction males	1.716					1.946					1.994				
Mean prediction females	1.584					1.703					1.739				
Raw differential	0.133					0.243					0.256				
- due to endowments	0.037					0.088					0.083				
- due to coefficients	-0.040					0.114					0.109				
- due to interaction	0.136					0.042					0.063				
Ω:	0	1	0.5	0.503	P	0	1	0.5	0.521	P	0	1	0.5	0.496	P
Unexplained	0.096	-0.040	0.028	0.027	-0.026	0.156	0.114	0.135	0.134	0.056	0.172	0.109	0.141	0.141	0.087
Explained	0.037	0.173	0.105	0.105	0.159	0.088	0.130	0.109	0.110	0.188	0.083	0.147	0.115	0.115	0.168
% unexplained	72.4	-30.5	20.9	20.6	-19.7	63.9	46.7	55.3	54.9	22.9	67.5	42.7	55.1	55.2	34.1
% explained	27.6	130.5	79.1	79.4	119.7	36.1	53.3	44.7	45.1	77.1	32.5	57.3	44.9	44.8	65.9
Differential due to selection variable	0.102					0.063					0.026				

(b) 2003

	Work-limited disabled					Non-work-limited disabled					Non-disabled				
Mean prediction males	2.101					2.270					2.267				
Mean prediction females	1.771					2.022					2.057				
Raw differential	0.329					0.247					0.210				
- due to endowments	0.074					0.096					0.092				
- due to coefficients	0.194					0.097					0.084				
- due to interaction	0.061					0.054					0.033				
Ω:	0	1	0.5	0.493	P	0	1	0.5	0.509	P	0	1	0.5	0.486	P
Unexplained	0.255	0.194	0.224	0.225	0.192	0.151	0.097	0.124	0.124	0.070	0.118	0.084	0.101	0.101	0.055
Explained	0.074	0.136	0.105	0.105	0.137	0.096	0.151	0.123	0.124	0.178	0.092	0.126	0.109	0.109	0.155
% unexplained	77.4	58.8	68.1	68.2	58.4	61.0	39.2	50.1	49.9	28.3	56.0	40.1	48.0	48.3	26.1
% explained	22.6	41.2	31.9	31.8	41.6	39.0	60.8	49.9	50.1	71.7	44.0	59.9	52.0	51.7	73.9
Differential due to selection variable	-0.132					0.019					0.032				

Table A3.7. Timewise Earnings Decompositions - Sensitivity Analysis

(a) Males

	Work-limited disabled					Non-work-limited disabled					Non-disabled				
Mean prediction 2003	1.960					2.129					2.126				
Mean prediction 1997	1.716					1.946					1.994				
Raw differential	0.244					0.183					0.132				
- due to endowments	0.036					0.035					0.023				
- due to coefficients	0.209					0.146					0.100				
- due to interaction	-0.001					0.002					0.009				
Ω:	0	1	0.5	0.517	P	0	1	0.5	0.576	P	0	1	0.5	0.423	P
Unexplained	0.208	0.209	0.208	0.208	0.200	0.148	0.146	0.147	0.147	0.142	0.109	0.100	0.105	0.105	0.101
Explained	0.036	0.035	0.035	0.035	0.044	0.035	0.037	0.036	0.036	0.041	0.023	0.032	0.027	0.027	0.031
% unexplained	85.3	85.7	85.5	85.5	81.9	80.8	80	80.4	80.3	77.6	82.7	75.9	79.3	79.8	76.7
% explained	14.7	14.3	14.5	14.5	18.1	19.2	20	19.6	19.7	22.4	17.3	24.1	20.7	20.2	23.3
Differential due to selection variable	-0.098					-0.057					0.001				

(b) Females

	Work-limited disabled					Non-work-limited disabled					Non-disabled				
Mean prediction 2003	1.631					1.882					1.916				
Mean prediction 1997	1.584					1.703					1.739				
Raw differential	0.047					0.179					0.177				
- due to endowments	0.053					0.038					0.042				
- due to coefficients	-0.009					0.143					0.140				
- due to interaction	0.003					-0.003					-0.004				
Ω:	0	1	0.5	0.527	P	0	1	0.5	0.588	P	0	1	0.5	0.434	P
Unexplained	-0.006	-0.009	-0.007	-0.008	-0.014	0.140	0.143	0.142	0.142	0.132	0.136	0.140	0.138	0.137	0.131
Explained	0.053	0.056	0.055	0.055	0.061	0.038	0.036	0.037	0.037	0.047	0.042	0.038	0.040	0.040	0.046
% unexplained	-12.1	-19.4	-15.7	-15.9	-29.2	78.5	80.0	79.3	79.4	73.8	76.4	78.7	77.5	77.4	73.8
% explained	112.1	119.4	115.7	115.9	129.2	21.5	20.0	20.7	20.6	26.2	23.6	21.3	22.5	22.6	26.2
Differential due to selection variable	0.137					-0.013					0.160				

Table A3.8. Within Group Heterogeneity Employment Probit Marginal Effects

	Male		Female	
	Work-limited	Non-work-limited	Work-limited	Non-work-limited
Summer	0.041**	-0.005	-0.005	-0.006
	(2.55)	(0.35)	(0.31)	(0.35)
Autumn	-0.004	0.004	-0.003	0.002
	(0.24)	(0.28)	(0.18)	(0.10)
Winter	0.033**	0.008	-0.003	-0.009
	(2.06)	(0.55)	(0.19)	(0.51)
Degree	0.325***	0.030*	0.371***	0.190***
	(11.88)	(1.80)	(14.08)	(12.03)
Other higher education	0.309***	0.001	0.345***	0.191***
	(10.06)	(0.03)	(13.90)	(12.41)
A level	0.171***	0.061***	0.263***	0.179***
	(9.82)	(4.26)	(12.25)	(11.34)
O level	0.193***	0.041***	0.217***	0.187***
	(8.72)	(2.64)	-12.090	(11.77)
Other	0.132***	0.058***	0.181***	0.125***
	(6.54)	(3.93)	(9.09)	(7.23)
Age	0.039***	0.053***	0.039***	0.074***
	(13.05)	(19.75)	(11.25)	(17.43)
Age squared/100	-0.053***	-0.063***	-0.052***	-0.089***
	(14.82)	(19.53)	(11.72)	(16.14)
Married	0.055***	0.037**	-0.054***	-0.075***
	(3.92)	(2.47)	(4.03)	(4.48)
North	-0.068***	-0.069**	-0.027	-0.006
	(3.48)	(2.36)	(1.22)	(0.19)
Yorkshire&Humberside	-0.023	0.003	-0.009	0.037*
	(1.18)	(0.14)	(0.48)	(1.70)
East Midlands	-0.017	0.015	-0.004	0.003
	(0.77)	(0.76)	(0.19)	(0.11)
East Anglia	-0.058**	0.012	-0.069***	0.068**
	(2.17)	(0.45)	(2.60)	(2.02)
South West	0.051**	0.008	0.015	0.035
	(2.19)	(0.41)	(0.71)	(1.52)
West Midlands	-0.022	-0.023	-0.021	0.025
	(1.11)	(1.11)	(1.11)	(1.07)
North West	-0.075***	-0.059***	-0.068***	0.042*
	(4.52)	(2.75)	(3.94)	(1.92)
Wales	-0.108***	-0.025	-0.062***	0.017
	(5.80)	(0.91)	(2.98)	(0.56)
Scotland	-0.046**	-0.028	-0.043**	0.009
	(2.45)	(1.30)	(2.26)	(0.37)
White	0.123***	0.168***	0.150***	0.196***
	(7.70)	(4.95)	(10.13)	(6.02)
Dependent children	-0.004	-0.005	-0.066***	-0.120***
	(0.57)	(0.71)	(10.20)	(15.46)
Other earner	0.129***	0.111***	0.122***	0.118***
	(10.31)	(8.62)	(9.84)	(7.01)
Social housing	-0.131***	-0.076***	-0.118***	-0.031
	(7.10)	(2.77)	(6.17)	(1.16)
Home owned	0.015	-0.072***	0.007	-0.027

	(0.70)	(3.03)	(0.30)	(0.99)
Home mortgaged	0.120***	0.068***	0.105***	0.142***
	(5.54)	(3.44)	(4.99)	(5.94)
Limbs	**0.249*** **	**0.088*** **	**0.198*** **	**0.115*** **
	(12.11)	**(4.72)**	**(10.49)**	**(3.97)**
Sight/hearing	**0.269*** **	**0.085*** **	**0.226*** **	**0.120*** **
	(6.83)	**(4.94)**	**(5.78)**	**(3.53)**
Skin, breathing and organs	**0.259*** **	**0.107*** **	**0.237*** **	**0.124*** **
	(11.74)	**(3.71)**	**(10.91)**	**(3.73)**
Other	**0.107*** **	**0.072*** **	**0.114*** **	**0.085*** **
	(4.05)	**(3.79)**	**(4.89)**	**(2.78)**
Number of health problems	**-0.063*** **	**0.001**	**-0.053*** **	**-0.013***
	(17.99)	**(0.19)**	**(16.02)**	**(1.77)**

Notes: Marginal effects accompany probit models in Table 3.14. ***, ** and * denote significance at the 1%, 5% and 10% level. The controls for within group differences are highlighted in **bold.**

CHAPTER FOUR

DISABILITY AND PART-TIME EMPLOYMENT

4.1 Introduction

The existing literature on discrimination against the disabled is dominated by the analysis of employment and earnings (see Blackaby *et al.*, 1999 and Kidd *et al.*, 2000). Whilst these studies identify direct discrimination, marginalisation of the disabled may also take the form of restricting opportunities for the disabled, for example, in particular sectors or in non-standard forms of employment (see Schur, 2002, 2003 and Hotchkiss, 2004a for US studies). As in the US, disabled workers in the UK are more likely to be employed in several types of non-traditional employment, for example, on temporary contracts (see Table 4.1). However, the most significant difference is in the prevalence of part-time work among the disabled. In 2003, 11 percent of disabled male employees work part-time compared to 5 percent of the non-disabled group and 49 percent of disabled females work part-time compared to 39 percent of the non-disabled group. While several studies in the UK have identified the concentration of females in part-time employment, (see for example, Manning and Petrongolo, 2004), these studies have not identified the important role it plays for the disabled.

Discrimination is not the only reason the disabled may be concentrated in part-time employment. Schur (2002) highlights two alternative explanations for the observed concentration of the disabled in non-standard forms of employment in the US. Firstly, disabled individuals may use non-standard employment as a way of accommodating their disability or as a transitional step to full-time employment and, thus, they may have different preferences towards non-standard work. Secondly, disability benefits in the US impose a limit on earnings and, therefore, restrict the number of hours worked, encouraging part-time, rather than full-time work for disabled individuals in receipt of benefit income. The policy implications of this depend crucially on whether the reasons underlying the concentration of the disabled in part-time employment represent constrained or voluntary choices for the disabled. If part-time employment provides the only viable source of employment due to the limitations imposed by their health, or, if it provides a path through which the disabled move from inactivity to full-time employment, then it may be a mechanism to increase employment amongst the disabled. If, in contrast, employers are constraining the opportunities of the disabled by limiting them to roles with fewer opportunities for progression and lower average earnings, this form of unequal treatment should be recognised. It is an examination of this issue that forms the basis for the rest of this Chapter.

Data from the LFS in 2003 are used to identify the causes of the higher incidence of part-time employment amongst the disabled. Using a bivariate probit model, which takes into account selection into employment, it is possible to control for differences in the characteristics of disabled workers that may affect their probability of being in part-time employment. Predicted conditional part-time employment probabilities can then be used to identify the proportion of the part-time employment gap that is unexplained between the disability groups; that is, the part that is not due to differences in the observable characteristics between the groups. This unexplained component is traditionally used to measure unequal treatment in the labour market. If, however, disabled individuals have different preferences for part-time work, via the role part-time employment plays as a workplace accommodation, this effect will be included in the unexplained gap, making it difficult to identify discrimination directly. In this Chapter, marginalisation by employers is separated from differences in preferences for part-time work by extending the method used by DeLeire (2001) to examine wage discrimination. The non-work-limited disabled group, who have a long-term health problem that does not affect either the amount or type of work they can do, are assumed to have no reason to choose part-time employment as a source of accommodation; thus any unexplained component relative to the non-disabled will only reflect unequal treatment. In a similar decomposition for the work-limited disabled, the unexplained component will reflect both unequal treatment and differences in preferences. If, as in DeLeire (2001), unequal treatment is assumed constant between the two disabled groups, the importance of part-time employment as a way of accommodating disabled workers can be identified.

The remainder of this Chapter is structured as follows. Section 4.2 briefly considers the previous evidence relating to disability and non-standard employment in the US and discusses how these effects may differ in the UK. Section 4.3 outlines the data and empirical methodology. Section 4.4 presents and discusses the results and Section 4.5 briefly concludes.

4.2 Background

As mentioned in Chapter 2, several studies in the US document the concentration of disabled workers in non-standard forms of employment, including part-time employment (Schur 2002, 2003 and Hotchkiss, 2004a). Schur (2002) uses data from the CPS and the SIPP to highlight the negative effect of part-time employment on both earnings and entitlement to other benefits such as health insurance and pension rights. However, she notes that part-time employment can be an intermediate step for some who want to go on to full-time work. When examining transitions over a year, she found that this effect was no more important for the disabled, with 28 percent of the part-time disabled moving to full-time employment compared to 33 percent of the non-disabled. Using the same data, Schur (2003) focuses on the reasons for the high rates of non-traditional employment among disabled workers and finds little evidence to support the influence of discrimination or earnings limits imposed by benefits. Instead, she suggests the high rates of part-time employment reflect a voluntary choice of the disabled to accommodate their health concerns. Higher rates of part-time employment among more severely disabled workers, particularly those who make more frequent visits to the doctors or hospital, support the accommodation theory. Moreover, despite 27 percent of disabled part-time employees receiving disability benefits, an increase in the earnings limit did not increase the earnings of disabled workers substantially, which suggests the earnings limits set by benefits are not an important consideration.

Hotchkiss (2004a) focuses specifically on part-time employment and identifies not only a higher incidence of part-time employment amongst the disabled, but also that the incidence of part-time employment among this group has increased from 27 percent in 1984 to 33 percent in 2000. She suggests the increase in the earnings allowance associated with benefit receipt in the 1990s may be a possible cause for this increase, but that it is also consistent with employers willing to make accommodations in line with the ADA. However, Hotchkiss (2004a) concludes that the growth in part-time employment was largely voluntary, finding little evidence to support the argument that opportunities are being constrained by employers.

Whilst the theories relating to employer marginalisation and work-place accommodation apply in the UK, variations in the benefit regime and legislation provide different incentives to undertake part-time employment. In the UK, incapacity benefit is intended for those who are unable to work due to sickness or disability; however, permitted work can take the form of earnings up to £20.00 a week for an unlimited period or earnings of less than £78.00 per week for a 26 week period. In a similar manner to the US, therefore, only part-time work is permitted whilst in receipt of disability benefit.[96] However, while 9.5 percent of people claiming SSDI or Supplemental Security Income (SSI) are employed in the US (Schur, 2003), in the UK the employment rate for incapacity benefit claimants is only 4.3 percent. As expected, a higher proportion of disabled part-time workers are in receipt of incapacity benefits than full-time workers (Table 4.1), but the figures are far lower than the corresponding rates in the US. The limited evidence that is available, therefore, suggests disability benefits may contribute to the choice over hours but the dominant effect in the UK is on participation.

The evidence presented in Figure 4.1, unlike in the US, shows the proportion of the disabled employed part-time has followed a similar pattern as the non-disabled between 1997 and 2003: it is fairly constant for females and increasing slightly for males.[97] In contrast to the US experience following the ADA, there is no evidence to suggest part-time employment of the disabled has increased amongst the work-limited disabled relative to the non-disabled since the DDA. Indeed, the implications of the DDA on part-time employment are not obvious. Disabled individuals may have more freedom to request reductions in hours of work as a reasonable accommodation, but, equally, employers may perceive it to be too expensive to make

[96] A maximum limit of 16 hours applies.
[97] The same also applies if data from 1994-2003 are considered; however, due to the discontinuity in the definition of disability in the LFS, this is not presented here.

physical workplace accommodations for a disabled part-time worker.[98] In addition, the role that part-time employment plays as a route into full-time employment appears to be quite limited in the UK. Using evidence from the longitudinal element of the LFS, 7.8 percent of disabled part-time workers are found to be in full-time employment one year later, compared to 10.8 percent of non-disabled part-time workers.[99] This Chapter, therefore, focuses on the two dominant explanations in the literature, unequal treatment by employers and differences in preferences, which are thought to be driven by the need for shorter hours to accommodate a disability.[100]

4.3 Data and Methodology

4.3.1 The Data

As in Chapter 3, the data is taken from the LFS and, since the construction of the data for 2003 and the definitions of disability status have already been explained in Section 3.3.1, such discussion is not repeated here. To a more limited extent, the justification bias hypothesis (discussed in Section 2.3) may also extend to the choice between full-time and part-time work and, if present, would cause the impact of disability on part-time employment to be overestimated. However, data from the 2003 HSE is used to confirm that the concentration of the disabled in part-time employment is not specific to the definition or the dataset used in the analysis and, importantly, extends to more objective measures of health, which are far less likely to suffer from justification bias.[101]

The sample consists of individuals of working age but excludes full-time students, the self-employed, those on government training schemes and unpaid family

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[98] This effect would act in the opposite direction to constraining the disabled into part-time employment. However, the Access to Work scheme in the UK should limit the real financial cost imposed on employers for accommodation.

[99] Data covers annual transitions for four quarterly periods from Spring to Winter 2003-2004. These numbers are based on small cell sizes.

[100] In the US there is an additional incentive to employ individuals on a part-time rather than full-time basis, since part-time workers are often not eligible for benefits such as medical insurance.

[101] The concentration in part-time employment is higher amongst those with more specific health measures such as taking medicine, experiencing pain, difficulty with mobility, difficulty with self care, difficulty with usual activity, anxiety or depression. Physical and mental wellbeing index (EQ-5 and GHQ12) values also confirm this. For more details about the HSE see Section 6.3.2.

workers. Since the choice of part-time or full-time employment is only observed for those who are employed, who may represent a non-random selection of the population, the type of employment is modelled using a bivariate probit model with selection (see Van de Ven and Van Praag, 1981). This model has been applied previously to part-time employment by Hotchkiss (2004a).

4.3.2 The Econometric Model

A bivariate probit model is estimated separately for each of the j disability groups ($j = D_1, D_2, N$) and for each gender. The latent variable determining employment is:

$$E^*_{ij} = \gamma_j Y_{ij} + \mu_{ij} \tag{4.1}$$

and the observed variable E_{ij} is related to E^*_{ij} as follows:

$$E_{ij} = \begin{cases} 1 & \text{if } E^*_{ij} > 0 \\ 0 & \text{otherwise} \end{cases}$$

Those in employment ($E_{ij}=1$) are restricted to employees and the non-employed ($E_{ij}=0$) include both the unemployed and the inactive. The part-time employment equation is:

$$P^*_{ij} = \beta_j X_{ij} + \varepsilon_{ij} \tag{4.2}$$

where the variable P_{ij}, which is only observed if $E_{ij}=1$, is related to the latent variable P^*_{ij} as follows:

$$P_{ij} = \begin{cases} 1 & \text{if } P^*_{ij} > 0 \\ 0 & \text{otherwise} \end{cases}$$

Thus, $P_{ij}=1$ and $P_{ij}=0$ indicate part-time and full-time employment respectively and, following similar studies, a self-assessed measure of part-time and full-time work is used.[102] However, it is reassuring to note the degree of consistency between the self-reporting of part-time employment and hours. The percentage of self-reported part-time workers, who report total usual hours in the main job equal to or less than 30, is 97 percent, compared to 4 percent for those who self-report full-time employment.

It is assumed that μ_{ij} and ε_{ij} are distributed as bivariate normal with zero means, unit variances and that the correlation between the two errors is ρ_j. Given unobservables may affect both equations (for example, ability) the correlation may be non-zero $(\rho_j \neq 0)$ and, in this situation, the results from a simple probit model will be biased.

The variables that determine employment, Y_{ij}, are standard in the literature and include age, age squared, marital status, ethnicity, educational qualifications, the presence of dependent children, housing related variables and a set of regional controls.[103] These variables are also included as determinants of part-time employment, X_{ij}. In this type of model, identification is achieved by including at least one variable in the selection equation that does not affect the outcome equation. As Sartori (2003) notes, the model can be estimated with identical explanatory variables, but it then relies on weak identification through the non-linear error term. In the current context, it is difficult to find an appropriate identifying variable that will affect the employment decision, but not the choice of hours.[104] However, identification is achieved in this model by including a variable indicating the length

[102] Manning and Petrongolo (2004) discuss the relative advantages and disadvantages of this type of measure, but argue that the differences that arise from using alternative definitions are small.
[103] See Table A3.1 for a description of variables that were also included in Chapter 3. In this analysis an additional variable is included to capture the influence of childcare on part-time employment. Dependent children < 2, denotes the total number of dependent children in the household aged less than 2 if the respondent is the head of household or spouse, and is zero otherwise. One further variable is specific to this Chapter; this is a dummy variable (mover), which indicates the length of time at the present residence is less than 12 months, zero otherwise.
[104] In the case of identical explanatory variables between the selection and outcome equation, Sartori (2003) proposes an alternative estimator, which assumes the error terms in the two equations are perfectly correlated for a given observation $(\rho_j = 1$ or $\rho_j = -1)$. This estimator is applied to the data; however, for the majority of specifications the correlation between the two errors terms violates the assumptions required for the technique. Results are therefore are not reported here.

of time at the present residence was less than 12 months.[105] Whilst a change of residence may involve a period without employment, it is less likely to change an individual's preference between full and part-time work.[106] Indeed, a short duration at the current residence is found to have a negative effect on employment (with the exception of disabled men) but does not have a significant effect on the choice of hours.[107]

Additional variables that are observed only for the employed are included in X_{ij}, such as industry, occupation, firm size and sector. For the disabled, a separate specification is estimated that supplements the above model, with controls for the type of health problem and the number of health problems, to examine within group heterogeneity. Five health groups are identified: namely, main health problem effects (i) limbs; (ii) sight and hearing; (iii) skin, breathing and organs; (iv) mental health and (v) other.

Since the focus of this Chapter is the part-time employment decision, the estimates from the bivariate probit model are used to form the predicted probability of part-time employment conditional on employment (P_{ij}^C). The average probability for the *j*th group, with sample η_j, is:

$$P_j^C = \frac{1}{\eta_j} \sum_{i=1}^{\eta_j} \frac{\Phi_2(\beta_j X_{ij}, \gamma_j Y_{ij}, \rho_j)}{\Phi(\gamma_j Y_{ij})} \tag{4.3}$$

where $\Phi_2()$ represents the bivariate normal distribution and $\Phi()$ the standard normal distribution. An Oaxaca (1973) type decomposition, which was applied to the

[105] Variations of this measure including 3 and 6 months were also tested, but did not improve the identification of the model.
[106] It could also be argued the unemployed have more incentive to relocate.
[107] Since, for disabled men, the bivariate probit relies on weak identification, the robustness of the results is tested using a simple probit model of the second stage (that is, assuming $\rho_j = 0$). In a similar manner to equations (4.4) and (4.5), a probit decomposition (Gomulka and Stern, 1990) is applied to decompose the probability of part-time employment into explained and unexplained components. The sensitivity of the main results are also tested by controlling for unobservable characteristics (for example, preferences, motivation) which may contribute to any unexplained difference between the groups identified in equations (4.4) and (4.5). The decomposition is computed using estimates from a random effects probit model on individuals who enter the LFS in 2003, using the 5 quarter longitudinal LFS data.

bivariate probit model by Mohanty (2002), can be used to isolate the unexplained difference in predicted conditional probabilities. This represents the difference in part-time employment due to differences in the coefficient structure between the groups, conditional on the same employment equation.[108] For the work-limited, the unexplained gap is[109]:

$$(P_{D_1}^C - P_N^C)_{\text{unexplained}} = \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_{D_1}X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} - \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_N X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} \tag{4.4}$$

For the non-work-limited the unexplained gap is:

$$(P_{D_2}^C - P_N^C)_{\text{unexplained}} = \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_{D_2}X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} - \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_N X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} \tag{4.5}$$

The first term on the right hand side of equation (4.4) is the predicted conditional probability of being employed part-time, if the non-disabled have the same coefficients for the part-time employment equation as the work-limited disabled, conditional on their own employment equation and characteristics. Therefore, the difference captures the effect of having a different coefficient structure between groups only when choosing part-time or full-time employment. Thus, equation (4.4) captures the effect of both differences in preferences for accommodation and

[108] Note this differs from the total unexplained gap of a decomposition of equation (4.3) for the work-limited disabled and the non-disabled. Equations (4.4) and (4.5) represent the unexplained gap of the second choice decision only. The reason for this distinction is that, if all coefficients are allowed to vary, the difference between the work-limited and the non-work-limited in equation (4.4) will be the combined influence of discrimination and unobserved productivity effects in employment *and* marginalisation and accommodation effects in part-time employment. Equation (4.5) will, then, identify the combined influence of discrimination in employment and marginalisation in the part-time/full-time decision. However, each of the separate influences cannot be identified. By focusing only on the second stage, the influence of marginalisation and accommodation can both be identified, but, of course, the technique assumes that the influence of discrimination on entry to employment can be separated from the marginalisation that may occur in the second stage.

[109] The non-disabled have been used as the reference category given their dominance in the population. The results are not sensitive to this and are similar if the pooled coefficient structure is used. The results presented in Table 4.8 enable a comparison to be made across each of the three alternative base groups.

discrimination. Isolating each of these effects, therefore, requires a decomposition in a similar manner to DeLeire (2001).

The DeLeire (2001) model is modified in order to apply it to the choice of hours. Firstly, the non-work-limited disabled are assumed to have no need to accommodate their disability in work; thus the unexplained gap, equation (4.5), will only reflect unequal treatment in the hours of work equation, since any differences in preferences are assumed to be zero.[110] Secondly, if it is also assumed that any form of unequal treatment against the non-work-limited disabled, in terms of employers marginalising the disabled into part-time employment, is equal to that experienced by the work-limited disabled, then the difference between equations (4.4) and (4.5) will measure the effect of workplace accommodations.[111] Clearly, this interpretation rests on the assumption that all disabled workers are equally discriminated against in the hours equation, but this will not hold if discrimination is positively related to the work-limiting nature of the disability. In this case, therefore, a lower bound of unequal treatment in employment type is identified for the work-limited disabled.

4.4 Results

4.4.1 Descriptive Statistics

Part-time employment is a more important source of work in the UK than the US, representing 24 percent and 13 percent of employment respectively.[112] In both countries, part-time employment rates are higher for disabled employees than the non-disabled (see Table 4.1 for the UK), although the difference in the UK, where part-time employment represents 22 percent of employment for the non-disabled and 30 percent for the disabled, is not as dramatic as in the US, where the rates are 13 percent and 30 percent respectively (see Schur, 2003 for the US data). Importantly for the DeLeire (2001) type approach, it is interesting to note that there is no significant difference in the concentration of workers in part-time employment between the non-work-limited and the non-disabled and, therefore, the concentration in part-time employment is restricted to the work-limited disabled. Figure 4.1

[110] Of course, unequal treatment in the employment equation may still exist.
[111] This is equivalent to $(P^C_{D_1} - P^C_{D_2})_{\text{unexplained}}$ evaluated at the non-disabled base.
[112] Source: OECD Labour Market Data 2004. Employees aged 15-64.

confirms this and shows these trends have been a consistent feature of UK data since 1997. The data in Table 4.1 also show that, as identified in Schur (2002), there is a wage penalty for working part-time. Full-time work-limited disabled male workers earn 84 percent of the average for full-time non-disabled male workers, 79 percent for part-time males, 87 percent for full-time females and 93 percent for part-time females. However, relative to full-time workers, average hourly earnings are lower for part-time workers and, thus, part-time disabled men only earn 62 percent of the non-disabled full-time wage.

Given the aim of this Chapter, it is interesting to examine the reasons for part-time employment reported by those currently employed part-time (Table 4.2). Just over 17 percent of the work-limited disabled report their part-time employment status is due to their disability. The corresponding proportion for the non-work-limited disabled is significantly lower at 1 percent, which provides some support for the first DeLeire (2001) assumption. Importantly, Table 4.2 suggests that there is no significant difference in the proportion reporting that they could not find full-time work across the disability groups, suggesting a limited role for discrimination. However, it is also important to recognise that there may be differences in observable characteristics between the groups that contribute to the differences identified in Tables 4.1 and 4.2. Table 4.3 presents the mean values of the variables included in the analysis. An important feature of these data is the differences in educational attainment achieved by each of the disability groups, which may contribute to their varying concentrations of part-time employment. The work-limited disabled are less than half as likely to have qualifications at degree level and have a higher concentration with no qualifications (the omitted group) than the non-disabled. Consistent with this, the work-limited disabled are underrepresented in professional occupations, but are concentrated in occupations such as personal services, plant and machine operatives and other elementary occupations, where part-time employment is also more common.[113] Similarly, in terms of industry, the work-limited disabled are concentrated in distribution and hotels, an industry which is associated with high rates of part-time employment. Moreover, the work-limited disabled are, also, more

[113] The Duncan and Duncan (1955) index of occupational segregation between part-time and full-time workers is relatively similar between disability groups and is greater than the occupational segregation that exists between disabled and non-disabled workers, regardless of employment type.

likely to be employed in small firms, where part-time employment is also more prevalent.

4.4.2 Bivariate Probit Model

Estimates of the bivariate probit models for each of the disability groups are presented in Tables 4.4 and 4.5 for males and females respectively.[114] A likelihood ratio test indicates the rho parameter is significant at the 10 percent level in all specifications.[115] This supports the bivariate probit model adopted here and suggests that inferences may be misleading when no correction is made for selection into employment.[116] In all specifications the correlation is negative, indicating that unobservables that affect employment positively (for example, ability) have a negative effect on the probability of part-time employment.

The coefficient estimates from the employment equation are largely in accordance with expectations and, since these influences are discussed in Chapter 3, the focus here is on the estimates from the part-time employment equation, which are qualitatively similar across the disability groups. As expected, many of the variables influence part-time employment in the opposite direction to employment. For example, part-time employment decreases with age, although at a diminishing rate. In contrast, living in social rented accommodation and being a member of an ethnic minority both have a positive effect on the probability of part-time employment. To reiterate a point mentioned earlier, the identifying variable, having moved residence in the last 12 months, is negative and significant throughout for females; however, for males it is only a significant determinant of employment for the non-disabled. Thus, for the two disabled male groups, the model relies on weak identification.

There are some gender specific effects, which may be expected, given the motivation behind working part-time may be different for men and women, since it is typically the latter that provide the majority of childcare.[117] Consistent with this, being married

[114] Marginal effects are presented for males and females in Appendix Tables A4.1 and A4.2 respectively.
[115] The only exception to this is for the work-limited disabled females, where the correlation lies just outside the 10 percent significance level.
[116] The variables, typically, have a similar qualitative influence in the probit model.
[117] It is, of course, also the case that the results for males are based on a much smaller sample than for females, which may be driving some of the differences observed.

and having dependent children increases the probability of part-time employment for females. For males, whilst marriage has no significant effect, having another earner in the household reduces the probability of working part-time. Possessing higher qualifications has a consistently strong negative effect on part-time employment for females consistent with an increased opportunity cost of non-work activities such as childcare. Moreover, consistent with the results in Chapter 3, the effect of education is greater for work-limited disabled females than the other groups.[118] For work-limited disabled males, having medium level qualifications reduces the probability of working part-time relative to the base group who have no qualifications.[119] In contrast, for the non-work-limited disabled and the non-disabled groups, having the highest level qualifications (such as a degree) has a positive effect on part-time employment.

The employment related variables have an important influence on the choice of hours, working in a small firm increases the probability of working part-time, whereas working in manufacturing, banking and finance, transport and communication and, for males only, construction decreases the probability of working part-time. Relative to being in a managerial role, all other occupations have a positive influence on part-time employment, and the effect is strongest for elementary and sales and customer service occupations.

Table 4.6 presents the specifications for the disabled that are supplemented with controls for heterogeneity within the disabled group.[120] For the work-limited disabled, consistent with previous evidence (Blackaby *et al.*, 1999 and Kidd *et al.*, 2000), mental health problems (the omitted group) are found to have the most negative effect on employment for both disabled males and females. Similarly, individuals with any health problems, other than mental health, have a lower probability of being employed part-time, confirming the severe labour difficulties faced by individuals in this group.[121] The number of health problems, which is frequently used to proxy the severity of the disability, has a negative effect on

[118] For example, having a degree reduces the probability of part-time employment by 23 percent for disabled females, but only 11 percent for non-disabled females.
[119] The effects are only significant for qualifications, up to and including A levels.
[120] Marginal effects are presented in Appendix Table A4.3.
[121] The 'other' health group is not significantly different to mental health for females.

employment, as expected. This variable also has a positive effect on part-time employment, which is consistent with the workplace accommodation argument. Moreover, the number of health problems does not affect the choice of hours for the non-work-limited disabled, which lends support to the assumption that their disability does not affect their choice of hours.

4.4.3 Conditional Probabilities

The bivariate probit models, presented in Tables 4.4 and 4.5, are used to estimate the conditional part-time employment probabilities for each gender and disability group and these results are presented in the Table 4.7. Consistent with the evidence presented in Table 4.1, the conditional part-time employment probability is 11 percent for disabled males, more than double their non-disabled counterparts, and 50 percent for disabled females, just over 10 percentage points higher than the non-disabled. Table 4.8 shows the effect of changing the coefficients in the part-time employment equation on the predicted probabilities, whilst all other components are left constant. If non-disabled males behave as the work-limited disabled, their predicted conditional probability of part-time employment would rise to nearly 16% (row 3, column 1), an 11 percentage point increase over their own conditional probability. Similarly for females, the probability rises to 58 percent, nearly 19 percentage points higher than their own rate. Reassuringly, if the work-limited disabled are assumed to have the same part-time employment coefficients as the non-disabled (row 1, column 3), their predicted conditional probability of part-time employment falls relative to their own behaviour. It is clear that, for a given set of observable characteristics and selection equation, the part-time employment coefficients for the work-limited disabled increase the conditional probability of part-time employment.

The unexplained gaps reflect a combination of differences in preferences and employer discrimination. If, instead, the coefficients from the non-work-limited disabled are imposed on the non-disabled (row 3, column 2), the probability of part-time employment rises only slightly, by less than 1 percentage point for males and females. Thus, it is the work-limiting nature of the disability that is driving these results and, under the assumptions of DeLeire (2001), this means that the majority of the part-time employment gap is due to the role of part-time employment as an accommodation for a work-limiting disability. The effect of employer marginalisation, albeit a lower bound estimate, is very small, accounting for only 7 percent and 3 percent of the unexplained disability gap in part-time employment for work-limited disabled males and females respectively.[122,123]

4.5 Conclusion

This Chapter presents evidence which identifies the concentration of disabled workers in part-time work in the UK, a feature shared with recent evidence from the US. By extending a method proposed by DeLeire (2001), an issue raised in the US literature, that is, if part-time employment is a result of employer restrictions or choices made by the disabled, is considered. The conditional probability of part-time employment is modelled using a bivariate probit model which controls for non-random selection into employment. Holding observable characteristics constant, the evidence suggests that the probability of part-time employment for the non-disabled would only increase if they behave like the work-limited disabled (and not the non-work-limited disabled) when choosing hours. This is consistent with the work-limiting nature of the disability being the principal determinant of part-time employment and, following the assumptions of a DeLeire (2001) type approach, provides more support for part-time employment as a workplace accommodation than discrimination against the entire disabled group.

These conclusions are consistent with recent evidence in the US, which also supports the voluntary nature of the decision (Schur, 2003 and Hotchkiss, 2004a). Moreover, given the limitations with respect to identification in the bivariate probit, particularly

[122] The decomposition uses the non-disabled group as the base; however, the results are not sensitive to this. For example, if the work-limited disabled are used $(P_{D_1}^C - P_N^C)_{\text{unexplained}}$=0.090 and $(P_{D_2}^C - P_N^C)_{\text{unexplained}}$=0.005.

[123] For the cross sectional probit decomposition $(P_{D_1}^C - P_N^C)_{\text{unexplained}}$=0.042 (males) and 0.070 (females) and $(P_{D_2}^C - P_N^C)_{\text{unexplained}}$ =-0.008 (males) and -0.015 (females). Whilst the values of $(P_{D_1}^C - P_N^C)_{\text{unexplained}}$ are smaller than in the bivariate probit decomposition, the overall conclusions remain the same. Workplace accommodation plays a far greater role than discrimination in the choice of part-time employment. Indeed, the small negative discrimination effect is consistent with there being no discrimination against the disabled in terms of hours. It is also reassuring to note that these results are robust to using the longitudinal data (all who entered the LFS in 2003) and, the results are qualitatively similar for females after controlling for random effects. For males, however, the small sample sizes precluded this additional estimation.

for disabled males, it is reassuring to note that the main conclusions are robust to estimation using a probit decomposition, and are consistent with the self-reported reasons for part-time employment. However, further analysis on the basis of the days and times of employment, in addition to the distribution of total hours, may further our understanding of how these features facilitate or impede the disabled in accessing work.

Heterogeneity within the disabled group is also identified on the basis of the type and severity of health problem. Individuals with mental health problems are significantly more likely to be employed part-time, in addition to being the least likely to be in employment, confirming the particular labour market disadvantage faced by this disabled group. Part-time employment also increases with the number of health problems, supporting its role in facilitating employment for those that otherwise could not work.

Further examination of this issue would naturally be extended to consider the dynamic nature of disability and the associated labour market transitions. Longitudinal data could be used to examine if transitions into (out from) part-time employment are the result of disability onset (exit). Moreover, it may be possible to identify if transitions between full and part-time work are associated with a change in the nature of employment and/or employer. Movements between full-time and part-time work within the same position would provide support for employer provided accommodations. Separate examination of the earnings of full-time and part-time workers may also provide insights into the relative magnitude of unexplained earnings differences and thus, possibly, a further motivation for the choice of hours. Equally, future research needs to consider other mechanisms through which the disabled may accommodate their disability. Consideration is given to the issue of self-employment in Chapter 5, but other features of employment that appear to be important and that have received little attention include home working and travel to work.

Figure 4.1. Proportion of Employees in Part-time Employment, 1997-2003

Notes: The sample is restricted to UK employees of working age and excludes full-time students. Data are obtained from the Summer quarter of the LFS for each year.

Table 4.1. Descriptive Statistics

	Male			Female		
	Work-limited disabled	Non-work-limited disabled	Non-disabled	Work-limited disabled	Non-work-limited disabled	Non-disabled
Employment rate (%)	37.41***	87.20***	88.62	36.02***	77.30	77.20
Of those in employment						
% in part-time employment	11.33***	5.25	5.00	49.43***	39.17	39.49
% temporary contract	5.31***	3.62*	4.12	6.53***	4.71**	5.48
% flexible working hours	9.83	8.96	8.81	13.28	14.30	12.68
% shiftwork	22.93	21.54	21.90	16.94	15.64	15.59
Part-time employment						
Average hourly earnings (£)	7.43**	9.25	9.37	7.33**	7.33***	7.92
% Incapacity benefit claimants	7.76			3.44		
Full-time employment						
Average hourly earnings (£)	10.02***	11.73	11.94	8.61***	9.49***	9.87
% Incapacity benefit claimant	1.73			2.27		

Notes: Data relate to 2003 and the sample is restricted to UK employees of working age and excludes full-time students. ***,** and * denote differences from the relevant non-disabled comparator group at the 1%, 5% and 10% significance level respectively.

Table 4.2. Reason for Part-time Employment

	Work-limited disabled	Non-work-limited disabled	Non-disabled
Student	1.77***	2.01***	4.08
Ill or disabled	17.19***	1.20***	0.25
Could not find full-time job	9.38	8.86	9.52
Did not want full-time work	71.67***	87.93**	86.15

Notes: See notes to Table 4.1. Figures relate to percentage of valid responses within each group.

Table 4.3. Variable Means

	Males			Females		
	Work-limited disabled	Non-work -limited disabled	Non-disabled	Work-limited disabled	Non-work -limited disabled	Non-disabled
Employment	0.370	0.871	0.884	0.357	0.770	0.770
Part-time	0.115	0.053	0.049	0.497	0.394	0.396
Age	47.537	45.792	39.014	44.330	42.401	38.173
Single	0.282	0.240	0.360	0.227	0.241	0.302
Married	0.584	0.678	0.573	0.577	0.629	0.597
Degree	0.079	0.174	0.214	0.071	0.134	0.174
Other higher education	0.058	0.093	0.087	0.080	0.109	0.105
A Level	0.272	0.320	0.282	0.124	0.159	0.161
O level	0.129	0.153	0.177	0.218	0.266	0.277
Other qualifications	0.158	0.138	0.130	0.159	0.159	0.139
Home owned	0.251	0.242	0.176	0.205	0.204	0.159
Home mortgaged	0.347	0.582	0.620	0.382	0.551	0.603
Social housing	0.316	0.107	0.104	0.331	0.164	0.139
Dependent children	0.464	0.529	0.682	0.658	0.704	0.913
Dependent child<2	0.035	0.045	0.075	0.042	0.056	0.098
White	0.933	0.956	0.930	0.921	0.947	0.919
Other earner	0.420	0.632	0.666	0.508	0.679	0.718
Small firm	0.274	0.238	0.239	0.318	0.293	0.288
Agriculture & fishing	0.013	0.011	0.011	0.004	0.004	0.003
Manufacturing	0.238	0.254	0.238	0.078	0.077	0.087
Construction	0.084	0.092	0.100	0.012	0.018	0.015
Distribution	0.175	0.153	0.160	0.234	0.200	0.202
Transport & communication	0.107	0.103	0.101	0.032	0.036	0.039
Banking & finance	0.122	0.141	0.152	0.122	0.138	0.151
Public admin	0.189	0.180	0.178	0.457	0.471	0.445
Public sector	0.201	0.204	0.195	0.373	0.388	0.374
Professional	0.103	0.126	0.142	0.079	0.102	0.118
Associate professional	0.118	0.126	0.139	0.127	0.134	0.149
Administrative	0.061	0.053	0.054	0.217	0.253	0.240
Skilled trades	0.176	0.164	0.166	0.023	0.019	0.016
Personal service occupations	0.034	0.025	0.021	0.152	0.138	0.134
Sales & customer service	0.036	0.033	0.038	0.131	0.113	0.110
Process, plant & machine	0.160	0.149	0.130	0.039	0.026	0.027
Elementary	0.176	0.120	0.113	0.156	0.115	0.104
Mover	0.083	0.073	0.110	0.077	0.088	0.113
Limbs	0.390	0.207		0.408	0.185	
Sight or hearing	0.039	0.056		0.034	0.034	
Skin, breathing & organs	0.321	0.627		0.253	0.561	
Mental health	0.129	0.026		0.149	0.034	
Other	0.122	0.085		0.155	0.187	
Number of health problems	2.582	1.401		2.620	1.463	

Notes: Means relate to regression samples

Table 4.4. Male Part-time Bivariate Probit Estimates

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Part	Employ	Part	Employ	Part	Employ
Constant	1.073	-2.119***	1.482*	-2.620***	1.520***	-2.420***
	(1.10)	(9.33)	(1.69)	(7.89)	(3.69)	(18.95)
Age	-0.111***	0.079***	-0.186***	0.179***	-0.184***	0.169***
	(6.09)	(8.45)	(7.96)	(13.08)	(14.18)	(31.18)
Age squared/100	0.162***	-0.121***	0.239***	-0.228***	0.240***	-0.220***
	(7.33)	(11.28)	(8.75)	(14.42)	(14.77)	(33.21)
Single	0.272**	-0.103*	0.141	-0.111	0.089	-0.092**
	(2.12)	(1.68)	(0.98)	(1.10)	(1.29)	(2.03)
Married	0.020	0.121**	-0.012	0.129	0.006	0.102**
	(0.16)	(2.30)	(0.10)	(1.49)	(0.10)	(2.52)
North	0.385***	-0.364***	0.215	-0.280***	0.272***	-0.189***
	(2.74)	(5.41)	(1.53)	(2.62)	(4.27)	(4.15)
Yorkshire & Humberside	0.035	-0.141**	-0.001	0.062	0.121**	0.003
	(0.29)	(2.42)	(0.01)	(0.69)	(2.32)	(0.09)
East Midlands	0.133	-0.108*	0.042	0.029	-0.030	0.037
	(1.05)	(1.65)	(0.33)	(0.29)	(0.48)	(0.85)
East Anglia	0.094	-0.077	-0.103	0.039	0.033	0.025
	(0.59)	(0.88)	(0.60)	(0.30)	(0.41)	(0.44)
South West	0.201	0.038	-0.060	0.008	0.116**	0.052
	(1.63)	(0.61)	(0.49)	(0.09)	(2.11)	(1.25)
West Midlands	0.217**	-0.086	-0.089	-0.059	0.042	0.086**
	(1.97)	(1.44)	(0.69)	(0.65)	(0.78)	(2.20)
North West	0.174	-0.264***	-0.064	-0.124	0.013	-0.053
	(1.39)	(4.66)	(0.52)	(1.48)	(0.25)	(1.44)
Wales	0.400***	-0.398***	0.037	0.025	-0.005	-0.112**
	(2.81)	(5.77)	(0.26)	(0.21)	(0.07)	(2.29)
Scotland	0.293**	-0.266***	-0.147	-0.158*	-0.025	-0.015
	(2.53)	(4.39)	(1.03)	(1.75)	(0.46)	(0.39)
Northern Ireland	0.471**	-0.592***	-0.421	-0.332**	-0.119	-0.171***
	(2.35)	(6.92)	(1.27)	(2.23)	(1.37)	(3.24)
Degree	-0.251	0.841***	0.368**	0.060	0.243***	0.308***
	(0.90)	(13.42)	(2.37)	(0.70)	(3.23)	(8.69)
Other higher education	-0.262	0.781***	0.192	-0.088	0.156*	0.312***
	(0.99)	(11.17)	(1.29)	(0.93)	(1.94)	(6.88)
A level	-0.389***	0.540***	0.044	0.320***	-0.014	0.391***
	(2.62)	(12.55)	(0.33)	(4.34)	(0.21)	(11.97)
O level	-0.292*	0.555***	0.120	0.156*	-0.065	0.316***
	(1.67)	(10.59)	(0.93)	(1.80)	(1.02)	(9.00)
Other	-0.285**	0.386***	-0.045	0.263***	-0.108*	0.306***
	(2.21)	(7.85)	(0.35)	(3.05)	(1.72)	(8.35)
Home owned	0.309*	0.103	0.634***	-0.286***	0.262***	-0.208***
	(1.90)	(1.64)	(4.12)	(2.83)	(4.88)	(5.22)
Home mortgaged	-0.071	0.439***	0.129	0.321***	-0.115**	0.229***
	(0.38)	(7.35)	(0.74)	(3.27)	(2.19)	(6.38)
Social housing	0.554***	-0.479***	0.395**	-0.387***	0.304***	-0.568***
	(3.97)	(7.92)	(2.34)	(3.64)	(3.97)	(14.26)
Dependent children	0.099**	0.008	0.054	-0.057	0.107***	-0.052***
	(2.27)	(0.40)	(1.18)	(1.56)	(5.89)	(3.95)
Dependent child <2	-0.312*	0.074	-0.254	0.045	-0.147**	0.093**
	(1.81)	(0.86)	(1.24)	(0.33)	(2.31)	(2.05)
White	-0.450***	0.316***	-0.311**	0.409***	-0.482***	0.359***

	(3.84)	(4.91)	(2.22)	(3.95)	(9.44)	(9.99)
Summer	-0.055	0.052	-0.142	0.028	0.073*	-0.031
	(0.68)	(1.19)	(1.59)	(0.43)	(1.86)	(1.08)
Autumn	-0.031	-0.009	-0.035	0.062	-0.019	-0.013
	(0.37)	(0.20)	(0.40)	(0.91)	(0.46)	(0.48)
Winter	-0.089	0.081*	-0.155*	0.044	0.021	0.023
	(1.09)	(1.87)	(1.72)	(0.65)	(0.53)	(0.80)
Other earner	-0.477***	0.491***	-0.316***	0.484***	-0.226***	0.387***
	(4.97)	(14.39)	(3.13)	(9.42)	(4.98)	(17.60)
Small firm	0.447***		0.311***		0.371***	
	(3.89)		(3.70)		(10.60)	
Agriculture & fishing	-0.120		-0.860**		-0.414***	
	(0.47)		(2.10)		(3.33)	
Manufacturing	-0.490***		-0.670***		-0.684***	
	(2.94)		(3.35)		(9.45)	
Construction	-0.562***		-0.653***		-0.722***	
	(2.78)		(2.90)		(8.26)	
Distribution	0.062		0.095		-0.015	
	(0.54)		(0.75)		(0.27)	
Transport & communication	-0.277*		-0.273*		-0.359***	
	(1.90)		(1.85)		(5.33)	
Banking & finance	-0.368**		-0.102		-0.423***	
	(2.40)		(0.78)		(6.47)	
Public admin	0.106		0.254*		0.052	
	(0.83)		(1.88)		(0.84)	
Public sector	-0.136		-0.217**		-0.046	
	(1.26)		(1.99)		(0.90)	
Professional	0.290*		0.378**		0.362***	
	(1.82)		(2.52)		(5.41)	
Associate professional	0.306**		0.170		0.331***	
	(1.98)		(1.19)		(4.92)	
Administrative	0.658***		0.593***		0.718***	
	(3.20)		(3.21)		(9.20)	
Skilled trades	0.165		0.026		0.233***	
	(1.21)		(0.17)		(3.31)	
Personal service occupations	0.511**		1.077***		1.010***	
	(2.49)		(4.24)		(10.94)	
Sales & customer service	0.720***		0.724***		1.068***	
	(3.21)		(3.43)		(12.90)	
Process, plant & machine	0.365**		0.534***		0.611***	
	(2.36)		(3.19)		(8.44)	
Elementary	0.855***		1.022***		1.048***	
	(3.72)		(4.60)		(13.73)	
Mover		0.025		-0.034		-0.138***
		(0.44)		(0.37)		(4.26)
ρ	-0.608		-0.696		-0.402	
(p-value)	LR (ρ=0): $\chi^2(1)$ = 2.95 (p=0.086)		LR (ρ=0): $\chi^2(1)$ =2.87 (p=0.090)		LR (ρ=0): $\chi^2(1)$ =4.17 (p=0.041)	
Observations	8643		5813		32843	
Censored	5443		751		3794	
Log Likelihood	-5285.60		-2546.27		14008.66	
Wald $\chi^2(46)$	634.57		563.73		2214.30	
(p-value)	(0.00)		(0.00)		(0.00)	

Notes: Z statistics reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. Censored observations are those that are removed at the first (selection) stage. In this case they refer to the non-employed.

Table 4.5. Female Part-time Bivariate Probit Estimates

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Part	Employ	Part	Employ	Part	Employ
Constant	-0.518	-1.625***	0.500	-3.160***	-1.295***	-2.625***
	(0.59)	(6.47)	(0.83)	(9.80)	(5.58)	(21.68)
Age	-0.016	0.054***	-0.132***	0.172***	-0.059***	0.157***
	(0.80)	(4.84)	(7.18)	(11.62)	(7.41)	(26.67)
Age squared/100	0.047**	-0.090***	0.179 ***	-0.216***	0.096***	-0.200***
	(1.99)	(6.61)	(8.11)	(11.87)	(9.69)	(26.58)
Single	0.069	-0.148***	-0.180**	-0.022	0.078**	-0.108***
	(0.79)	(2.63)	(2.11)	(0.28)	(2.20)	(3.16)
Married	0.349***	-0.197***	0.389***	-0.253***	0.470***	-0.331***
	(5.34)	(4.52)	(5.98)	(3.94)	(16.00)	(11.26)
North	0.031	-0.222***	-0.116	-0.058	-0.123***	0.064*
	(0.27)	(3.29)	(1.22)	(0.65)	(3.12)	(1.73)
Yorkshire &	0.009	-0.103*	-0.101	0.135*	0.061*	0.106***
Humberside	(0.11)	(1.79)	(1.38)	(1.86)	(1.94)	(3.52)
East Midlands	0.126	-0.141**	-0.043	0.013	-0.008	0.138***
	(1.39)	(2.17)	(0.51)	(0.16)	(0.21)	(4.07)
East Anglia	0.025	-0.057	-0.020	0.154	0.044	0.136***
	(0.21)	(0.65)	(0.17)	(1.30)	(0.99)	(3.14)
South West	0.152*	-0.015	-0.000	0.060	0.058*	0.099***
	(1.84)	(0.25)	(0.00)	(0.79)	(1.76)	(3.11)
West Midlands	0.044	-0.117**	-0.218***	0.057	0.002	0.089***
	(0.53)	(2.03)	(2.71)	(0.75)	(0.05)	(2.97)
North West	0.112	-0.194***	-0.165**	0.131*	-0.126***	0.145***
	(1.32)	(3.45)	(2.26)	(1.80)	(4.12)	(4.91)
Wales	0.113	-0.299***	-0.123	0.006	-0.160***	0.166***
	(0.99)	(4.31)	(1.19)	(0.06)	(3.89)	(4.09)
Scotland	0.062	-0.227***	-0.149*	0.045	-0.128***	0.180***
	(0.64)	(3.81)	(1.94)	(0.61)	(4.04)	(5.74)
Northern Ireland	-0.043	-0.409***	-0.403***	0.237*	-0.365***	-0.001
	(0.26)	(5.08)	(2.81)	(1.67)	(7.85)	(0.02)
Degree	-0.681***	1.005***	-0.320***	0.691***	-0.268***	0.723***
	(4.15)	(15.79)	(2.97)	(8.99)	(5.97)	(24.29)
Other higher	-0.535***	0.912***	-0.263**	0.689***	-0.193***	0.817***
education	(3.26)	(15.45)	(2.54)	(8.82)	(4.23)	(24.10)
A level	-0.567***	0.718***	-0.237***	0.591***	-0.172***	0.577***
	(5.03)	(14.05)	(2.64)	(8.53)	(4.48)	(20.21)
O level	-0.374***	0.615***	-0.196**	0.553***	-0.088**	0.508***
	(3.23)	(13.96)	(2.41)	(9.23)	(2.51)	(20.49)
Other	-0.331***	0.518***	-0.262***	0.362***	-0.171***	0.366***
	(3.06)	(10.95)	(3.40)	(5.67)	(4.83)	(13.23)
Home owned	0.128	0.095	0.394***	-0.007	0.317***	-0.064*
	(1.20)	(1.47)	(3.98)	(0.08)	(8.37)	(1.93)
Home mortgaged	-0.224**	0.334***	-0.050	0.440***	0.031	0.364***
	(2.32)	(5.60)	(0.52)	(5.80)	(0.86)	(12.85)
Social housing	0.146	-0.438***	0.209**	-0.142*	0.231***	-0.287***
	(1.13)	(7.17)	(2.15)	(1.75)	(5.65)	(9.00)
Dependent	0.334***	-0.148***	0.532***	-0.388***	0.515***	-0.367***
children	(10.20)	(7.80)	(19.49)	(15.97)	(45.29)	(40.38)
Dependent	0.659***	-0.468***	0.644***	-0.416***	0.568***	-0.501***
children <2	(4.77)	(5.35)	(6.22)	(5.13)	(16.56)	(20.05)

White	0.090	0.405***	0.352**	0.430***	0.338***	0.400***
	(0.56)	(6.46)	(2.52)	(5.28)	(7.63)	(14.31)
Summer	0.033	-0.039	-0.074	-0.051	0.004	-0.069***
	(0.54)	(0.91)	(1.28)	(0.92)	(0.15)	(3.11)
Autumn	0.047	-0.039	0.016	-0.012	-0.039*	-0.030
	(0.76)	(0.91)	(0.28)	(0.21)	(1.66)	(1.34)
Winter	0.025	-0.043	0.050	-0.017	0.008	-0.029
	(0.41)	(0.98)	(0.88)	(0.31)	(0.36)	(1.31)
Other earner	-0.212**	0.435***	-0.056	0.376***	-0.017	0.297***
	(2.30)	(12.21)	(0.88)	(8.02)	(0.68)	(15.09)
Small firm	0.423***		0.369***		0.349***	
	(5.04)		(7.53)		(18.04)	
Agriculture & fishing	-0.196		-0.318		-0.054	
	(0.58)		(0.98)		(0.37)	
Manufacturing	-0.593***		-0.521***		-0.403***	
	(3.38)		(4.05)		(8.20)	
Construction	-0.156		0.136		-0.102	
	(0.75)		(0.82)		(1.36)	
Distribution	-0.044		0.123		0.071*	
	(0.43)		(1.23)		(1.71)	
Transport & communication	-0.023		-0.316**		-0.272***	
	(0.16)		(2.28)		(4.90)	
Banking & finance	-0.247**		-0.057		-0.127***	
	(2.11)		(0.56)		(3.03)	
Public admin	-0.019		0.064		0.117***	
	(0.20)		(0.69)		(3.03)	
Public sector	0.035		0.066		-0.008	
	(0.56)		(1.13)		(0.31)	
Professional	0.586***		0.303***		0.365***	
	(3.59)		(2.77)		(8.47)	
Associate professional	0.565***		0.522***		0.578***	
	(3.72)		(5.23)		(14.49)	
Administrative	0.693***		0.736***		0.834***	
	(4.16)		(7.68)		(22.14)	
Skilled trades	0.781***		0.604***		0.718***	
	(3.57)		(3.59)		(10.14)	
Personal service occupations	0.882***		0.909***		0.886***	
	(4.65)		(8.28)		(21.04)	
Sales and customer service	1.154***		1.268***		1.349***	
	(4.96)		(10.20)		(29.57)	
Process, plant and machine	0.691***		1.010***		0.778***	
	(3.66)		(5.91)		(11.89)	
Elementary	1.354***		1.552***		1.543***	
	(4.95)		(11.58)		(32.50)	
Mover		-0.107*		-0.201***		-0.163***
		(1.79)		(2.91)		(6.27)
ρ	-0.724		-0.611		-0.408	
(p-value)	LR (ρ=0): $\chi^2(1) = 2.47$ (p= 0.1159)		LR (ρ=0): $\chi^2(1) = 6.12$ (p=0.013)		LR (ρ=0): $\chi^2(1) = 29.30$ (p=0.000)	
Observations	8631		5937		37286	
Censored	5553		1363		8579	
Log Likelihood	-6255.624		-4999.574		-30845.43	
Wald $\chi^2(46)$	998.41		1261.53		8051.01	
(p-value)	(0.00)		(0.00)		(0.00)	

Notes: See notes to Table 4.4.

Table 4.6. Within Group Heterogeneity Part-time Bivariate Probit Estimates

	Male				Female			
	Work-limited		Non-work-limited		Work-limited		Non-work-limited	
	Part	Employ	Part	Employ	Part	Employ	Part	Employ
Constant	1.119	-2.490***	1.995**	-3.088***	-0.695	-2.095***	0.587	-3.464***
	(0.93)	(10.26)	(2.15)	(8.67)	(0.77)	(7.90)	(0.91)	(10.11)
Age	-0.112***	0.089***	-0.186***	0.180***	-0.016	0.070***	-0.133***	0.175***
	(4.92)	(9.02)	(8.22)	(13.07)	(0.75)	(5.98)	(7.14)	(11.69)
Age squared/100	0.162 ***	-0.131 ***	0.240***	-0.230***	0.046*	-0.106***	0.180***	-0.219***
	(5.57)	(11.60)	(9.10)	(14.43)	(1.80)	(7.50)	(8.07)	(11.94)
Single	0.235*	-0.056	0.140	-0.097	0.044	-0.135**	-0.185**	-0.031
	(1.70)	(0.87)	(0.99)	(0.95)	(0.48)	(2.29)	(2.15)	(0.38)
Married	0.033	0.126**	-0.022	0.136	0.364***	-0.251***	0.390***	-0.256***
	(0.25)	(2.28)	(0.18)	(1.57)	(5.32)	(5.56)	(5.95)	(3.96)
North	0.329**	-0.309***	0.235*	-0.297***	-0.022	-0.161**	-0.107	-0.046
	(2.16)	(4.35)	(1.69)	(2.77)	(0.19)	(2.29)	(1.13)	(0.51)
Yorkshire & Humberside	-0.011	-0.079	-0.000	0.069	-0.016	-0.061	-0.094	0.147**
	(0.09)	(1.30)	(0.00)	(0.76)	(0.18)	(1.01)	(1.28)	(2.02)
East Midlands	0.089	-0.050	0.044	0.025	0.104	-0.094	-0.030	0.026
	(0.65)	(0.73)	(0.35)	(0.24)	(1.09)	(1.40)	(0.35)	(0.31)
East Anglia	0.174	-0.170*	-0.091	0.024	0.048	-0.102	-0.017	0.166
	(1.03)	(1.87)	(0.53)	(0.18)	(0.37)	(1.13)	(0.15)	(1.39)
South West	0.220	0.093	-0.061	0.001	0.139	0.031	-0.009	0.072
	(1.63)	(1.39)	(0.51)	(0.01)	(1.60)	(0.50)	(0.12)	(0.93)
West Midlands	0.243**	-0.074	-0.082	-0.051	0.028	-0.092	-0.219***	0.069
	(2.07)	(1.18)	(0.64)	(0.56)	(0.32)	(1.53)	(2.71)	(0.91)
North West	0.174	-0.284***	-0.045	-0.116	0.110	-0.200***	-0.165**	0.128*
	(1.24)	(4.82)	(0.37)	(1.38)	(1.23)	(3.43)	(2.25)	(1.76)
Wales	0.365**	-0.325***	0.039	0.048	0.071	-0.243***	-0.120	0.014
	(2.40)	(4.45)	(0.28)	(0.40)	(0.62)	(3.37)	(1.16)	(0.14)
Scotland	0.252**	-0.205***	-0.147	-0.156*	-0.005	-0.127**	-0.142*	0.053

	(2.05)	(3.22)	(1.01)	(1.72)	(0.06)	(2.05)	(1.85)	(0.71)
Northern Ireland	0.499**	-0.723***	-0.386	-0.326**	-0.069	-0.466***	-0.409***	0.246*
	(1.98)	(8.23)	(1.16)	(2.18)	(0.40)	(5.65)	(2.85)	(1.72)
Degree	-0.130	0.777***	0.368**	0.038	-0.592***	0.964***	-0.315***	0.695***
	(0.44)	(11.81)	(2.37)	(0.44)	(3.54)	(14.63)	(2.90)	(9.02)
Other higher education	-0.157	0.771***	0.185	-0.102	-0.439***	0.888***	-0.263**	0.698***
	(0.53)	(10.48)	(1.26)	(1.07)	(2.64)	(14.47)	(2.52)	(8.88)
A level	-0.285*	0.471***	0.041	0.304***	-0.499***	0.688***	-0.235***	0.604***
	(1.72)	(10.44)	(0.31)	(4.11)	(4.14)	(12.95)	(2.59)	(8.68)
O level	-0.218	0.503***	0.111	0.151*	-0.303***	0.577***	-0.192**	0.559***
	(1.14)	(9.16)	(0.86)	(1.74)	(2.59)	(12.62)	(2.33)	(9.29)
Other	-0.234	0.363***	-0.055	0.266***	-0.282**	0.499***	-0.252***	0.371***
	(1.59)	(7.07)	(0.43)	(3.06)	(2.50)	(10.18)	(3.26)	(5.78)
Home owned	0.351**	0.096	0.635***	-0.300***	0.148	0.073	0.390***	-0.018
	(2.10)	(1.45)	(4.16)	(2.95)	(1.40)	(1.09)	(3.94)	(0.21)
Home mortgaged	-0.018	0.433***	0.130	0.301***	-0.199**	0.314***	-0.056	0.427***
	(0.09)	(6.89)	(0.75)	(3.05)	(2.01)	(5.07)	(0.58)	(5.59)
Social housing	0.478***	-0.425***	0.385**	-0.381***	0.074	-0.398***	0.204**	-0.141*
	(3.02)	(6.66)	(2.33)	(3.57)	(0.58)	(6.24)	(2.08)	(1.73)
Dependent children	0.132***	-0.020	0.057	-0.059	0.359***	-0.189***	0.532***	-0.389***
	(3.15)	(0.97)	(1.25)	(1.62)	(11.89)	(9.71)	(19.39)	(15.95)
Dependent children <2	-0.308*	0.049	-0.236	0.030	0.666***	-0.505***	0.649***	-0.441***
	(1.69)	(0.54)	(1.16)	(0.22)	(4.59)	(5.68)	(6.22)	(5.39)
White	-0.486***	0.389***	-0.353**	0.424***	0.118	0.478***	0.353**	0.432***
	(3.61)	(5.78)	(2.55)	(4.07)	(0.74)	(7.38)	(2.52)	(5.27)
Summer	-0.075	0.075	-0.149*	0.030	0.037	-0.058	-0.081	-0.048
	(0.85)	(1.64)	(1.66)	(0.45)	(0.57)	(1.32)	(1.40)	(0.86)
Autumn	-0.045	-0.012	-0.034	0.071	0.044	-0.035	0.010	-0.006
	(0.50)	(0.27)	(0.40)	(1.03)	(0.69)	(0.78)	(0.18)	(0.12)
Winter	-0.084	0.077*	-0.142	0.050	0.023	-0.040	0.044	-0.020
	(0.96)	(1.70)	(1.58)	(0.74)	(0.36)	(0.88)	(0.77)	(0.35)
Other earner	-0.412***	0.438***	-0.302***	0.472***	-0.148*	0.386***	-0.058	0.361***

	(3.82)	(12.28)	(3.00)	(9.15)	(1.70)	(10.46)	(0.92)	(7.66)
Number of health problems	**0.150****	**-0.226*****	**0.034**	**-0.016**	**0.088*****	**-0.182*****	**-0.011**	**-0.055****
	(2.38)	**(20.70)**	**(0.93)**	**(0.55)**	**(2.64)**	**(18.17)**	**(0.46)**	**(2.49)**
Limbs	**-0.665*****	**0.767*****	**-0.554*****	**0.549*****	**-0.362*****	**0.684*****	**-0.106**	**0.395*****
	(3.27)	**(13.20)**	**(2.99)**	**(4.11)**	**(2.63)**	**(12.61)**	**(0.77)**	**(3.63)**
Sight/hearing	**-0.799*****	**0.818*****	**-0.298**	**0.576*****	**-0.314***	**0.779*****	**-0.124**	**0.439*****
	(3.35)	**(8.78)**	**(1.33)**	**(3.63)**	**(1.66)**	**(8.25)**	**(0.73)**	**(2.96)**
Skin, breathing & organs	**-0.679*****	**0.809*****	**-0.507*****	**0.513*****	**-0.409*****	**0.764*****	**-0.038**	**0.376*****
	(3.16)	**(13.59)**	**(2.84)**	**(4.04)**	**(2.80)**	**(13.34)**	**(0.29)**	**(3.68)**
Other	**-0.318***	**0.393*****	**-0.527*****	**0.455*****	**-0.088**	**0.456*****	**-0.040**	**0.292*****
	(1.96)	**(5.71)**	**(2.63)**	**(3.09)**	**(0.63)**	**(7.39)**	**(0.29)**	**(2.69)**
Small firm	0.486***		0.297***		0.454***		0.371***	
	(4.48)		(3.50)		(6.09)		(7.53)	
Agriculture & fishing	-0.176		-0.818**		-0.281		-0.372	
	(0.64)		(2.03)		(0.78)		(1.11)	
Manufacturing	-0.553***		-0.677***		-0.627***		-0.522***	
	(3.28)		(3.24)		(3.87)		(4.04)	
Construction	-0.679***		-0.634***		-0.172		0.133	
	(3.17)		(2.80)		(0.78)		(0.80)	
Distribution	0.043		0.085		-0.048		0.122	
	(0.34)		(0.68)		(0.44)		(1.21)	
Transport & communications	-0.296*		-0.287*		-0.013		-0.307**	
	(1.93)		(1.94)		(0.09)		(2.19)	
Banking & finance	-0.409***		-0.098		-0.264**		-0.066	
	(2.59)		(0.77)		(2.25)		(0.65)	
Public admin	0.115		0.226*		-0.011		0.068	
	(0.83)		(1.69)		(0.11)		(0.72)	
Public sector	-0.188		-0.218**		0.027		0.061	
	(1.61)		(2.01)		(0.40)		(1.03)	
Professional	0.338**		0.339**		0.635***		0.302***	
	(2.01)		(2.28)		(4.12)		(2.76)	
Associate professional	0.332**		0.167		0.626***		0.518***	

	(2.04)		(1.19)		(4.41)		(5.19)	
Administrative	0.729***		0.582***		0.752***		0.736***	
	(3.54)		(3.08)		(5.14)		(7.65)	
Skilled trades	0.189		0.030		0.860***		0.607***	
	(1.27)		(0.20)		(4.14)		(3.60)	
Personal service	0.520**		1.043***		0.958***		0.904***	
occupations	(2.50)		(3.89)		(5.70)		(8.21)	
Sales & customer service	0.801***		0.687***		1.262***		1.269***	
	(3.58)		(3.21)		(6.34)		(10.15)	
Process, plant & machine	0.403**		0.520***		0.745***		1.005***	
	(2.49)		(3.03)		(4.00)		(5.87)	
Elementary	0.909***		0.988***		1.472***		1.549***	
	(4.21)		(4.22)		(6.50)		(11.51)	
Mover		-0.006		-0.029		-0.131**		-0.213***
		(0.10)		(0.32)		(2.09)		(3.06)
ρ	-0.497		-0.730		-0.622		-0.615	
	LR (ρ=0): $\chi^2(1) = 1.61$		LR (ρ=0): $\chi^2(1) = 3.12$		LR (ρ=0): $\chi^2(1) = 3.54$		LR (ρ=0): $\chi^2(1) = 6.25$	
(p-value)	(p= 0.2041)		(p= 0.078)		(p= 0.060)		(p= 0.0124)	
Observations	8583		5791		8581		5902	
Censored	5396		747		5513		1359	
Log Likelihood	-4852.64		-2522.45		-5924.497		-4951.98	
Wald $\chi^2(51)$ (p-value)	519.30 (0.00)		581.23 (0.00)		996.76 (0.00)		1265.73 (0.00)	

Notes: See notes to Table 4.4. The controls for within group differences are highlighted in **bold**.

Table 4.7. Predicted Conditional Part-time Employment Probabilities

	Males			Females		
	Work-limited disabled	Non-work-limited disabled	Non-disabled	Work-limited disabled	Non-work-limited disabled	Non-disabled
Probability of employment	0.3714	0.8708	0.8846	0.3573	0.7703	0.7699
Conditional probability of part-time employment (P_j^C)	0.1144	0.0530	0.0495	0.4971	0.3935	0.3937

Notes: Predicted probabilities calculated from bivariate probit estimates presented in Tables 4.4 and 4.5. Probabilities are calculated as follows:

$$\hat{P}_{\text{Emp } ij} = \Phi(\gamma_j Y_{ij})$$

$$\hat{P}_{ij}^C = \frac{\Phi_2(B_j X_{ij}, \gamma_j Y_{ij}, \rho_j)}{\Phi(\gamma_j Y_{ij})}$$

Table 4.8. Decomposition of Predicted Conditional Part-time Employment Probabilities

	Coefficient vector on part-time employment equation		
Males	β_{D_1}	β_{D_2}	β_N
Disabled work-limited	0.1144	0.0295	0.0247
Disabled non-work-limited	0.1722	0.0530	0.0462
Non-disabled	0.1578	0.0573	0.0495
$(P_{D_1}^C - P_N^C)_{\text{unexplained}}$	0.1083		
$(P_{D_2}^C - P_N^C)_{\text{unexplained}}$	0.0079		
Females	β_{D_1}	β_{D_2}	β_N
Disabled work-limited	0.4971	0.2753	0.2639
Disabled non-work-limited	0.6025	0.3935	0.3872
Non-disabled	0.5809	0.3991	0.3937
$(P_{D_1}^C - P_N^C)_{\text{unexplained}}$	0.1872		
$(P_{D_2}^C - P_N^C)_{\text{unexplained}}$	0.0054		

Notes: Estimates calculated from equations (4.4) and (4.5) and are based on the estimates in Tables 4.4 and 4.5.

CHAPTER FOUR

APPENDIX

Table A4.1. Male Part-time Bivariate Probit Model Marginal Effects

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Part	Employ	Part	Employ	Part	Employ
Age	-0.041***	0.029***	-0.018*	0.027***	-0.013***	0.025***
	(3.29)	(8.46)	(1.95)	(12.79)	(4.39)	(30.57)
Age squared/100	0.060***	-0.044***	0.024**	-0.034***	0.017***	-0.033***
	(3.35)	(11.31)	(1.98)	(14.07)	(4.42)	(32.53)
Single	0.103**	-0.037*	0.015	-0.017	0.007	-0.014**
	(2.09)	(1.70)	(0.86)	(1.05)	(1.22)	(2.00)
Married	0.007	0.044**	-0.001	0.020	0.000	0.015**
	(0.17)	(2.31)	(0.10)	(1.45)	(0.10)	(2.49)
North	0.149**	-0.122***	0.025	-0.050**	0.024***	-0.031***
	(2.31)	(6.00)	(1.11)	(2.26)	(2.92)	(3.72)
Yorkshire &	0.013	-0.050**	-0.000	0.009	0.009**	0.000
Humberside	(0.28)	(2.49)	(0.01)	(0.71)	(2.07)	(0.09)
East Midlands	0.050	-0.038*	0.004	0.004	-0.002	0.005
	(1.00)	(1.68)	(0.32)	(0.29)	(0.49)	(0.87)
East Anglia	0.035	-0.027	-0.009	0.006	0.002	0.004
	(0.58)	(0.90)	(0.63)	(0.30)	(0.40)	(0.45)
South West	0.076*	0.014	-0.006	0.001	0.009*	0.008
	(1.77)	(0.60)	(0.51)	(0.09)	(1.94)	(1.29)
West Midlands	0.083*	-0.031	-0.008	-0.009	0.003	0.012**
	(1.90)	(1.46)	(0.75)	(0.63)	(0.76)	(2.32)
North West	0.066	-0.091***	-0.006	-0.020	0.001	-0.008
	(1.20)	(4.95)	(0.57)	(1.39)	(0.24)	(1.40)
Wales	0.155**	-0.132***	0.004	0.004	-0.000	-0.018**
	(2.36)	(6.49)	(0.26)	(0.21)	(0.07)	(2.14)
Scotland	0.113**	-0.091***	-0.013	-0.026	-0.002	-0.002
	(2.13)	(4.68)	(1.26)	(1.61)	(0.47)	(0.38)
Northern Ireland	0.184**	-0.183***	-0.030**	-0.062*	-0.008	-0.028***
	(2.03)	(8.65)	(2.09)	(1.86)	(1.58)	(2.93)
Degree	-0.089	0.325***	0.044**	0.009	0.020***	0.040***
	(0.76)	(13.85)	(2.22)	(0.72)	(3.51)	(9.84)
Other higher	-0.092	0.303***	0.022	-0.014	0.013*	0.038***
education	(0.83)	(11.42)	(1.04)	(0.89)	(1.96)	(8.41)
A level	-0.138*	0.203***	0.004	0.044***	-0.001	0.051***
	(1.67)	(12.41)	(0.35)	(4.68)	.	(13.36)
O level	-0.103	0.213***	0.013	0.022*	-0.004	0.040***
	(1.23)	(10.39)	(0.96)	(1.95)	(0.96)	(10.42)
Other	-0.101	0.146***	-0.004	0.034***	-0.007	0.038***
	(1.56)	(7.65)	(0.34)	(3.51)	(1.57)	(9.88)
Home owned	0.117**	0.038	0.083**	-0.048**	0.022***	-0.034***
	(2.27)	(1.63)	(2.33)	(2.56)	(3.29)	(4.77)
Home mortgaged	-0.026	0.162***	0.012	0.050***	-0.008*	0.035***
	(0.36)	(7.27)	(0.87)	(3.15)	(1.80)	(6.15)
Social housing	0.210***	-0.166***	0.050	-0.071***	0.027**	-0.113***
	(2.86)	(8.44)	(1.37)	(3.04)	(2.35)	(11.20)
Dependent	0.037***	0.003	0.005	-0.009	0.008***	-0.008***

children	(2.69)	(0.40)	(1.02)	(1.56)	(4.08)	(3.95)
Dependent	-0.116*	0.027	-0.025	0.007	-0.010**	0.014**
children <2	(1.86)	(0.86)	(1.17)	(0.33)	(2.13)	(2.05)
White	-0.175***	0.107***	-0.039	0.078***	-0.050***	0.065***
	(3.35)	(5.35)	(1.31)	(3.23)	(4.21)	(8.37)
Summer	-0.020	0.019	-0.013	0.004	0.005*	-0.005
	(0.67)	(1.18)	(1.53)	(0.43)	(1.72)	(1.07)
Autumn	-0.011	-0.003	-0.003	0.009	-0.001	-0.002
	(0.38)	(0.20)	(0.40)	(0.93)	(0.46)	(0.47)
Winter	-0.033	0.030*	-0.014	0.006	0.002	0.003
	(1.04)	(1.86)	(1.61)	(0.66)	(0.53)	(0.80)
Other earner	-0.173**	0.180***	-0.034	0.080***	-0.017***	0.063***
	(2.47)	(14.43)	(1.41)	(8.60)	(2.84)	(16.10)
Small firm	0.166***		0.031***		0.026***	
	(7.35)		(2.92)		(6.51)	
Agriculture & fishing	-0.044		-0.085**		-0.030***	
	(0.48)		(2.04)		(3.05)	
Manufacturing	-0.182***		-0.066***		-0.049***	
	(4.00)		(3.39)		(6.47)	
Construction	-0.209***		-0.064***		-0.052***	
	(3.54)		(2.81)		(6.03)	
Distribution	0.023		0.009		-0.001	
	(0.54)		(0.75)		(0.27)	
Transport &	-0.103**		-0.027*		-0.026***	
communication	(2.09)		(1.75)		(4.47)	
Banking & finance	-0.137***		-0.010		-0.030***	
	(2.85)		(0.78)		(5.09)	
Public admin	0.039		0.025*		0.004	
	(0.84)		(1.77)		(0.83)	
Public sector	-0.050		-0.021*		-0.003	
	(1.31)		(1.91)		(0.89)	
Professional	0.108**		0.037**		0.026***	
	(2.00)		(2.42)		(4.58)	
Associate	0.113**		0.017		0.024***	
professional	(2.22)		(1.20)		(4.27)	
Administrative	0.244***		0.058***		0.051***	
	(4.54)		(2.99)		(6.34)	
Skilled trades	0.061		0.003		0.017***	
	(1.24)		(0.17)		(3.06)	
Personal service	0.189***		0.106***		0.072***	
occupations	(3.07)		(3.49)		(6.66)	
Sales&customer	0.267***		0.071***		0.076***	
service	(4.59)		(3.14)		(6.97)	
Process, plant &	0.135***		0.053***		0.044***	
machine	(2.81)		(3.04)		(6.03)	
Elementary	0.317***		0.101***		0.075***	
	(7.33)		(3.72)		(7.31)	
Mover		0.009		-0.005		-0.022***
		(0.44)		(0.36)		(3.97)

Notes: Marginal effects relate to coefficients in Table 4.4. See notes to Table 4.4. The marginal effects relate to the probability of a positive outcome in the part-time equation and in the selection equation.

Table A4.2. Female Part-time Bivariate Probit Model Marginal Effects

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Part	Employ	Part	Employ	Part	Employ
Age	-0.004	0.019***	-0.053***	0.047***	-0.023***	0.043***
	(0.87)	(4.84)	(7.09)	(11.68)	(7.30)	(26.76)
Age squared/100	0.013*	-0.032***	0.071***	-0.059***	0.038***	-0.054***
	(2.37)	(6.62)	(8.01)	(11.94)	(9.50)	(26.69)
Single	0.019	-0.052***	-0.072**	-0.006	0.031**	-0.030***
	(0.83)	(2.69)	(2.13)	(0.28)	(2.20)	(3.11)
Married	0.099***	-0.071***	0.154***	-0.067***	0.184***	-0.088***
	(3.31)	(4.51)	(6.07)	(4.07)	(16.15)	(11.63)
North	0.009	-0.076***	-0.046	-0.016	-0.048***	0.017*
	(0.29)	(3.49)	(1.23)	(0.63)	(3.15)	(1.77)
Yorkshire & Humberside	0.003	-0.036*	-0.040	0.035**	0.024*	0.028***
	(0.11)	(1.83)	(1.39)	(1.96)	(1.94)	(3.66)
East Midlands	0.034	-0.049**	-0.017	0.004	-0.003	0.036***
	(1.44)	(2.25)	(0.51)	(0.16)	(0.21)	(4.31)
East Anglia	0.007	-0.020	-0.008	0.040	0.018	0.035***
	(0.21)	(0.65)	(0.17)	(1.39)	(0.99)	(3.33)
South West	0.040*	-0.005	-0.000	0.016	0.023*	0.026***
	(1.66)	(0.25)	(0.00)	(0.80)	(1.76)	(3.23)
West Midlands	0.012	-0.041**	-0.086***	0.015	0.001	0.023***
	(0.54)	(2.08)	(2.75)	(0.77)	(0.05)	(3.07)
North West	0.030	-0.067***	-0.065**	0.034*	-0.050***	0.037***
	(1.47)	(3.60)	(2.28)	(1.89)	(4.15)	(5.18)
Wales	0.030	-0.099***	-0.049	0.002	-0.063***	0.042***
	(1.13)	(4.70)	(1.20)	(0.06)	(3.94)	(4.40)
Scotland	0.017	-0.077***	-0.059**	0.012	-0.050***	0.046***
	(0.70)	(4.03)	(1.96)	(0.62)	(4.07)	(6.16)
Northern Ireland	-0.012	-0.131***	-0.155***	0.059*	-0.139***	-0.000
	(0.24)	(5.82)	(2.98)	(1.88)	(8.37)	(0.02)
Degree	-0.230***	0.384***	-0.125***	0.148***	-0.105***	0.156***
	(5.43)	(16.92)	(3.00)	(12.02)	(5.99)	(31.44)
Other higher education	-0.174***	0.350***	-0.103**	0.145***	-0.076***	0.161***
	(4.30)	(16.05)	(2.56)	(12.10)	(4.24)	(35.71)
A level	-0.183***	0.275***	-0.094***	0.134***	-0.068***	0.130***
	(6.42)	(13.95)	(2.64)	(10.61)	(4.48)	(24.86)
O level	-0.113***	0.231***	-0.078**	0.135***	-0.035**	0.125***
	(4.56)	(13.75)	(2.40)	(10.47)	(2.51)	(22.78)
Other	-0.101***	0.196***	-0.103***	0.089***	-0.067***	0.088***
	(3.89)	(10.67)	(3.43)	(6.42)	(4.85)	(15.13)
Home owned	0.035	0.034	0.156***	-0.002	0.126***	-0.018*
	(1.08)	(1.45)	(4.04)	(0.08)	(8.43)	(1.89)
Home mortgaged	-0.064***	0.121***	-0.020	0.123***	0.012	0.102***
	(2.62)	(5.54)	(0.52)	(5.74)	(0.86)	(12.54)
Social housing	0.040	-0.150***	0.083**	-0.041*	0.092***	-0.085***
	(1.36)	(7.58)	(2.16)	(1.69)	(5.65)	(8.35)
Dependent children	0.093***	-0.053***	0.212***	-0.106***	0.204***	-0.100***
	(3.67)	(7.82)	(19.19)	(16.07)	(41.84)	(40.50)
Dependent children <2	0.183***	-0.167***	0.257***	-0.114***	0.225***	-0.136***
	(3.32)	(5.35)	(6.22)	(5.12)	(16.23)	(19.94)
White	0.026	0.131***	0.137***	0.136***	0.130***	0.124***
	(0.50)	(7.31)	(2.69)	(4.72)	(8.26)	(12.90)

Summer	0.009	-0.014	-0.029	-0.014	0.001	-0.019***
	(0.54)	(0.91)	(1.28)	(0.91)	(0.15)	(3.06)
Autumn	0.013	-0.014	0.006	-0.003	-0.015*	-0.008
	(0.75)	(0.91)	(0.28)	(0.21)	(1.66)	(1.33)
Winter	0.007	-0.015	0.020	-0.005	0.003	-0.008
	(0.42)	(0.99)	(0.88)	(0.31)	(0.36)	(1.30)
Other earner	-0.059***	0.154***	-0.022	0.109***	-0.007	0.085***
	(3.50)	(12.42)	(0.87)	(7.64)	(0.68)	(14.35)
Small firm	0.118**		0.147***		0.138***	
	(2.56)		(7.60)		(18.28)	
Agriculture & fishing	-0.054		-0.127		-0.022	
	(0.57)		(0.98)		(0.37)	
Manufacturing	-0.165**		-0.208***		-0.160***	
	(2.14)		(4.07)		(8.22)	
Construction	-0.043		0.054		-0.041	
	(0.73)		(0.82)		(1.36)	
Distribution	-0.012		0.049		0.028*	
	(0.42)		(1.23)		(1.71)	
Transport & communication	-0.006		-0.126**		-0.108***	
	(0.16)		(2.28)		(4.90)	
Banking & finance	-0.069*		-0.023		-0.050***	
	(1.67)		(0.56)		(3.03)	
Public admin	-0.005		0.025		0.046***	
	(0.19)		(0.69)		(3.03)	
Public sector	0.010		0.026		-0.003	
	(0.55)		(1.13)		(0.31)	
Professional	0.163**		0.121***		0.145***	
	(2.21)		(2.78)		(8.50)	
Associate professional	0.157**		0.208***		0.229***	
	(2.23)		(5.26)		(14.65)	
Administrative	0.193**		0.293***		0.330***	
	(2.32)		(7.77)		(22.70)	
Skilled trades	0.217**		0.241***		0.284***	
	(2.20)		(3.60)		(10.20)	
Personal service occupations	0.245**		0.362***		0.351***	
	(2.44)		(8.40)		(21.51)	
Sales& customer service	0.321**		0.505***		0.535***	
	(2.49)		(10.42)		(30.81)	
Process, plant & machine	0.192**		0.402***		0.308***	
	(2.28)		(5.96)		(11.97)	
Elementary	0.377**		0.619***		0.611***	
	(2.47)		(11.89)		(34.25)	
Mover		-0.038*		-0.059***		-0.047***
		(1.84)		(2.74)		(5.97)

Notes: Marginal effects relate to coefficients in Table 4.5. See notes to Table 4.4.

Table A4.3. Within Group Heterogeneity Part-time Bivariate Probit Model Marginal Effects

	Marginal Effects							
	Male				Female			
	Work-limited		Non-work-limited		Work-limited		Non-work-limited	
Age	-0.040**	0.032***	-0.019*	0.027***	-0.005	0.025***	-0.053***	0.048***
	(2.13)	(9.03)	(1.92)	(12.77)	(0.81)	(5.98)	(7.05)	(11.75)
Age squared/100	0.057**	-0.046***	0.025*	-0.034***	0.014**	-0.037***	0.072***	-0.060***
	(2.16)	(11.62)	(1.95)	(14.08)	(2.15)	(7.50)	(7.97)	(12.01)
Single	0.085	-0.020	0.015	-0.015	0.013	-0.046**	-0.073**	-0.009
	(1.63)	(0.88)	(0.88)	(0.91)	(0.49)	(2.34)	(2.17)	(0.38)
Married	0.012	0.045**	-0.002	0.021	0.110***	-0.089***	0.154***	-0.068***
	(0.26)	(2.29)	(0.18)	(1.52)	(3.81)	(5.54)	(6.05)	(4.09)
North	0.123	-0.102***	0.029	-0.053**	-0.007	-0.054**	-0.043	-0.013
	(1.64)	(4.75)	(1.18)	(2.37)	(0.19)	(2.39)	(1.14)	(0.50)
Yorkshire & Humberside	-0.004	-0.028	-0.000	0.010	-0.005	-0.021	-0.037	0.038**
	(0.09)	(1.32)	(0.00)	(0.79)	(0.18)	(1.02)	(1.29)	(2.14)
East Midlands	0.032	-0.018	0.005	0.004	0.030	-0.032	-0.012	0.007
	(0.63)	(0.74)	(0.34)	(0.25)	(1.12)	(1.44)	(0.35)	(0.32)
East Anglia	0.064	-0.058**	-0.009	0.004	0.014	-0.035	-0.007	0.042
	(0.92)	(1.96)	(0.56)	(0.18)	(0.38)	(1.17)	(0.15)	(1.50)
South West	0.081*	0.034	-0.006	0.000	0.039	0.011	-0.004	0.019
	(1.85)	(1.37)	(0.53)	(0.01)	(1.47)	(0.50)	(0.12)	(0.96)
West Midlands	0.090*	-0.026	-0.008	-0.008	0.008	-0.032	-0.086***	0.018
	(1.84)	(1.20)	(0.70)	(0.54)	(0.32)	(1.57)	(2.77)	(0.94)
North West	0.063	-0.095***	-0.004	-0.018	0.032	-0.067***	-0.065**	0.034*
	(0.99)	(5.18)	(0.40)	(1.30)	(1.36)	(3.60)	(2.26)	(1.84)
Wales	0.137*	-0.107***	0.004	0.007	0.021	-0.080***	-0.047	0.004
	(1.80)	(4.90)	(0.27)	(0.42)	(0.66)	(3.62)	(1.17)	(0.14)
Scotland	0.093	-0.070***	-0.014	-0.025	-0.002	-0.043**	-0.056*	0.014
	(1.60)	(3.38)	(1.27)	(1.59)	(0.06)	(2.11)	(1.86)	(0.72)
Northern Ireland	0.190	-0.206***	-0.029**	-0.060*	-0.021	-0.143***	-0.157***	0.060*

	(1.51)	(11.25)	(1.96)	(1.82)	(0.37)	(6.70)	(3.03)	(1.94)
Degree	-0.045	0.299***	0.046**	0.006	-0.205***	0.369***	-0.124***	0.149***
	(0.39)	(11.81)	(2.25)	(0.45)	(4.47)	(15.24)	(2.93)	(12.08)
Other higher education	-0.053	0.297***	0.022	-0.016	-0.147***	0.340***	-0.103**	0.146***
	(0.47)	(10.51)	(1.02)	(1.01)	(3.33)	(14.73)	(2.54)	(12.25)
A level	-0.097	0.174***	0.004	0.042***	-0.167***	0.261***	-0.093***	0.136***
	(1.13)	(10.23)	(0.33)	(4.41)	(5.33)	(12.67)	(2.59)	(10.85)
O level	-0.074	0.190***	0.012	0.021*	-0.095***	0.214***	-0.076**	0.136***
	(0.86)	(8.87)	(0.90)	(1.88)	(3.42)	(12.32)	(2.33)	(10.56)
Other	-0.079	0.135***	-0.006	0.035***	-0.089***	0.186***	-0.100***	0.091***
	(1.11)	(6.85)	(0.41)	(3.53)	(3.08)	(9.85)	(3.28)	(6.57)
Home owned	0.128***	0.034	0.086**	-0.050***	0.042	0.026	0.154***	-0.005
	(2.59)	(1.44)	(2.34)	(2.65)	(1.25)	(1.08)	(4.00)	(0.21)
Home mortgaged	-0.006	0.157***	0.013	0.047***	-0.060**	0.112***	-0.022	0.119***
	(0.09)	(6.78)	(0.89)	(2.95)	(2.21)	(5.01)	(0.58)	(5.53)
Social housing	0.174*	-0.144***	0.051	-0.070***	0.022	-0.134***	0.081**	-0.040*
	(1.91)	(7.05)	(1.36)	(2.99)	(0.63)	(6.57)	(2.09)	(1.67)
Dependent children	0.047***	-0.007	0.006	-0.009	0.106***	-0.066***	0.212***	-0.107***
	(2.71)	(0.97)	(1.06)	(1.61)	(4.22)	(9.72)	(19.08)	(16.05)
Dependent children <2	-0.108*	0.017	-0.024	0.005	0.197***	-0.177***	0.259***	-0.121***
	(1.66)	(0.54)	(1.12)	(0.22)	(3.47)	(5.69)	(6.21)	(5.38)
White	-0.184**	0.125***	-0.047	0.082***	0.036	0.148***	0.137***	0.137***
	(2.51)	(6.53)	(1.41)	(3.30)	(0.64)	(8.68)	(2.69)	(4.71)
Summer	-0.026	0.027	-0.014	0.004	0.011	-0.020	-0.032	-0.013
	(0.79)	(1.62)	(1.62)	(0.45)	(0.58)	(1.33)	(1.40)	(0.86)
Autumn	-0.016	-0.004	-0.003	0.010	0.013	-0.012	0.004	-0.002
	(0.51)	(0.27)	(0.39)	(1.05)	(0.68)	(0.78)	(0.18)	(0.12)
Winter	-0.029	0.028*	-0.014	0.007	0.007	-0.014	0.017	-0.005
	(0.89)	(1.69)	(1.52)	(0.75)	(0.36)	(0.88)	(0.77)	(0.35)
Other earner	-0.142*	0.157***	-0.033	0.077***	-0.044**	0.135***	-0.023	0.104***
	(1.77)	(12.25)	(1.36)	(8.36)	(2.24)	(10.60)	(0.92)	(7.32)
Number of health problems	**0.053**	**-0.080*** **	**0.003**	**-0.002**	**0.026*** **	**-0.064*** **	**-0.005**	**-0.015** **

	(1.36)	**(21.16)**	**(0.87)**	**(0.55)**	**(4.54)**	**(18.42)**	**(0.46)**	**(2.49)**
Limbs	**-0.223**	**0.277*** **	**-0.044***	**0.066*** **	**-0.110*** **	**0.243*** **	**-0.042**	**0.096*** **
	(1.62)	**(13.36)**	**(1.69)**	**(5.15)**	**(3.68)**	**(12.73)**	**(0.77)**	**(4.13)**
Sight/hearing	**-0.218**	**0.316*** **	**-0.025**	**0.059*** **	**-0.103***	**0.300*** **	**-0.049**	**0.099*** **
	(1.45)	**(8.93)**	**(1.11)**	**(5.63)**	**(1.81)**	**(8.24)**	**(0.73)**	**(3.76)**
Skin, breathing & organs	**-0.221**	**0.298*** **	**-0.059**	**0.084*** **	**-0.130*** **	**0.283*** **	**-0.015**	**0.105*** **
	(1.54)	**(13.64)**	**(1.54)**	**(3.66)**	**(3.75)**	**(13.21)**	**(0.29)**	**(3.62)**
Other	**-0.105**	**0.148*** **	**-0.038***	**0.052*** **	**-0.027**	**0.170*** **	**-0.016**	**0.074*** **
	(1.31)	**(5.51)**	**(1.73)**	**(4.19)**	**(0.68)**	**(7.13)**	**(0.29)**	**(2.95)**
Small firm	0.172***		0.031***		0.134***		0.148***	
	(4.96)		(2.91)		(2.87)		(7.61)	
Agriculture & fishing	-0.062		-0.084**		-0.083		-0.148	
	(0.65)		(2.01)		(0.76)		(1.11)	
Manufacturing	-0.195***		-0.070***		-0.186**		-0.208***	
	(3.59)		(3.50)		(2.43)		(4.05)	
Construction	-0.239***		-0.065***		-0.051		0.053	
	(3.36)		(2.83)		(0.76)		(0.80)	
Distribution	0.015		0.009		-0.014		0.049	
	(0.34)		(0.70)		(0.44)		(1.21)	
Transport & communications	-0.105**		-0.029*		-0.004		-0.122**	
	(1.98)		(1.84)		(0.09)		(2.19)	
Banking & finance	-0.144***		-0.010		-0.078*		-0.026	
	(2.69)		(0.77)		(1.85)		(0.65)	
Public admin	0.041		0.023*		-0.003		0.027	
	(0.83)		(1.66)		(0.11)		(0.72)	
Public sector	-0.066		-0.022*		0.008		0.024	
	(1.60)		(1.95)		(0.40)		(1.03)	
Professional	0.119**		0.035**		0.188**		0.120***	
	(2.05)		(2.31)		(2.49)		(2.77)	
Associate professional	0.117**		0.017		0.185**		0.206***	
	(2.12)		(1.20)		(2.54)		(5.22)	
Administrative	0.257***		0.060***		0.223***		0.293***	

	(3.83)		(3.04)		(2.66)		(7.75)	
Skilled trades	0.067		0.003		0.255**		0.242***	
	(1.26)		(0.20)		(2.48)		(3.61)	
Personal service occupations	0.183***		0.107***		0.284***		0.360***	
	(2.69)		(3.59)		(2.76)		(8.33)	
Sales & customer service	0.283***		0.071***		0.374***		0.506***	
	(3.87)		(3.14)		(2.85)		(10.38)	
Process, plant & machine	0.142***		0.053***		0.221**		0.401***	
	(2.65)		(3.09)		(2.50)		(5.92)	
Elementary	0.321***		0.102***		0.436***		0.617***	
	(5.13)		(3.81)		(2.84)		(11.83)	
Mover		-0.002		-0.004		-0.045**		-0.063***
		(0.10)		(0.31)		(2.16)		(2.87)

Notes: Marginal effects relate to coefficients in Table 4.6. See notes to Table 4.4. The controls for within group differences are highlighted in **bold.**

CHAPTER FIVE

DISABILITY AND SELF-EMPLOYMENT

5.1 Introduction

The emphasis on employer discrimination in the literature on disability has meant that empirical analysis is dominated by studies which constrain their sample to employees only, as is the case in Chapter 3 and Chapter 4. However, this means a significant proportion of disabled workers and an alternative source of paid employment, self-employment, have largely been ignored in the literature (with the important exceptions of Blanck *et al.*, 2000 for the US and Boylan and Burchardt, 2002 for the UK). Moreover, in the UK, self-employment is a more important source of work for the disabled than the non-disabled, with 21 percent of work-limited disabled men in employment being self-employed, compared to 17 percent of the non-disabled, while the corresponding figures for females are 9 percent and 7 percent respectively (see Table 5.1).[124]

Following the same arguments to that for ethnic minorities (see, for example, Clark and Drinkwater, 1998), over-representation of the disabled in self-employment may be a rational response to the presence of employer discrimination in the salaried sector. However, in the absence of enclave effects, it is possible that consumer discrimination will affect the returns to self-employment (Borjas and Bronars, 1989). Whilst the incentives to enter self-employment depend on the relative strengths of these two sources of discrimination, other features of self-employment may provide alternative benefits for the disabled relative to the non-disabled group. In particular,

[124] It is implied throughout that the causation runs in this direction. However, given the nature of self-employment may be different from paid employment, it is possible that the causation may run in the opposite direction. However, 2003 LFS data on whether an individual had an accident at work in the previous 12 months show no significant difference between the self-employed and employees (conditional on them currently being employed). Equally, it may be argued that the self-employed may be more likely to suffer from stress related mental health problems. However, among the work-limited disabled group there is a significantly lower concentration of mental health problems for the self-employed compared to paid employees.

the work-limited disabled may be better able to accommodate their disability by being able to choose duties, hours and location.[125] The latter influence can be expected to act as a pull factor that might encourage a disabled individual to be self-employed.[126]

In a similar manner to Chapter 4, this empirical analysis investigates the alternative explanations for the higher incidence of self-employment among the disabled. Predicted conditional self-employment probabilities are calculated from bivariate probit estimates which control for the possibility of selection effects; probability differentials between disability groups are decomposed to identify the contribution of differences in coefficients – the 'unexplained' gap. While traditionally interpreted as a measure of discrimination, this gap also captures differences in preferences for self-employment among disability groups and, hence, potentially conflates these two effects. However, using similar modifications of the DeLeire (2001) decomposition to that in Chapter 4, the unexplained gap can then be apportioned between these two elements by separating the disabled into those who report their disability limits the amount and/or type of work they can perform, and those who state that their disability is not work-limiting. Specifically, if it is assumed that the latter have no need to enter self-employment in order to accommodate their disability, then the unexplained component (relative to the non-disabled) reflects only the relative influence of discrimination. For the work-limited disabled, however, both effects are present. Making a further assumption, in a similar manner to DeLeire (2001), that the overall discrimination effect is the same for the work-limited and non-work-limited disabled, it is then possible to isolate the role of self-employment in accommodating disability.

The remainder of this Chapter is structured as follows. Section 5.2 briefly reviews the small number of existing studies relating to disability and self-employment. Section 5.3 extends the theoretical model of Clark and Drinkwater (1998) to the disabled and investigates the influence of discrimination and accommodation factors.

[125] The flexibility of hours has previously been found to be of importance in the context of female self-employment, a feature that is argued to reflect family responsibilities (see for example, Carr, 1996 and Boden, 1999).

[126] The ability to accommodate a disability could act to increase the relative return to self-employment in two ways: accommodation could increase an individual's productivity in self-employment relative to salaried employment, or could reduce the costs associated with work differentially by sector.

The data and methodology are briefly considered in Section 5.4. Section 5.5 presents and interprets the main empirical findings. Section 5.6 concludes.

5.2 Background

A small number of studies have identified the importance of self-employment amongst the disabled and examine the possible reasons for this. For example, Blanck *et al.* (2000) investigate Iowa's Entrepreneurs with Disabilities Program and highlight that discrimination (either perceived or actual), particularly in relation to hiring and firing, is a major motivation for disabled persons starting their own business. Discrimination is also found by Schur (2003) to be more important as an explanation of higher self-employment rates among the disabled than for the other non-standard forms of employment that this group may enter. In contrast, an RTC Rural Research Report (2001), summarising the findings of a national survey of disabled entrepreneurs and/or disabled persons seeking help from state Vocational Rehabilitation (VR) agencies, notes that the need to create one's own job, and to accommodate a disability, were cited by respondents almost as frequently as wanting to work for oneself, owning one's own business, making more money and identification of a market opportunity. Only in a much smaller proportion of cases did respondents state that other jobs were unavailable. The absence of job opportunities is identified as a key factor underpinning the greater use of self-employment as a potential vocational rehabilitation tool by state VR counsellors in Arnold *et al.* (1995).

In the UK, an early study by Prescott-Clarke (1990) using primary data from her own survey on economically active persons with health problems, highlights the differences between disabled employees and self-employed workers. Several of Prescott-Clarke's findings point to the role of disability/health as a contributory factor in the self-employment decision, many of them consistent with the accommodation hypothesis. For example, 19 percent of the self-employed reported that they had to work at home due to their condition, compared with just 1 percent of employees. In many instances, the accommodation of the disability related to a greater flexibility of work patterns/schedules. Around twice as many of the self-employed (40 percent) say they are unable to work a standard week compared to those in waged employment (19 percent), while the corresponding percentages for those reporting having to take breaks regularly due to health are 48 percent and 23 percent respectively. Accordingly, a higher average work handicap score was reported for the self-employed (compared to employees). Among those who were currently disabled and self-employed, half suggested their decision to become self-employed was affected by their health problem, leading Prescott-Clarke (1990, p.69) to conclude that "There is a clear implication in the data that their self-employment status is at least in part a result of their health problem".

More recently, in commissioned research undertaken for the Small Business Service, Boylan and Burchardt (2002) identify a number of empirical regularities using nationally representative data from the LFS and the Family Expenditure Survey (FES). Foremost among these is that the disabled[127] are more likely to be self-employed than their non-disabled counterparts. However, further investigation reveals that, for men at least, this is explicable in terms of the different age profiles. Among the self-employed, disabled persons were less likely than the non-disabled to cite positive reasons, such as the desire for independence or exploiting a market opportunity, as reasons for becoming self-employed. Instead, for some disabled persons (and, most notably, those with low levels of educational attainment), the decision to enter self-employment appeared to be a consequence of push factors, and, in particular, the lack of alternative opportunities.

It is important to note that the concentration of the disabled in self-employment has been relatively stable across time (see Figure 5.1) and, therefore, this feature of the data is not unique to a specific year and does not appear to be a temporary phenomenon.[128] Moreover, there seems little reason to suggest that this concentration is a result of any recent policy initiative or change in legislation. Policy initiatives aimed at increasing the employment of the disabled, such as Disabled Persons Tax Credit (now replaced by Working Tax Credit) and the Access to Work scheme, also apply to self-employment. More generally, because many of the existing enterprise schemes cover both the disabled and the non-disabled, there is little reason to

[127] As defined by the DDA.
[128] The same conclusion can be made if the data are traced from 1994, but since the definition changes over time this is not presented here.

suppose that these schemes are directly responsible for the higher self-employment incidence among the disabled population who work.[129] Also, as noted by Boylan and Burchardt (2002), the DDA's employment provisions do not impact directly on the self-employment of disabled persons, although any reduction in employer discrimination against the disabled may reduce the impact of the push into self-employment occasioned by such discrimination. There are, however, other sections of the DDA that may affect the self-employment decision. Firstly, the DDA makes it unlawful for service providers to discriminate against buyers of a good or service on the basis of disability, including in the provision of services to those seeking to become self-employed, and, secondly, self-employed persons who work under contract are covered by the DDA, potentially including the requirement for reasonable adjustments.

5.3 Theoretical Framework

Clark and Drinkwater (1998) use a variant of the framework outlined by Coate and Tennyson (1992) to model the self-employment decision of ethnic minorities. By modifying their original analysis to consider the disabled, it is possible to examine the implications of discrimination and accommodating features on the incentive to become self-employed. Following the notation in Clark and Drinkwater (1998), it is assumed that rewards in self-employment are a function of profits (π) and entrepreneurial talent (θ) (which is assumed to be randomly drawn and private information). If e denotes earnings in the salaried sector, then a risk neutral individual will enter self-employment if the return to self-employment ($\pi\theta$) is greater than the return from salaried employment. This implies there is a critical value of entrepreneurial talent (θ^*) such that, if the probability of success in self-employment exceeds the critical value, the individual will become self-employed. This critical value is given by:

$$\theta^* = \frac{e}{\pi} \qquad (5.1)$$

[129] The main exception to this is the NDDP pilot schemes (see Boylan and Burchardt, 2002 for an account of these).

Profit depends on consumer valuation of a given good or service, where the actual value is given by z. However, a consumer's own evaluation is affected by the ability of the entrepreneur; since ability is private information, consumers must form an expectation of ability:

$$E(\theta \mid \theta > \theta^*) \tag{5.2}$$

which is increasing in θ^*. It follows that the profit of an entrepreneur can be shown to be:

$$\pi = V(\theta^*, z) \tag{5.3}$$

which is increasing in both θ^* and z. As Clark and Drinkwater (1998) show, the reduced forms for equations 5.1 and 5.3 can be expressed as:

$$\pi = \pi(e, z) \text{ and } \theta^* = \theta^*(e, z) \tag{5.4}$$

Assuming both the disabled and non-disabled have the same distribution of ability $F(\theta)$, employer wage discrimination against the disabled, which implies $e_D < e_N$, will result in a lower value of θ^* (the critical level of ability) for the disabled.[130] Since $\theta^*_D < \theta^*_N$ a larger proportion of disabled workers will enter self-employment.

However, while the enclave effects considered by Clark and Drinkwater (1998) are appropriate for ethnicity, their influence on disability seems less justified. Instead, it seems important to consider the influence of consumer discrimination, highlighted in this context by Borjas and Bronars (1989). Consumer discrimination occurs when a buyer of a good or service of given quality values it differently because it is

[130] If consumers can observe the disability status of the seller, consumers will also expect the quality of a disabled sellers' good to be lower since $E(\theta_N \mid \theta_N > \theta^*_N) > E(\theta_D \mid \theta_D > \theta^*_D)$. Hence, it also follows that the rewards to self-employment will be lower for the disabled; however, the absence of earnings data for the self-employed means this hypothesis is not tested.

purchased from a disabled or non-disabled individual.[131] As such, goods of the same quality have a different value on the basis of the supplier, independent of ability, hence an individual's valuation if the seller is disabled is $z(1-d)$, where d represents the extent to which the goods or service are devalued in a similar manner to Becker's (1971) taste for discrimination. Since $\frac{\partial\theta^*}{\partial z}<0$, consumer discrimination will increase the size of θ^*, the critical level of ability for the disabled and, hence, reduce their concentration in self-employment. Essentially, the two influences will work in opposite directions, so the relative value of θ^* between the disabled and non-disabled depends on the relative magnitude of these two sources of discrimination. In the empirical analysis, it is the balance of these two discrimination effects that will be estimated in the model and referred to as discrimination.

Clark and Drinkwater (1998) implicitly assume that the cost of working in each sector is equal across ethnic minority groups. To account for the possibility of workplace accommodations that make it more accessible for a disabled individual with given ability to work in self-employment rather than paid employment, it is, instead, assumed that individuals maximise the net benefit of employment (rather than earnings). The net benefit of employment in a given sector is a function of earnings minus the cost of working in a given sector j, γ^j, which can be thought of as the value of job disamenities.[132] As such, equation (5.1) can be expressed as:

$$\theta^* = \frac{e-\gamma^e+\gamma^s}{\pi} \tag{5.5}$$

and the critical level of ability depends on the relative costs of participating in each sector. If the workplace accommodation argument is true, then $\gamma_D^e > \gamma_D^s$ and θ^*_D will fall, increasing the proportion of the disabled in self-employment. In the absence

[131] Clearly, not all disabled self-employed individuals will actually be accurately identified as such by consumers, but this analysis demonstrates the potential effect. Moreover, not all self-employed individuals will have direct contact with consumers. Indeed, if consumer discrimination is important, the disabled self-employed are likely to select certain types of self-employment to minimise the discrimination they face.

[132] If both groups have the same cost of working in a given sector the results are identical to Clark and Drinkwater (1998).

of either form of discrimination, for a higher concentration of the disabled in self-employment relative to the non-disabled, the following must hold:

$$\gamma_D^e - \gamma_D^s > \gamma_N^e - \gamma_N^s \tag{5.6}$$

That is, self-employment provides a greater workplace accommodation for the disabled than the non-disabled. Thus, even in the absence of any form of discrimination, accommodation influences may pull disabled individuals into self-employment.

An alternative way of considering the same influence is to allow returns in each sector to vary by productivity. Consistent with the above analysis, a concentration in self-employment would arise if the negative effect of disability on productivity is greater in paid employment than in self-employment, due to the accommodation effect. However, if disability can affect productivity in self-employment then it may also be important to consider the validity of the assumption of constant ability in self-employment across the disability groups. Clark and Drinkwater (1998) argue ethnic minorities may be 'more entrepreneurial' through mechanisms such as inter-generational transmission; however, the precise mechanism through which disability would affect θ is not obvious. The disabled may be less enterprising if, for example, they become more risk averse following disability onset. Following Clark and Drinkwater (1998), if the disabled are assumed to be less enterprising than the non-disabled, their distribution of ability can be denoted $G(\theta)$, where $F(\theta)$ first-order stochastically dominates $G(\theta)$. For a given value of θ^*, $G(\theta^*) \geq F(\theta^*)$ and hence a greater concentration of the non-disabled will be observed in self-employment. Even if, through the mechanisms of accommodation or employer discrimination discussed above, $\theta^*_D < \theta^*_N$, this does not now imply a greater concentration of the disabled in self-employment, since the difference in ability between the groups may be sufficient to offset these effects. Therefore, if the disabled have lower ability in self-employment, this will reduce their incentive to become self-employed and act against the accommodation and discrimination influences discussed above.

5.4 Data and Methodology

The description of the data and the methodology presented in Section 4.3 also largely applies to the current analysis and so is not repeated here. The main exception to this is that the self-employed are included within the sample and therefore the employed group ($E_{ij}=1$) includes both paid employees and the self-employed. A dummy variable S_{ij} replaces P_{ij} in equation 4.2 where S_{ij}, which is observed only for the employed, identifies self-employment ($S_{ij}=1$) and paid employment ($S_{ij}=0$). Importantly, the bivariate probit model accounts for the potential non-random selection into employment that may otherwise render estimates inconsistent. This issue has largely been ignored in the self-employment literature, but, in the context of disability, where the employment rate, is less than half the non-disabled rate, this issue is more likely to be important.[133]

The variables that determine employment Y_{ij} will largely be the same as those that determine self-employment X_{ij}. Thus, both vectors include standard controls for age, education, ethnicity, marital status, housing tenure, the presence of another income earner in the household and region.[134] In the self-employment equation, the presence of another income earner in the household and housing tenure are, essentially, proxies for access to financial capital and, hence, for capital constraints in this decision, factors which cannot be controlled for directly in the LFS.[135]

[133] An exception to this is Pagán's (2002) examination of gender differences in participation and self-employment in rural Guatemala, where selectivity effects were found to be of considerable significance for females.

[134] See Table A3.1 for details of the variables already introduced in Chapter 3. Variables not previously defined include Dependent children < 5, which denotes the total number of dependent children in the household aged less than 5 if the respondent is the head of household or spouse, and is zero otherwise. Given the established influence of ethnicity, an additional variable, immigrant, is included. Immigrant is a dummy variable which takes the value of 1 if the respondent was born outside the UK and zero otherwise. Dummy variables relating to age bands also replace age (and age squared) in the regressions. Aged 25-34 is a dummy variable which indicates the respondent is aged between 25 and 34, 0 otherwise. Aged 35-44 is a dummy variable which indicates the respondent is aged between 35 and 44, 0 otherwise. Aged 45-54 is a dummy variable which indicates the respondent is aged between 45 and 54, 0 otherwise. Aged 55+ is a dummy variable which indicates the respondent is aged between 55 and standard retirement age, 0 otherwise. Those aged between 16 and 24 form the omitted group.

[135] While the set of controls is relatively comprehensive, there are a couple of more obvious omissions, such as psychological factors and family background which are unavailable in the LFS. See Le (1999) for a review of the empirical work in this area. Moreover, the absence of longitudinal data means it is not possible to control for unobservable factors that determine employment choice

One issue that does arise with the above, however, concerns identification, which requires at least one variable in the selection (employment) equation (in Y_{ij}) that does not appear in the final outcome (self-employment) equation (in X_{ij}). As is true in many contexts, however, finding suitable identifying restrictions is far from straightforward, since almost any regressor that determines whether an individual works could conceivably also impact on the decision to be self-employed. The identifying restriction adopted here is the number of dependent children of pre-school age – with the exception of disabled males, this variable is a significant factor in determining whether an individual works, but in no case does it impact on the decision to be self-employed, and as such appears a reasonable choice. In addition, since X_{ij} is observed for the employed, it also contains a set of industry dummies[136]. As in Chapters 3 and 4, an additional specification is also estimated for the disabled which includes controls for the type and severity of the health problem, to examine the influence of within group heterogeneity on self-employment.

In a similar manner to part-time employment, the average predicted conditional probability of self-employment for the jth group, with sample size η_j, is:

$$S_j^C = \frac{1}{\eta_j}\sum_{i=1}^{\eta_j}\frac{\Phi_2(\beta_j X_{ij}, \gamma_j Y_{ij}, \rho_j)}{\Phi(\gamma_j Y_{ij})} \tag{5.7}$$

For the work-limited disabled, the unexplained gap is the difference between the predicted conditional probability of self-employment for the non-disabled, evaluated at the work-limited disabled self-employment coefficient vector, and their predicted own conditional probability, that is:

(for example, preferences for risk). However, the sample sizes in longitudinal surveys like the BHPS are likely to be insufficient to examine the self-employment decision amongst the disabled.

[136] Note that occupational dummies are not included in the second stage due to the likely endogeneity with self-employment status (for example, being a manager).

$$(S_{D_1}^C - S_N^C)_{\text{unexplained}} = \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_{D_1}X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} - \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_N X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} \tag{5.8}$$

while, for the non-work-limited disabled, the corresponding gap is:

$$(S_{D_2}^C - S_N^C)_{\text{unexplained}} = \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_{D_2}X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} - \frac{1}{\eta_N}\sum_{i=1}^{\eta_N}\frac{\Phi_2(\beta_N X_{iN},\gamma_N Y_{iN},\rho_N)}{\Phi(\gamma_N Y_{iN})} \tag{5.9}$$

Thus, equation (5.8) represents the difference in the conditional self-employment probability of a non-disabled individual if they behave like a work-limited disabled worker in choosing between salaried and self-employment, while equation (5.9) denotes the change if the non-work-limited disabled coefficient vector is instead applied at the second stage. Thus the approach applies different coefficient vectors to the same (non-disabled) characteristics throughout.

Equation (5.8), which performs the comparison between the work-limited disabled and the non-disabled, therefore incorporates the influence of both preferences (including the need to accommodate) and of differences in discrimination between those that are self-employment and those that work in the salaried sector. Following a similar logic to Chapter 4, the DeLeire (2001) method is modified to separate the influence of accommodation from discrimination. It is assumed that there is no difference in the need for accommodation between the non-work-limited disabled and the non-disabled, since they have stated that their disability does not affect the type or amount of work they can do. Equation (5.9), therefore, relates solely to the influence of discrimination. If discrimination in the salaried sector exceeds that in self-employment, then this will act to increase the probability of self-employment and equation (5.9) will be positive. By assuming this balance of discrimination is equal across the disabled groups, the estimate from equation (5.9) can be used with equation (5.8) to identify a residual term. The difference between equations (5.8) and (5.9) is, therefore, the estimate of accommodation as a driver of the self-employment decision of the work-limited disabled. Unlike Chapter 4, the measure of discrimination relates to the outcome of two sources of discrimination, namely employer and consumer discrimination. Consequently, if the balance of discrimination is unequal between the two groups, that is, the second assumption fails to hold, it is no longer true that a lower bound on discrimination against the disabled will necessarily be identified. This is because, even if discrimination is positively related to the work-limiting nature of the disability, it does not imply the same relationship for the balance of discrimination.

5.5 Results

5.5.1 Descriptive Statistics

Table 5.1 shows that regardless of gender, for those in employment, the work-limited disabled are significantly more likely to be self-employed than the non-disabled. Whilst for men there is no significant difference in the self-employment rates between the non-work-limited and the non-disabled, for women the difference is actually negative. Moreover, Figure 5.1 shows that these trends have been evident since 1997 and reinforces the argument that the work-limited disabled are different from the other two groups.

For males, the self-employed with a disability are more likely to work from home and live and work in the same Local Authority District (LAD). Since the difficulties disabled individuals face in getting to work may be an incentive to undertake self-employment, which provides greater opportunities to work from home or locally, there is some support for a workplace accommodation effect here.[137] Consistent with the evidence in Chapter 3, the disabled work significantly fewer hours than the non-disabled, whether in paid work or self-employment. Overall, those whose disability is not work-limiting appear more similar in almost all respects to those without any form of disability. This anecdotal evidence supports the assumption of the modified DeLeire (2001) approach used here, namely that those who have a disability that is work-limiting are fundamentally different to the non-work-limited disabled.

[137] The same influence is observed for females, although the proportion working from home is not significantly different from the non-disabled.

The type of self-employment is fairly similar among the disability groups. However, the work-limited disabled, in particular, are more likely than the other disability groups to class themselves as *working for self* and, for men, less likely to be a partner in a professional practice or a sole director of a limited company. Consistent with this, the proportion of the work-limited disabled male self-employed employing others is significantly lower, with nearly 80 percent having no employees compared to 74 percent of non-disabled and non-work-limited disabled men. The evidence relating to the reasons for self-employment, in Table 5.2, also fails to support the idea that the disabled are inherently more enterprising, as there is no significant difference in the proportion of disabled and non-disabled respondents reporting they entered self-employment *to be more independent* or because they *wanted more money*. For males, the work-limited disabled are significantly more likely to report that *no jobs available locally* and *other reasons*, which could include their health. Thus, there is some evidence to support unequal access to employment as a push factor for the disabled.

The means of the variables used in the regression analysis are presented for each of the six sub-groups in Table 5.3. Since the key features have already been identified in Chapters 3 and 4, they are not discussed again here.

5.5.2 Bivariate Probit Model

The results of estimating the bivariate probit models for each of the six sub-groups are presented in Tables 5.4 (males) and 5.5 (females).[138] The parameter ρ is consistently negative for males and, as indicated by a Likelihood Ratio test, it is significant for both the non-work-limited disabled and the non-disabled. In contrast, ρ is positive but insignificant for females. Therefore, for men, unobservables that exert a positive effect on employment impact negatively on self-employment, which suggests that, for men, the choice of self-employment is occasioned, at least in part, by a lack of other employment opportunities.

Since the employment decision is investigated in Chapter 3, the emphasis of the discussion here is the type of employment choice. However, one feature of the

[138] The marginal effects are presented in Appendix Tables A5.1 and A5.2 for males and females respectively.

employment equation is important. The impact of young children on employment is generally weak for males, so, in the absence of more plausible identifying restrictions, the disabled male equations rely on weak identification. In contrast, for females, the number of pre-school age children, both significantly and consistently, reduces the probability that an individual will be in work.

For all disability groups and both genders, there is a positive relationship between age and self-employment. However, for other variables, there are considerable differences by gender. In terms of qualifications, for males, the general relationship for each of the disability groups is one in which the probability of being in employment is generally higher for individuals with qualifications, while the converse applies when considering the choice between self- and waged employment. In contrast, for females, qualifications (and, in particular, higher qualifications, such as having a degree) increase both the probability of being in work and of being self-employed.[139] This suggests that there are important differences in the motivation for self-employment across genders, which are likely to reflect real or perceived differences in the relative opportunities between paid and self-employment at different levels of education.

A further interesting feature of the results concerns the roles of ethnicity and immigrant status. For males, the data indicate that non-whites and immigrants are less likely to be in work, but, where they are, they are more likely to be in self-employment. For females, in contrast, the pattern which emerges is one in which those from ethnic minorities are less likely to work and (conditionally) to be self-employed, while for immigrants, participation and self-employment are both the more likely outcome.[140] Thus the results for men are entirely in accordance with those previous studies, both for the UK and elsewhere, which suggest that among ethnic minorities, self-employment is, at least in part, a response to discrimination in the labour market (for example, Clark and Drinkwater, 1998).

[139] This pattern is robust to the inclusion of occupational controls, which also have little impact on the relative accommodation and discrimination components of the decompositions reported. This is also consistent with the gender differences in the sign of ρ.
[140] Blackaby *et al.*, (2002) and Clark and Drinkwater (1998), amongst others, have shown that there is also substantial variation on the basis of individual ethnic groups which comprise the non-white group in terms of employment and self-employment, which is ignored here.

Household characteristics, such as the presence of children, and marital status also appear to exhibit differential patterns by gender. For both men and women, however, having dependent children in the household is consistently and positively related to the probability of being in self-employment for each of the disability sub-groups. While the precise mechanism underlying this result for men is unclear, for women it presumably derives from the fact that self-employment offers the greater flexibility some women require in order to combine work and child-rearing responsibilities.

Of the variables included as (crude) controls for access to capital, living in social housing has a negative effect on self-employment, particularly for females, whilst home ownership has a positive influence on self-employment for males. It should be noted that there is a powerful role for the industry group in the self-employment equation. As might be expected, self-employment is more likely among workers in agriculture and fishing, and, for males, also in construction, relative to the base group ('Other'), and, generally, less likely in other sectors such as public administration, education and health.

The specifications for disabled males and females are supplemented with controls for the type and number of health problems in Table 5.6, to consider if there are differences in the probability of self-employment within the disabled group.[141] After controlling for characteristics, with the exception of the 'other' group for work-limited disabled females, none of the within group differences is significant. Self-employment is not positively related to severity, at least as measured by the number of health problems; neither is it related to the type of disability. Thus, the higher incidence of self-employment is reflected fairly equally among the disabled, regardless of their particular type of disability. The absence of a severity effect may serve to limit the arguments made in terms of accommodation for the work-limited disabled. However, consumer discrimination is likely to be sensitive to the visibility of the disability, which may be partly a function of the type and severity of the disability. It may, therefore, be that any 'pull' that stems from the influence of

[141] Marginal effects are presented in Appendix Table A5.3.

accommodation for the more severely disabled is more than offset by the influence of increased consumer discrimination.[142]

5.5.3 Conditional Probabilities

Elements on the leading diagonal of Table 5.7 are the conditional self-employment predictions for each group on the basis of their own coefficients. Thus, the estimated self-employment rate for work-limited disabled males in employment is 21.2 percent, while it is approximately 17 percent for both the non-work-limited disabled and the non-disabled. Among females the corresponding rates are 9.3 percent, 6.3 percent and 7.3 percent respectively.

The remaining elements of Table 5.7 indicate how these probabilities would change were alternative coefficient vectors applied to the self-employment equation, holding all other components constant, and, in particular, the employment probabilities. For example, a non-disabled male has a self-employment probability of 17.4 percent evaluated at their own coefficients, but applying the work-limited disabled self-employment coefficients (β_{D_1}) increases the probability of self-employment to 24.3 percent. For the same employment probability, the conditional self-employment probability evaluated at the non-work-limited disabled self-employment coefficients (β_{D_2}) is just 15.1 percent and, importantly, is lower than their own conditional probability. Similar comparisons can be made using other groups as the base; for example, for the work-limited disabled characteristics and selection equation, behaving as non-disabled reduces the conditional probability of self-employment, and this is even more so if they behave as the non-work-limited disabled.

These predicted conditional probabilities can, as described above, be used to isolate the contributions of discrimination and accommodation to the unexplained gap between the conditional self-employment probabilities. For males, the impact of discrimination is found to be negative, suggesting that discrimination is actually greater in the self-employment sector, or that the entire disabled group has preferences favouring waged employment (for example, due to the security of

[142] More accurately, the balance of discrimination between paid employment and self-employment must deteriorate sufficiently for the more severely disabled, since employer discrimination may also be sensitive to severity and type.

sickness pay); self-employment rates for the non-disabled evaluated at the non-work-limiting disabled self-employment coefficients would actually be approximately 2.3 percentage points lower.[143] More importantly, however, there is clear evidence of a substantial increase in the probability of self-employment (nearly 7 percentage points) if the non-disabled behaved like the work-limited disabled when entering employment type. Therefore, the influence of differences in preferences, which represents the difference between the two figures, amounts to 9 percentage points and supports the presence of accommodating features of self-employment for the work-limited disabled. In the case of females, the same pattern emerges, but the extent of the differences is much smaller in magnitude. Therefore, the unexplained gaps are similarly signed to the case for males, but both are very small (around 1 percentage point), and suggest that discrimination and accommodation factors are much weaker for women.[144]

5.6 Conclusion

This Chapter investigates the reasons why, for those in work, self-employment rates are higher for those with work-limiting disabilities than for the non-disabled. Previous survey based evidence suggests two possible explanations for the concentration of the disabled in self-employment, namely the influence of wage discrimination and accommodation. The impact of both of these features are considered using the theoretical framework of Clark and Drinkwater (1998), which confirms that a concentration in self-employment may result from wage discrimination in the salaried sector or self-employment having greater accommodating features for the disabled. However, this model also confirms that consumer discrimination will reduce the incentive to become self-employed.

Data from the UK LFS and a model which modifies the DeLeire (2001) assumptions are used to consider these alternative explanations empirically. For a non-disabled individual with their own characteristics and selection equation, the conditional

[143] Table 5.7 can be used to compute the decomposition at any base. The results are not sensitive to the change of base.

[144] When pooling across disability groups as the basis for comparison, $(S^C_{D_1} - S^C_N)_{\text{unexplained}} = 0.051$ and $(S^C_{D_2} - S^C_N)_{\text{unexplained}} = -0.042$ for males, while for females, they are both again effectively zero.

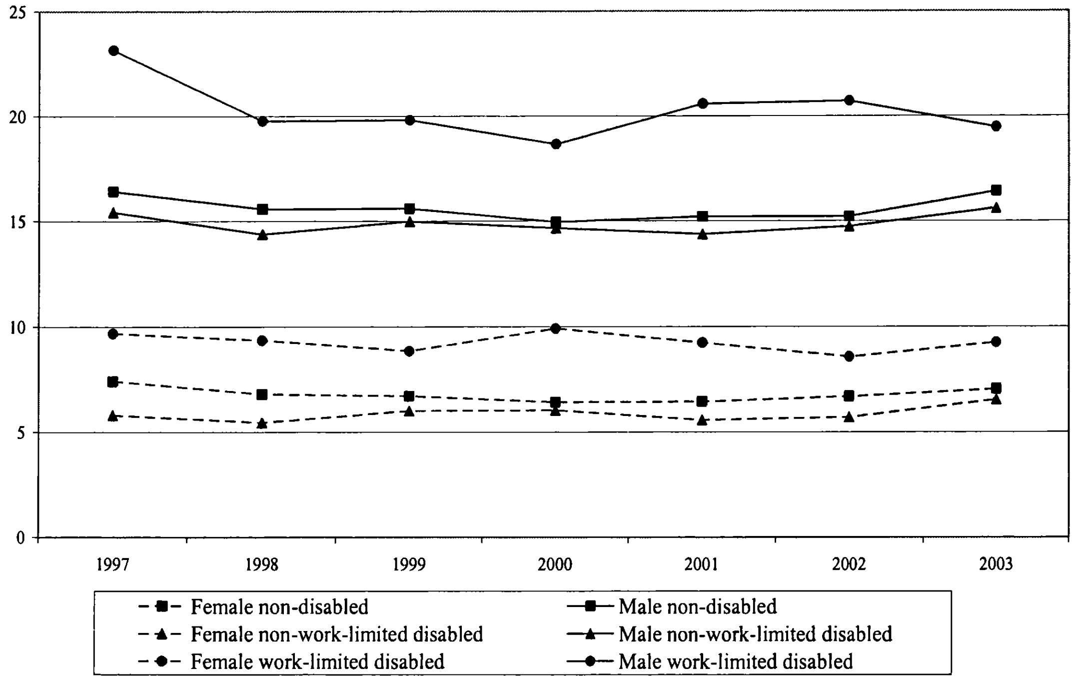
probability of self-employment increases when behaving like a work-limited disabled in the self-employment decision, but falls slightly when behaving like the non-work-limited disabled. Since this latter negative effect is the measure of the balance of discrimination, there is some evidence that consumer discrimination is important against the disabled. Moreover, since discrimination cannot explain the more extensive increase in the conditional probability for the work-limited disabled, the accommodation effect is actually more important. For men at least, there seems to be evidence that the preferences for self-employment are different for the work-limited disabled, which may be driven by the need to choose location, duties and hours.

Unlike the analysis in Chapters 3 and 4, there is no evidence of differences within the disabled group in relation to their propensity to become self-employed. Having a greater number of disabilities, or having a particular type of disability, has no significant effect relative to the rest of the disabled group. Thus, the concentration in self-employment appears to exist more generally among those self-reporting work-limiting disability.

Whilst the influence of preferences identified by the empirical analysis is consistent with arguments put forward in the literature and the predictions of the theoretical framework, it is important to acknowledge the limitations of the analysis. Finding an appropriate identifying variable in this context is difficult and the model is forced to rely on weak identification for disabled men. Moreover, due to the nature of data in the LFS, the specification of the model fails to control for several factors previously identified as important determinants of self-employment. The decision to enter self-employment is likely to be determined in part by parental self-employment, risk aversion, access to finance and an individuals own perception of the opportunities and his/her own ability. Although some of these factors are difficult to control for in any study, and some will have a similar influence across disability groups, further investigation is needed to test if, for example, disability affects preference for risk, which may contribute to the observed difference in self-employment.

In a similar manner to Chapter 4, a natural extension to this analysis would be to consider analysis of transitions between self-employment and paid employment, and disability onset. Furthermore, more specific analysis of the disabled in self-employment is required to identify which features provide accommodation for the disabled. It would also be interesting to examine the relative welfare of the disabled in self-employment, through, for example, comparisons of the relative earnings and other measures of success in self-employment.

Figure 5.1. Proportion of Workers in Self-employment, 1997-2003



Notes: Data are obtained from the Summer quarter of the LFS for each year.

Table 5.1. Descriptive Statistics

	Male			Female		
	Work-limited disabled	Non-work-limited disabled	Non-disabled	Work-limited disabled	Non-work-limited disabled	Non-disabled
Employment rate (%)	43.16***	89.08***	90.41	38.29***	78.42	78.51
Self-employment rate (as % of all employed)	21.28***	16.56	17.41	9.29***	6.28***	7.33
Employed						
Work from home (%)	5.73	6.39*	5.80	4.47**	3.52	3.61
Work in same LAD as residence (%)	57.41***	51.31	50.47	68.17***	66.04***	63.61
Average tenure (months)	108.58***	124.44***	99.35	88.72***	98.64***	82.20
Average hours	41.33***	43.48	43.46	29.77***	32.52	32.43
Self-employed						
Work from home (%)	65.24***	58.52	56.35	62.93	60.70	60.00
Work in same LAD as residence (%)	88.18***	82.36	80.70	88.64**	85.16	84.23
Average tenure (months)	155.80***	167.10***	138.05	108.14*	105.15	97.32
Average hours	42.21***	45.56**	46.62	28.89**	31.71	31.60
Type of self-employment (%)						
Paid by agency	1.25**	1.78	2.44	1.57	2.26	2.97
Sole director of limited liability business	5.33*	5.63	6.82	2.52	1.94	3.72
Running professional practice	23.04	25.27	24.20	21.70	27.10	24.63
Partner in professional practice	8.97***	10.46**	12.96	16.04	18.71	16.23
Working for self	53.01***	48.08**	44.31	52.52**	43.87	45.93
Sub contractor	6.02	5.82	7.02	1.89	1.29	1.97
Freelance work	2.38	2.96	2.25	3.77	4.84	4.55
Without employees	79.14***	73.81	73.56	79.57	77.32	76.64

Notes: Data from 2003, sample excludes unpaid family workers and government trainees. LAD denotes local authority district. ***, ** and * denote differences from the relevant non-disabled comparator group at the 1%, 5% and 10% significance level respectively.

Table 5.2. Reasons for Becoming Self-employed

	Males			Females		
	Work-limited disabled	Non-work-limited disabled	Non-disabled	Work-limited disabled	Non-work-limited disabled	Non-disabled
To be more independent	28.03	28.63	29.78	18.18	26.22	22.19
Wanted more money	7.74	7.84	8.56	2.84	6.10	5.27
For better conditions of work	1.88	1.76	1.94	1.70	1.22	1.57
Family commitments	1.46	0.59	1.30	15.90	14.02	17.54
Capital, space, equipment, opportunities	6.49	9.61	8.01	6.82	4.27*	8.26
Saw demand	2.92	4.12	2.95	2.84	3.05	3.78
Joined the family business	5.44	5.09	5.79	8.52	9.15*	5.43
Nature of occupation	13.18	12.75	16.35	21.02	17.07	18.72
No jobs available locally	4.81***	3.33	2.28	1.70	1.22	0.87
Made redundant	11.08	10.59	9.15	2.27	3.66	2.75
Other reasons	12.97**	11.37	9.31	13.07	11.58	10.77
No reason given	3.97	4.31	4.54	5.11	2.44	2.83

Notes: Sample is the self-employed of working age and figures relate to first response. LFS data refer to Spring 2001. ***, ** and * denote differences from the relevant non-disabled comparator group at the 1%, 5% and 10% significance level respectively. Figures represent the percentage of valid responses.

Table 5.3. Variable Means

Variable	Males: Work-limited disabled	Males: Non-work-limited disabled	Males: Non-disabled	Females: Work-limited disabled	Females: Non-work-limited disabled	Females: Non-disabled
Aged 25-34	0.118	0.131	0.231	0.142	0.174	0.262
Aged 35-44	0.190	0.209	0.279	0.251	0.262	0.304
Aged 45-54	0.260	0.276	0.215	0.316	0.292	0.221
Aged 55+	0.375	0.322	0.145	0.229	0.188	0.091
Single	0.271	0.228	0.474	0.225	0.237	0.296
Married	0.597	0.687	0.592	0.582	0.635	0.604
North	0.070	0.054	0.050	0.067	0.054	0.052
Yorkshire & Humberside	0.096	0.099	0.091	0.092	0.101	0.090
East Midlands	0.071	0.075	0.071	0.070	0.071	0.069
East Anglia	0.035	0.037	0.037	0.032	0.032	0.038
South West	0.078	0.087	0.082	0.078	0.091	0.082
West Midlands	0.089	0.084	0.090	0.094	0.082	0.088
North West	0.114	0.102	0.096	0.106	0.100	0.098
Wales	0.066	0.046	0.046	0.064	0.046	0.047
Scotland	0.094	0.084	0.087	0.092	0.091	0.088
Northern Ireland	0.045	0.024	0.039	0.048	0.022	0.039
Degree	0.083	0.175	0.208	0.074	0.137	0.178
Other higher education	0.058	0.091	0.084	0.083	0.108	0.106
A levels	0.281	0.325	0.290	0.127	0.161	0.164
O levels	0.128	0.148	0.173	0.218	0.264	0.272
Other qualification	0.158	0.135	0.130	0.158	0.158	0.138
Home owned	0.256	0.251	0.186	0.207	0.203	0.162
Home mortgaged	0.363	0.581	0.620	0.389	0.555	0.606
Social housing	0.295	0.100	0.097	0.321	0.160	0.134
Dependent children	0.477	0.542	0.714	0.660	0.707	0.915
Dependent children< 5	0.095	0.120	0.193	0.123	0.158	0.247
White	0.934	0.955	0.929	0.921	0.948	0.920
Immigrant	0.083	0.063	0.093	0.095	0.080	0.106
Other earner	0.439	0.634	0.668	0.519	0.685	0.723
Agriculture & fishing	0.026	0.018	0.020	0.007	0.005	0.005
Manufacturing	0.199	0.223	0.209	0.078	0.077	0.084
Construction	0.128	0.121	0.139	0.012	0.019	0.016
Distribution	0.175	0.153	0.159	0.237	0.201	0.201
Transport & communication	0.110	0.102	0.098	0.031	0.036	0.038
Banking & finance	0.127	0.156	0.159	0.130	0.142	0.155
Public administration	0.158	0.158	0.155	0.429	0.456	0.429

Notes: Means relate to regression samples.

Table 5.4. Male Self-employment Bivariate Probit Estimates

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Self	Employ	Self	Employ	Self	Employ
Constant	-0.224	-0.773***	-0.898***	0.328*	-1.075***	0.303***
	(0.42)	(6.14)	(3.17)	(1.65)	(8.42)	(4.06)
Aged 25-34	0.248	0.201***	0.258*	0.517***	0.389***	0.549***
	(1.53)	(2.71)	(1.66)	(4.89)	(6.63)	(16.77)
Aged 35-44	0.432***	0.157**	0.504***	0.587***	0.610***	0.603***
	(2.61)	(2.13)	(3.09)	(5.40)	(9.53)	(16.26)
Aged 45-54	0.703***	-0.067	0.684***	0.660***	0.763***	0.514***
	(4.49)	(0.89)	(4.02)	(5.93)	(11.78)	(12.81)
Aged 55+	0.976***	-0.511***	0.948***	-0.071	1.056***	-0.084**
	(6.54)	(6.61)	(6.35)	(0.65)	(19.55)	(2.00)
Single	-0.234**	-0.109*	-0.038	-0.178*	0.012	-0.126***
	(2.11)	(1.95)	(0.43)	(1.87)	(0.31)	(2.97)
Married	-0.166**	0.098**	-0.118	0.005	-0.017	0.060
	(2.07)	(2.03)	(1.62)	(0.07)	(0.50)	(1.59)
North	-0.040	-0.407***	-0.117	-0.266***	-0.110**	-0.224***
	(0.27)	(6.47)	(1.15)	(2.64)	(2.50)	(5.17)
Yorkshire &	0.014	-0.181***	-0.153**	-0.031	-0.160***	-0.049
Humberside	(0.14)	(3.32)	(2.03)	(0.36)	(4.86)	(1.35)
East Midlands	-0.078	-0.157**	-0.036	0.018	-0.133***	-0.027
	(0.72)	(2.57)	(0.45)	(0.19)	(3.74)	(0.67)
East Anglia	-0.019	-0.089	-0.321***	-0.043	-0.070	-0.021
	(0.16)	(1.10)	(2.63)	(0.34)	(1.55)	(0.40)
South West	-0.069	-0.019	0.042	-0.002	0.010	0.019
	(0.79)	(0.33)	(0.56)	(0.02)	(0.31)	(0.48)
West Midlands	-0.065	-0.123**	-0.094	-0.111	-0.086***	0.036
	(0.70)	(2.19)	(1.19)	(1.28)	(2.70)	(0.97)
North West	0.051	-0.296***	-0.093	-0.163**	-0.130***	-0.088**
	(0.48)	(5.61)	(1.23)	(2.04)	(4.03)	(2.52)
Wales	-0.058	-0.422***	-0.219**	-0.067	-0.053	-0.153***
	(0.37)	(6.59)	(2.07)	(0.60)	(1.23)	(3.32)
Scotland	-0.190	-0.297***	-0.118	-0.190**	-0.175***	-0.056
	(1.39)	(5.21)	(1.39)	(2.23)	(5.24)	(1.49)
Northern	0.192	-0.472***	0.018	-0.383***	0.044	-0.157***
Ireland	(1.23)	(6.23)	(0.13)	(2.73)	(1.00)	(3.14)
Degree	-0.071	0.841***	-0.022	0.140*	-0.122***	0.302***
	(0.34)	(14.40)	(0.28)	(1.72)	(3.60)	(9.03)
Other higher	-0.345**	0.718***	-0.108	-0.084	-0.209***	0.296***
education	(2.01)	(10.90)	(1.18)	(0.94)	(5.25)	(6.84)
A levels	-0.172	0.524***	-0.125*	0.315***	-0.123***	0.378***
	(1.30)	(13.33)	(1.84)	(4.58)	(3.83)	(12.41)
O levels	-0.205	0.516***	-0.164**	0.171**	-0.131***	0.281***
	(1.47)	(10.48)	(2.09)	(2.08)	(3.84)	(8.49)
Other	-0.191*	0.365***	-0.207***	0.240***	-0.201***	0.281***
	(1.70)	(8.02)	(2.64)	(2.94)	(5.71)	(8.15)
Home owned	0.111	0.080	0.225**	-0.347***	0.186***	-0.185***
	(1.13)	(1.43)	(2.46)	(3.67)	(5.33)	(5.05)
Home	-0.141	0.398***	-0.072	0.267***	-0.042	0.240***
mortgaged	(1.23)	(7.36)	(0.84)	(2.87)	(1.32)	(7.19)
Social housing	0.021	-0.552***	-0.112	-0.487***	-0.114*	-0.588***

	(0.11)	(9.90)	(0.91)	(4.79)	(1.94)	(15.67)
White	-0.111	0.239***	-0.219*	0.373***	-0.150***	0.279***
	(0.85)	(3.13)	(1.86)	(3.11)	(3.68)	(6.93)
Summer	-0.037	0.026	0.005	0.018	0.058**	-0.031
	(0.56)	(0.65)	(0.09)	(0.28)	(2.47)	(1.16)
Autumn	-0.005	-0.029	0.033	0.080	0.025	-0.015
	(0.08)	(0.73)	(0.57)	(1.23)	(1.05)	(0.54)
Winter	-0.060	0.050	0.017	0.021	0.025	0.023
	(0.94)	(1.25)	(0.31)	(0.33)	(1.07)	(0.84)
Immigrant	0.249**	-0.127*	0.028	0.001	0.146***	-0.112***
	(2.30)	(1.80)	(0.29)	(0.01)	(4.21)	(2.92)
Other earner	-0.218**	0.513***	-0.148**	0.523***	-0.090***	0.391***
	(1.99)	(16.05)	(2.54)	(10.81)	(3.74)	(18.73)
Agriculture &	0.907***		0.856***		0.931***	
fishing	(5.38)		(6.08)		(15.71)	
Manufacturing	-0.856***		-0.740***		-0.713***	
	(6.29)		(7.63)		(17.30)	
Construction	0.560***		0.520***		0.637***	
	(5.20)		(6.08)		(17.12)	
Distribution	-0.207**		-0.016		-0.041	
	(2.29)		(0.19)		(1.13)	
Transport &	-0.132		-0.123		-0.232***	
communication	(1.38)		(1.35)		(5.77)	
Banking &	-0.078		0.140*		0.024	
finance	(0.84)		(1.72)		(0.68)	
Public admin	-1.023***		-0.730***		-0.780***	
	(6.54)		(7.09)		(17.78)	
Dependent	0.012	0.031	0.086***	0.015	0.090***	0.003
children	(0.40)	(1.57)	(3.50)	(0.38)	(9.69)	(0.24)
Dependent		0.060		0.027		0.054**
children <5		(1.21)		(0.32)		(1.99)
ρ	-0.482		-0.304		-0.492	
	LR(ρ=0): $\chi^2(1) = 1.77$		LR(ρ=0): $\chi^2(1) = 4.68$		LR(ρ=0): $\chi^2(1) =$	
(p-value)	(p=0.184)		(p=0.031)		11.37 (p=0.001)	
Observations	9558		6891		39554	
Censored	5445		751		3795	
Log Likelihood	-6860.12		-4290.35		-24412.92	
Wald $\chi^2(38)$	733.75		725.89		4177.46	
(p-value)	(0.00)		(0.00)		(0.00)	

Notes: Z statistics reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. Censored observations are those that are removed at the first (selection) stage. In this case they refer to the non-employed.

Table 5.5. Female Self-employment Bivariate Probit Estimates

	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Self	Employ	Self	Employ	Self	Employ
Constant	-2.151***	-0.703***	-2.430***	-0.350**	-1.770***	-0.041
	(3.75)	(5.52)	(4.23)	(2.13)	(14.10)	(0.68)
Aged 25-34	1.063***	0.072	0.450*	0.561***	0.462***	0.444***
	(4.19)	(0.96)	(1.94)	(6.47)	(7.46)	(14.97)
Aged 35-44	1.050***	-0.033	0.831***	0.702***	0.703***	0.539***
	(4.10)	(0.44)	(3.20)	(7.68)	(10.69)	(16.47)
Aged 45-54	1.303***	-0.211***	0.883***	0.566***	0.822***	0.397***
	(4.95)	(2.73)	(3.49)	(6.03)	(12.33)	(11.33)
Aged 55+	1.459***	-0.495***	1.035***	0.164	0.897***	-0.006
	(4.89)	(5.99)	(4.43)	(1.63)	(12.17)	(0.15)
Single	0.096	-0.122**	0.133	-0.030	0.032	-0.148***
	(0.71)	(2.23)	(1.03)	(0.39)	(0.65)	(4.44)
Married	0.103	-0.175***	0.192*	-0.213***	0.129***	-0.282***
	(0.90)	(4.10)	(1.71)	(3.37)	(3.08)	(9.73)
North	-0.042	-0.244***	-0.248	-0.093	-0.380***	-0.002
	(0.27)	(3.70)	(1.48)	(1.05)	(5.86)	(0.06)
Yorkshire &	-0.241*	-0.149***	-0.091	0.088	-0.209***	0.049
Humberside	(1.82)	(2.61)	(0.80)	(1.22)	(4.54)	(1.64)
East Midlands	-0.170	-0.166***	-0.023	-0.027	-0.083*	0.103***
	(1.18)	(2.63)	(0.19)	(0.33)	(1.76)	(3.08)
East Anglia	-0.322	-0.104	-0.281	0.110	-0.044	0.113***
	(1.54)	(1.20)	(1.36)	(0.94)	(0.74)	(2.63)
South West	-0.173	-0.044	0.130	0.034	0.072*	0.074**
	(1.41)	(0.74)	(1.26)	(0.46)	(1.79)	(2.35)
West Midlands	-0.065	-0.154***	-0.094	0.026	-0.211***	0.036
	(0.51)	(2.72)	(0.76)	(0.35)	(4.51)	(1.21)
North West	-0.187	-0.226***	-0.089	0.113	-0.163***	0.104***
	(1.41)	(4.10)	(0.77)	(1.56)	(3.73)	(3.54)
Wales	0.114	-0.308***	0.174	0.003	-0.112**	0.120***
	(0.70)	(4.60)	(1.29)	(0.03)	(1.97)	(3.01)
Scotland	-0.136	-0.258***	-0.199*	0.002	-0.282***	0.131***
	(0.96)	(4.41)	(1.65)	(0.03)	(6.02)	(4.23)
Northern Ireland	-0.247	-0.451***	0.162	0.215	-0.199***	-0.047
	(1.05)	(5.74)	(0.84)	(1.55)	(2.92)	(1.16)
Degree	0.629**	1.048***	0.299	0.713***	0.467***	0.776***
	(2.37)	(16.97)	(1.63)	(9.43)	(8.91)	(26.61)
Other higher	0.676***	0.942***	-0.079	0.682***	0.333***	0.828***
education	(2.73)	(16.47)	(0.41)	(8.84)	(5.79)	(24.78)
A levels	0.522**	0.756***	0.087	0.585***	0.338***	0.592***
	(2.45)	(15.28)	(0.53)	(8.59)	(6.63)	(21.13)
O levels	0.248	0.630***	-0.082	0.535***	0.114**	0.496***
	(1.24)	(14.66)	(0.53)	(9.08)	(2.34)	(20.28)
Other	0.208	0.542***	-0.102	0.366***	0.113**	0.394***
	(1.12)	(11.71)	(0.72)	(5.79)	(2.17)	(14.37)
Home owned	-0.119	0.070	-0.127	-0.034	0.072	-0.051
	(0.90)	(1.15)	(0.88)	(0.42)	(1.44)	(1.60)
Home	-0.150	0.309***	-0.025	0.445***	-0.032	0.376***
mortgaged	(1.08)	(5.47)	(0.17)	(6.05)	(0.73)	(13.77)
Social housing	-0.333*	-0.477***	-0.011	-0.143*	-0.320***	-0.299***

	(1.73)	(8.12)	(0.07)	(1.80)	(4.96)	(9.67)
White	-0.057	0.254***	0.486**	0.277***	0.130**	0.285***
	(0.31)	(3.29)	(2.18)	(2.86)	(2.31)	(8.90)
Summer	-0.095	-0.045	0.114	-0.050	-0.019	-0.071***
	(1.06)	(1.08)	(1.38)	(0.92)	(0.59)	(3.26)
Autumn	-0.204**	-0.055	0.001	-0.012	0.022	-0.019
	(2.25)	(1.32)	(0.01)	(0.21)	(0.69)	(0.88)
Winter	-0.173*	-0.062	-0.035	-0.019	-0.022	-0.021
	(1.86)	(1.45)	(0.41)	(0.34)	(0.67)	(0.97)
Immigrant	0.111	-0.191***	0.281**	-0.281***	0.226***	-0.211***
	(0.72)	(2.70)	(2.03)	(3.43)	(5.18)	(7.11)
Other earner	0.269**	0.459***	0.089	0.379***	0.028	0.295***
	(2.03)	(13.14)	(0.82)	(8.20)	(0.88)	(15.23)
Agriculture &	0.630**		0.332		0.507***	
fishing	(2.31)		(1.13)		(4.78)	
Manufacturing	-0.702***		-0.590***		-1.023***	
	(4.89)		(4.41)		(18.95)	
Construction	-0.793***		-0.467**		-0.662***	
	(2.71)		(2.27)		(7.66)	
Distribution	-0.605***		-0.597***		-0.749***	
	(5.52)		(5.54)		(18.91)	
Transport &	-0.829***		-0.675***		-0.889***	
communication	(3.91)		(3.64)		(13.09)	
Banking &	-0.493***		-0.501***		-0.683***	
finance	(4.18)		(4.50)		(17.12)	
Public admin	-1.374***		-1.036***		-1.232***	
	(11.59)		(10.20)		(32.45)	
Dependent	0.109**	-0.086***	0.111	-0.286***	0.098***	-0.248***
children	(2.15)	(4.44)	(1.48)	(11.31)	(5.77)	(26.72)
Dependent		-0.331***		-0.399***		-0.485***
children <5		(6.86)		(8.40)		(30.30)
ρ	0.134		0.026		0.157	
(p-value)	LR (ρ=0): χ^2 (1) = 0.12 (p=0.727)		LR (ρ=0): χ^2 (1) = 0.00 (p=0.961)		LR (ρ=0): χ^2 (1) = 2.69 (p=0.101)	
Observations	8988		6277		39866	
Censored	5553		1363		8580	
Log Likelihood	-5706.42		-3752.76		-23789.18	
Wald $\chi^2(38)$	273.75		205.08		1831.42	
(p-value)	(0.00)		(0.00)		(0.00)	

Notes: See notes to Table 5.4.

Table 5.6. Within Group Heterogeneity Self-employment Bivariate Probit Estimates

	Male				Female			
	Work-limited		Non-work-limited		Work-limited		Non-work-limited	
	Self	Employ	Self	Employ	Self	Employ	Self	Employ
Constant	-0.453	-0.936***	-0.904**	-0.057	-2.581***	-0.896***	-2.095***	-0.572***
	(0.92)	(6.74)	(2.54)	(0.25)	(4.92)	(6.44)	(3.12)	(2.95)
Aged 25-34	0.273*	0.182**	0.270*	0.520***	1.059***	0.107	0.401*	0.585***
	(1.75)	(2.35)	(1.69)	(4.89)	(4.21)	(1.38)	(1.67)	(6.70)
Aged 35-44	0.440***	0.172**	0.520***	0.587***	1.050***	0.055	0.752***	0.718***
	(2.75)	(2.22)	(3.13)	(5.36)	(4.15)	(0.70)	(2.72)	(7.81)
Aged 45-54	0.695***	0.002	0.701***	0.649***	1.276***	-0.131	0.821***	0.580***
	(4.46)	(0.03)	(4.04)	(5.79)	(4.93)	(1.62)	(3.06)	(6.11)
Aged 55+	0.928***	-0.465***	0.958***	-0.081	1.384***	-0.408***	1.013***	0.180*
	(5.93)	(5.72)	(6.35)	(0.73)	(4.81)	(4.71)	(4.17)	(1.77)
Single	-0.264**	-0.051	-0.041	-0.171*	0.085	-0.118**	0.141	-0.039
	(2.54)	(0.86)	(0.46)	(1.78)	(0.64)	(2.07)	(1.09)	(0.49)
Married	-0.171**	0.117**	-0.117	0.004	0.076	-0.225***	0.218**	-0.215***
	(2.06)	(2.31)	(1.61)	(0.05)	(0.66)	(5.09)	(1.96)	(3.38)
North	-0.089	-0.349***	-0.118	-0.278***	-0.046	-0.178***	-0.238	-0.081
	(0.70)	(5.26)	(1.14)	(2.74)	(0.31)	(2.60)	(1.41)	(0.91)
Yorkshire &	-0.019	-0.118**	-0.154**	-0.023	-0.246*	-0.108*	-0.097	0.099
Humberside	(0.21)	(2.06)	(2.03)	(0.27)	(1.92)	(1.84)	(0.86)	(1.37)
East Midlands	-0.113	-0.103	-0.034	0.013	-0.174	-0.119*	-0.015	-0.015
	(1.09)	(1.62)	(0.42)	(0.13)	(1.24)	(1.83)	(0.12)	(0.18)
East Anglia	-0.010	-0.187**	-0.324***	-0.057	-0.321	-0.144	-0.298	0.119
	(0.08)	(2.22)	(2.63)	(0.45)	(1.56)	(1.62)	(1.45)	(1.02)
South West	-0.085	0.028	0.042	-0.006	-0.175	0.002	0.133	0.045
	(0.95)	(0.46)	(0.56)	(0.07)	(1.44)	(0.03)	(1.28)	(0.59)
West Midlands	-0.084	-0.108*	-0.101	-0.108	-0.076	-0.134**	-0.092	0.038
	(0.91)	(1.83)	(1.27)	(1.24)	(0.62)	(2.30)	(0.74)	(0.51)
North West	0.029	-0.330***	-0.096	-0.157*	-0.205	-0.231***	-0.108	0.110
	(0.28)	(6.00)	(1.27)	(1.96)	(1.61)	(4.05)	(0.93)	(1.52)
Wales	-0.119	-0.359***	-0.226**	-0.045	0.092	-0.248***	0.181	0.011

	(0.89)	(5.29)	(2.12)	(0.39)	(0.61)	(3.56)	(1.34)	(0.11)
Scotland	-0.250**	-0.231***	-0.119	-0.186**	-0.139	-0.152**	-0.220*	0.009
	(2.18)	(3.84)	(1.40)	(2.16)	(1.05)	(2.50)	(1.80)	(0.12)
Northern Ireland	0.181	-0.615***	0.012	-0.379***	-0.282	-0.507***	0.141	0.220
	(1.11)	(7.87)	(0.09)	(2.68)	(1.25)	(6.30)	(0.73)	(1.57)
Degree	0.026	0.785***	-0.016	0.120	0.711***	1.004***	0.243	0.712***
	(0.16)	(12.77)	(0.20)	(1.46)	(3.48)	(15.72)	(1.28)	(9.38)
Other higher education	-0.290*	0.711***	-0.105	-0.094	0.731***	0.912***	-0.129	0.693***
	(1.87)	(10.25)	(1.14)	(1.06)	(3.77)	(15.35)	(0.69)	(8.93)
A levels	-0.113	0.458***	-0.118*	0.305***	0.582***	0.726***	0.028	0.596***
	(1.05)	(11.09)	(1.73)	(4.40)	(3.43)	(14.14)	(0.17)	(8.71)
O levels	-0.151	0.476***	-0.162**	0.161*	0.300*	0.589***	-0.121	0.542***
	(1.26)	(9.21)	(2.05)	(1.95)	(1.84)	(13.23)	(0.80)	(9.16)
Other	-0.157	0.353***	-0.201**	0.241***	0.259	0.521***	-0.132	0.372***
	(1.52)	(7.40)	(2.53)	(2.92)	(1.62)	(10.91)	(0.96)	(5.86)
Home owned	0.125	0.071	0.225**	-0.359***	-0.098	0.052	-0.125	-0.043
	(1.27)	(1.21)	(2.41)	(3.77)	(0.75)	(0.82)	(0.87)	(0.52)
Home mortgaged	-0.108	0.384***	-0.068	0.250***	-0.110	0.295***	-0.050	0.436***
	(1.01)	(6.74)	(0.77)	(2.67)	(0.83)	(5.01)	(0.35)	(5.88)
Social housing	-0.046	-0.508***	-0.126	-0.480***	-0.355**	-0.431***	0.027	-0.139*
	(0.30)	(8.63)	(1.01)	(4.69)	(2.11)	(7.05)	(0.17)	(1.74)
White	-0.088	0.279***	-0.225*	0.387***	-0.024	0.311***	0.456**	0.272***
	(0.65)	(3.49)	(1.88)	(3.21)	(0.13)	(3.90)	(2.00)	(2.80)
Summer	-0.038	0.049	0.004	0.013	-0.108	-0.061	0.122	-0.047
	(0.57)	(1.16)	(0.07)	(0.21)	(1.22)	(1.43)	(1.47)	(0.87)
Autumn	-0.004	-0.028	0.031	0.082	-0.197**	-0.050	0.006	-0.008
	(0.06)	(0.66)	(0.54)	(1.26)	(2.20)	(1.15)	(0.07)	(0.15)
Winter	-0.052	0.052	0.017	0.021	-0.177*	-0.056	-0.035	-0.018
	(0.79)	(1.24)	(0.29)	(0.33)	(1.94)	(1.28)	(0.40)	(0.33)
Immigrant	0.262**	-0.180**	0.028	0.004	0.087	-0.195***	0.295**	-0.289***
	(2.32)	(2.44)	(0.28)	(0.03)	(0.58)	(2.69)	(2.19)	(3.52)
Other earner	-0.161*	0.455***	-0.141**	0.512***	0.296***	0.410***	0.067	0.367***
	(1.87)	(13.64)	(2.35)	(10.51)	(2.78)	(11.38)	(0.62)	(7.89)
Agriculture & fishing	0.947***		0.863***		0.628**		0.361	
	(6.06)		(6.06)		(2.33)		(1.22)	

Manufacturing	-0.884***		-0.752***		-0.691***		-0.591***	
	(7.79)		(7.67)		(4.76)		(4.36)	
Construction	0.581***		0.523***		-0.770***		-0.470**	
	(5.77)		(6.06)		(2.66)		(2.27)	
Distribution	-0.200**		-0.019		-0.590***		-0.591***	
	(2.16)		(0.22)		(5.31)		(5.38)	
Transport & communication	-0.134		-0.125		-0.817***		-0.673***	
	(1.35)		(1.36)		(3.87)		(3.57)	
Banking & finance	-0.080		0.138*		-0.477***		-0.487***	
	(0.84)		(1.69)		(4.00)		(4.30)	
Public admin	-1.053***		-0.740***		-1.347***		-1.029***	
	(8.17)		(7.11)		(10.41)		(9.60)	
Dependent children	0.020	0.008	0.086***	0.014	0.092*	-0.118***	0.133*	-0.286***
	(0.71)	(0.40)	(3.51)	(0.36)	(1.77)	(5.95)	(1.85)	(11.30)
Dependent children <5		0.050		0.019		-0.372***		-0.411***
		(0.96)		(0.23)		(7.60)		(8.60)
Limbs	**-0.083**	**0.807*****	**-0.008**	**0.500*****	**0.295**	**0.677*****	**-0.058**	**0.367*****
	(0.45)	**(14.68)**	**(0.05)**	**(3.89)**	**(1.55)**	**(12.76)**	**(0.28)**	**(3.46)**
Sight/hearing	**-0.287**	**0.772*****	**0.050**	**0.469*****	**0.207**	**0.763*****	**-0.114**	**0.446*****
	(1.39)	**(8.65)**	**(0.27)**	**(3.11)**	**(0.81)**	**(8.25)**	**(0.45)**	**(3.04)**
Skin, breathing and organs	**-0.110**	**0.801*****	**-0.022**	**0.453*****	**0.299**	**0.753*****	**-0.137**	**0.334*****
	(0.59)	**(14.28)**	**(0.13)**	**(3.71)**	**(1.50)**	**(13.45)**	**(0.70)**	**(3.35)**
Other	**0.045**	**0.416*****	**-0.046**	**0.410*****	**0.345***	**0.474*****	**0.013**	**0.273*****
	(0.28)	**(6.41)**	**(0.26)**	**(2.91)**	**(1.94)**	**(7.88)**	**(0.07)**	**(2.58)**
Number of health problems	**0.056**	**-0.235*****	**0.001**	**-0.028**	**-0.009**	**-0.177*****	**-0.052**	**-0.068*****
	(1.24)	**(23.15)**	**(0.03)**	**(1.05)**	**(0.21)**	**(18.45)**	**(1.25)**	**(3.12)**
ρ	-0.374		-0.560		0.296		-0.157	
(p-value)	LR (ρ=0): χ^2 (1) = 1.85 (p=0.174)		LR (ρ=0): χ^2 (1) = 3.64 (p=0.056)		LR (ρ=0): χ^2 (1) = 0.75 (p=0.386)		LR (ρ=0): χ^2 (1) = 0.10 (p=0.746)	
Observations	9495		6869		8936		6241	
Censored	5398		747		5513		1359	
Log Likelihood	-6357.231		-4271.012		-5376.451		-3718.22	
Wald $\chi^2(43)$ (p-value)	681.39 (0.00)		723.15 (0.00)		286.84 (0.00)		214.21 (0.00)	

Notes: See notes to Table 5.4. The controls for within group differences are highlighted in **bold.**

Table 5.7. Decomposition of Predicted Conditional Self-employment Probabilities

	Coefficient vector on self-employment equation		
Males	β_{D_1}	β_{D_2}	β_N
Disabled work-limited	0.212	0.115	0.137
Disabled non-work- limited	0.274	0.165	0.189
Non-disabled	0.243	0.151	0.174
$(S^C_{D_1} - S^C_N)_{\text{unexplained}}$	0.069		
$(S^C_{D_2} - S^C_N)_{\text{unexplained}}$	-0.023		
Females	β_{D_1}	β_{D_2}	β_N
Disabled work- limited	0.093	0.074	0.083
Disabled non-work- limited	0.079	0.063	0.070
Non-disabled	0.085	0.065	0.073
$(S^C_{D_1} - S^C_N)_{\text{unexplained}}$	0.012		
$(S^C_{D_2} - S^C_N)_{\text{unexplained}}$	-0.008		

Notes: Calculated from equations (5.8) and (5.9) and based on estimates in Tables 5.4 and 5.5.

CHAPTER FIVE

APPENDIX

Table A5.1. Male Self-employment Bivariate Probit Model Marginal Effects

	Marginal Effects					
	Work-limited disabled		Non-work-limited disabled		Non-disabled	
	Self	Employ	Self	Employ	Self	Employ
Aged 25-34	0.094	0.079***	0.071	0.051***	0.105***	0.057***
	(1.60)	(2.69)	(1.61)	(6.61)	(7.10)	(20.44)
Aged 35-44	0.165***	0.062**	0.144***	0.060***	0.169***	0.064***
	(2.85)	(2.12)	(3.06)	(6.91)	(10.73)	(19.24)
Aged 45-54	0.268***	-0.026	0.195***	0.070***	0.224***	0.053***
	(4.91)	(0.90)	(4.13)	(7.15)	(12.94)	(15.77)
Aged 55+	0.362***	-0.193***	0.272***	-0.009	0.340***	-0.011*
	(5.52)	(6.87)	(6.36)	(0.64)	(19.79)	(1.92)
Single	-0.084**	-0.042**	-0.009	-0.025*	0.003	-0.017***
	(2.47)	(1.97)	(0.43)	(1.75)	(0.31)	(2.88)
Married	-0.061**	0.038**	-0.030	0.001	-0.004	0.008
	(1.97)	(2.04)	(1.59)	(0.07)	(0.50)	(1.57)
North	-0.015	-0.149***	-0.028	-0.041**	-0.026***	-0.033***
	(0.28)	(7.04)	(1.24)	(2.26)	(2.70)	(4.52)
Yorkshire&	0.005	-0.069***	-0.036**	-0.004	-0.037***	-0.006
Humberside	(0.14)	(3.41)	(2.17)	(0.36)	(5.29)	(1.31)
East Midlands	-0.028	-0.060***	-0.009	0.002	-0.031***	-0.004
	(0.77)	(2.63)	(0.46)	(0.19)	(3.99)	(0.66)
East Anglia	-0.007	-0.034	-0.069***	-0.006	-0.017	-0.003
	(0.16)	(1.11)	(3.16)	(0.33)	(1.60)	(0.39)
South West	-0.025	-0.007	0.011	-0.000	0.002	0.002
	(0.81)	(0.33)	(0.56)	(0.02)	(0.31)	(0.49)
West Midlands	-0.024	-0.047**	-0.023	-0.016	-0.020***	0.005
	(0.73)	(2.23)	(1.25)	(1.20)	(2.78)	(0.99)
North West	0.019	-0.111***	-0.022	-0.023*	-0.030***	-0.012**
	(0.45)	(5.88)	(1.30)	(1.87)	(4.35)	(2.39)
Wales	-0.021	-0.154***	-0.050**	-0.009	-0.013	-0.022***
	(0.40)	(7.22)	(2.32)	(0.57)	(1.27)	(3.02)
Scotland	-0.068*	-0.111***	-0.028	-0.028**	-0.040***	-0.007
	(1.74)	(5.47)	(1.50)	(2.00)	(5.78)	(1.44)
Northern	0.073	-0.169***	0.005	-0.065**	0.011	-0.022***
Ireland	(1.11)	(6.98)	(0.13)	(2.20)	(0.98)	(2.85)
Degree	-0.026	0.324***	-0.005	0.017*	-0.029***	0.034***
	(0.33)	(15.94)	(0.28)	(1.85)	(3.56)	(10.30)
Other higher	-0.118	0.279***	-0.026	-0.011	-0.047***	0.031***
education	(1.58)	(11.71)	(1.25)	(0.89)	(5.42)	(8.38)
A levels	-0.063	0.206***	-0.031*	0.038***	-0.029***	0.043***
	(1.11)	(13.48)	(1.81)	(4.93)	(3.67)	(13.79)
O levels	-0.073	0.204***	-0.039**	0.020**	-0.031***	0.031***
	(1.24)	(10.65)	(2.18)	(2.28)	(3.80)	(9.76)
Other	-0.068	0.144***	-0.048***	0.028***	-0.046***	0.031***
	(1.42)	(8.02)	(2.74)	(3.37)	(5.68)	(9.59)
Home owned	0.041	0.031	0.060**	-0.052***	0.048***	-0.026***

	(1.16)	(1.42)	(2.24)	(3.24)	(4.88)	(4.64)
Home mortgaged	-0.052	0.155***	-0.018	0.036***	-0.010	0.032***
	(1.09)	(7.38)	(0.82)	(2.78)	(1.29)	(6.89)
Social housing	0.008	-0.205***	-0.027	-0.084***	-0.027**	-0.106***
	(0.11)	(10.55)	(0.98)	(3.80)	(2.14)	(11.94)
White	-0.042	0.090***	-0.060*	0.062**	-0.039***	0.043***
	(0.80)	(3.25)	(1.67)	(2.54)	(3.36)	(5.92)
Summer	-0.013	0.010	0.001	0.002	0.014**	-0.004
	(0.56)	(0.65)	(0.09)	(0.28)	(2.43)	(1.15)
Autumn	-0.002	-0.011	0.008	0.010	0.006	-0.002
	(0.08)	(0.73)	(0.57)	(1.27)	(1.05)	(0.54)
Winter	-0.022	0.020	0.004	0.003	0.006	0.003
	(0.93)	(1.25)	(0.30)	(0.33)	(1.06)	(0.85)
Immigrant	0.095**	-0.049*	0.007	0.000	0.038***	-0.015***
	(2.14)	(1.83)	(0.29)	(0.01)	(3.95)	(2.74)
Other earner	-0.080	0.199***	-0.038**	0.077***	-0.023***	0.056***
	(1.56)	(16.29)	(2.22)	(9.72)	(3.38)	(17.00)
Agriculture &fishing	0.335***		0.215***		0.229***	
	(6.15)		(6.14)		(15.86)	
Manufacturing	-0.316***		-0.186***		-0.175***	
	(8.59)		(8.57)		(18.49)	
Construction	0.207***		0.131***		0.156***	
	(6.03)		(6.15)		(17.05)	
Distribution	-0.076**		-0.004		-0.010	
	(2.34)		(0.19)		(1.13)	
Transport& communication	-0.049		-0.031		-0.057***	
	(1.40)		(1.36)		(5.82)	
Banking & finance	-0.029		0.035*		0.006	
	(0.84)		(1.71)		(0.68)	
Public admin	-0.378***		-0.183***		-0.192***	
	(9.10)		(7.92)		(18.73)	
Dependent children	0.004	0.012	0.021***	0.002	0.022***	0.000
	(0.41)	(1.57)	(3.54)	(0.38)	(9.84)	(0.24)
Dependent children<5		0.023		0.004		0.007**
		(1.21)		(0.32)		(1.99)

Notes: Marginal effects relate to coefficient estimates in Table 5.4. See notes to Table 5.4.

Table A5.2. Female Self-employment Bivariate Probit Model Marginal Effects

	Marginal Effects					
	Work-limited Disabled		Non-work-limited Disabled		Non-disabled	
	Self	Employ	Self	Employ	Self	Employ
Aged 25-34	0.166*	0.027	0.054*	0.123***	0.053***	0.103***
	(1.65)	(0.95)	(1.70)	(7.98)	(6.38)	(16.77)
Aged 35-44	0.140	-0.012	0.111***	0.157***	0.086***	0.125***
	(1.61)	(0.44)	(2.95)	(9.20)	(9.09)	(18.40)
Aged 45-54	0.173	-0.077***	0.116***	0.133***	0.116***	0.092***
	(1.63)	(2.78)	(3.06)	(6.82)	(9.44)	(12.76)
Aged 55+	0.239	-0.171***	0.165***	0.041*	0.152***	-0.002
	(1.59)	(6.53)	(2.79)	(1.72)	(8.04)	(0.15)
Single	0.008	-0.044**	0.013	-0.008	0.003	-0.039***
	(0.58)	(2.27)	(0.92)	(0.38)	(0.65)	(4.32)
Married	0.008	-0.065***	0.017	-0.055***	0.012***	-0.071***
	(0.67)	(4.09)	(1.35)	(3.47)	(3.03)	(10.02)
North	-0.003	-0.086***	-0.019	-0.025	-0.027***	-0.001
	(0.29)	(3.92)	(1.64)	(1.02)	(7.55)	(0.06)
Yorkshire&	-0.017	-0.054***	-0.008	0.022	-0.017***	0.012*
Humberside	(1.35)	(2.68)	(0.79)	(1.26)	(5.10)	(1.67)
East Midlands	-0.012	-0.060***	-0.002	-0.007	-0.007*	0.026***
	(1.12)	(2.73)	(0.19)	(0.33)	(1.86)	(3.22)
East Anglia	-0.020	-0.038	-0.021	0.028	-0.004	0.028***
	(1.23)	(1.22)	(1.42)	(0.99)	(0.77)	(2.77)
South West	-0.012	-0.016	0.013	0.009	0.007*	0.018**
	(1.13)	(0.75)	(1.12)	(0.47)	(1.70)	(2.42)
West Midlands	-0.005	-0.055***	-0.008	0.007	-0.017***	0.009
	(0.55)	(2.81)	(0.79)	(0.36)	(5.08)	(1.23)
North West	-0.013	-0.080***	-0.008	0.029	-0.014***	0.026***
	(1.36)	(4.29)	(0.76)	(1.63)	(4.06)	(3.69)
Wales	0.010	-0.107***	0.019	0.001	-0.010**	0.029***
	(0.52)	(4.98)	(1.08)	(0.03)	(2.13)	(3.18)
Scotland	-0.010	-0.091***	-0.016	0.001	-0.022***	0.032***
	(1.07)	(4.67)	(1.61)	(0.03)	(6.82)	(4.46)
Northern	-0.017	-0.150***	0.017	0.051*	-0.016***	-0.012
Ireland	(1.26)	(6.60)	(0.76)	(1.73)	(3.42)	(1.13)
Degree	0.082***	0.399***	0.034*	0.145***	0.058***	0.155***
	(3.41)	(19.07)	(1.89)	(12.82)	(7.90)	(35.49)
Other higher	0.090***	0.363***	-0.007	0.137***	0.040***	0.152***
education	(3.64)	(17.76)	(0.39)	(12.22)	(5.15)	(37.54)
A levels	0.060***	0.293***	0.009	0.127***	0.039***	0.125***
	(3.20)	(15.58)	(0.56)	(10.71)	(5.99)	(26.40)
O levels	0.023*	0.242***	-0.007	0.125***	0.011**	0.115***
	(1.89)	(14.64)	(0.49)	(10.31)	(2.32)	(22.69)
Other	0.019	0.209***	-0.009	0.086***	0.012**	0.088***
	(1.48)	(11.58)	(0.66)	(6.60)	(2.08)	(16.79)
Home owned	-0.009	0.026	-0.011	-0.009	0.007	-0.013
	(0.77)	(1.14)	(0.93)	(0.42)	(1.38)	(1.58)
Home mortgaged	-0.012	0.115***	-0.002	0.120***	-0.003	0.101***
	(0.74)	(5.44)	(0.16)	(5.96)	(0.72)	(13.37)
Social housing	-0.025*	-0.169***	-0.001	-0.039*	-0.025***	-0.085***
	(1.91)	(8.61)	(0.07)	(1.73)	(6.34)	(8.88)
White	-0.005	0.089***	0.031***	0.081***	0.011***	0.082***
	(0.28)	(3.49)	(2.67)	(2.61)	(2.59)	(8.13)
Summer	-0.007	-0.017	0.011	-0.013	-0.002	-0.019***

	(0.94)	(1.08)	(1.19)	(0.91)	(0.59)	(3.21)
Autumn	-0.015	-0.020	0.000	-0.003	0.002	-0.005
	(1.33)	(1.33)	(0.01)	(0.21)	(0.69)	(0.87)
Winter	-0.013	-0.023	-0.003	-0.005	-0.002	-0.006
	(1.30)	(1.46)	(0.41)	(0.34)	(0.68)	(0.96)
Immigrant	0.010	-0.068***	0.032	-0.082***	0.025***	-0.059***
	(0.56)	(2.81)	(1.33)	(3.15)	(4.29)	(6.65)
Other earner	0.022**	0.168***	0.008	0.106***	0.003	0.081***
	(2.44)	(13.42)	(1.01)	(7.78)	(0.90)	(14.43)
Agriculture&	0.052		0.031		0.048***	
fishing	(1.24)		(1.07)		(4.63)	
Manufacturing	-0.058		-0.055***		-0.098***	
	(1.42)		(2.58)		(13.86)	
Construction	-0.065		-0.044*		-0.063***	
	(1.32)		(1.85)		(7.15)	
Distribution	-0.050		-0.056***		-0.071***	
	(1.43)		(2.76)		(13.64)	
Transport&	-0.068		-0.063**		-0.085***	
communication	(1.38)		(2.46)		(10.94)	
Banking &	-0.040		-0.047***		-0.065***	
finance	(1.40)		(2.62)		(13.03)	
Public admin	-0.113		-0.097***		-0.118***	
	(1.48)		(3.06)		(17.14)	
Dependent	0.009	-0.032***	0.010	-0.075***	0.009***	-0.064***
children	(1.00)	(4.44)	(1.04)	(11.36)	(4.85)	(26.79)
Dependent		-0.122***		-0.105***		-0.125***
children<5		(6.86)		(8.36)		(30.08)

Notes: Marginal effects relate to coefficient estimates in Table 5.5. See notes to Table 5.4.

Table A5.3. Within Group Heterogeneity Self-employment Bivariate Probit Model Marginal Effects

	Male				Female			
	Work-limited		Non-work-limited		Work-limited		Non-work-limited	
	Self	Employ	Self	Employ	Self	Employ	Self	Employ
Aged 25-34	0.100*	0.071**	0.073*	0.051***	0.135*	0.040	0.052	0.127***
	(1.76)	(2.32)	(1.65)	(6.63)	(1.77)	(1.36)	(1.57)	(8.35)
Aged 35-44	0.161***	0.067**	0.147***	0.060***	0.113*	0.020	0.107***	0.160***
	(2.85)	(2.20)	(3.11)	(6.87)	(1.81)	(0.69)	(2.78)	(9.40)
Aged 45-54	0.256***	0.001	0.199***	0.069***	0.136*	-0.047	0.116***	0.136***
	(4.48)	(0.03)	(4.18)	(6.96)	(1.84)	(1.64)	(2.99)	(6.94)
Aged 55+	0.331***	-0.175***	0.273***	-0.011	0.183*	-0.141***	0.175***	0.045*
	(4.58)	(5.93)	(6.33)	(0.72)	(1.73)	(5.05)	(2.92)	(1.88)
Single	-0.088***	-0.019	-0.010	-0.024*	0.006	-0.042**	0.016	-0.010
	(2.67)	(0.86)	(0.47)	(1.66)	(0.55)	(2.10)	(0.97)	(0.49)
Married	-0.060*	0.045**	-0.030	0.000	0.005	-0.083***	0.022	-0.055***
	(1.90)	(2.32)	(1.58)	(0.05)	(0.55)	(5.07)	(1.46)	(3.47)
North	-0.030	-0.127***	-0.028	-0.043**	-0.003	-0.062***	-0.021	-0.022
	(0.77)	(5.65)	(1.23)	(2.33)	(0.33)	(2.70)	(1.57)	(0.89)
Yorkshire & Humberside	-0.007	-0.045**	-0.036**	-0.003	-0.013	-0.039*	-0.010	0.025
	(0.21)	(2.10)	(2.18)	(0.27)	(1.49)	(1.88)	(0.83)	(1.42)
East Midlands	-0.038	-0.039	-0.008	0.002	-0.009	-0.042*	-0.002	-0.004
	(1.16)	(1.64)	(0.42)	(0.13)	(1.18)	(1.88)	(0.12)	(0.18)
East Anglia	-0.003	-0.070**	-0.069***	-0.008	-0.015	-0.051*	-0.025	0.030
	(0.08)	(2.29)	(3.17)	(0.43)	(1.42)	(1.68)	(1.48)	(1.07)
South West	-0.029	0.011	0.011	-0.001	-0.009	0.001	0.015	0.012
	(0.96)	(0.46)	(0.55)	(0.07)	(1.20)	(0.03)	(1.15)	(0.60)
West Midlands	-0.029	-0.041*	-0.024	-0.015	-0.004	-0.048**	-0.009	0.010
	(0.95)	(1.86)	(1.34)	(1.17)	(0.65)	(2.36)	(0.76)	(0.52)
North West	0.010	-0.122***	-0.023	-0.022*	-0.011	-0.081***	-0.011	0.028
	(0.27)	(6.37)	(1.35)	(1.79)	(1.53)	(4.26)	(0.90)	(1.59)
Wales	-0.040	-0.131***	-0.050**	-0.006	0.006	-0.086***	0.022	0.003

	(1.01)	(5.71)	(2.39)	(0.38)	(0.50)	(3.80)	(1.12)	(0.11)
Scotland	-0.082***	-0.086***	-0.028	-0.027*	-0.008	-0.054***	-0.020*	0.002
	(2.70)	(3.99)	(1.51)	(1.95)	(1.06)	(2.58)	(1.71)	(0.12)
Northern Ireland	0.065	-0.209***	0.003	-0.064**	-0.014	-0.163***	0.017	0.052*
	(0.98)	(9.46)	(0.09)	(2.16)	(1.50)	(7.48)	(0.67)	(1.76)
Degree	0.009	0.305***	-0.004	0.015	0.078***	0.384***	0.029	0.144***
	(0.16)	(13.74)	(0.20)	(1.55)	(3.47)	(17.15)	(1.51)	(12.75)
Other higher education	-0.093	0.277***	-0.025	-0.013	0.081***	0.351***	-0.013	0.138***
	(1.53)	(10.86)	(1.21)	(1.00)	(3.52)	(16.21)	(0.62)	(12.42)
A levels	-0.039	0.179***	-0.029*	0.037***	0.055***	0.281***	0.003	0.128***
	(0.93)	(11.11)	(1.69)	(4.72)	(3.17)	(14.22)	(0.17)	(10.91)
O levels	-0.051	0.187***	-0.038**	0.019**	0.022**	0.224***	-0.012	0.126***
	(1.10)	(9.26)	(2.13)	(2.12)	(2.29)	(13.09)	(0.68)	(10.42)
Other	-0.053	0.138***	-0.046***	0.027***	0.019*	0.200***	-0.013	0.087***
	(1.31)	(7.36)	(2.61)	(3.35)	(1.84)	(10.71)	(0.83)	(6.70)
Home owned	0.044	0.028	0.059**	-0.053***	-0.006	0.019	-0.012	-0.011
	(1.28)	(1.20)	(2.19)	(3.32)	(0.71)	(0.81)	(0.91)	(0.52)
Home mortgaged	-0.037	0.149***	-0.017	0.034***	-0.007	0.109***	-0.005	0.117***
	(0.93)	(6.74)	(0.76)	(2.59)	(0.68)	(4.98)	(0.32)	(5.80)
Social housing	-0.016	-0.188***	-0.030	-0.082***	-0.020**	-0.151***	0.003	-0.038*
	(0.31)	(9.16)	(1.11)	(3.73)	(1.98)	(7.44)	(0.17)	(1.68)
White	-0.031	0.103***	-0.061*	0.065***	-0.002	0.106***	0.034**	0.079**
	(0.62)	(3.68)	(1.67)	(2.59)	(0.13)	(4.22)	(2.53)	(2.56)
Summer	-0.013	0.019	0.001	0.002	-0.006	-0.022	0.013	-0.013
	(0.57)	(1.16)	(0.07)	(0.21)	(1.10)	(1.44)	(1.25)	(0.86)
Autumn	-0.001	-0.011	0.008	0.010	-0.011	-0.018	0.001	-0.002
	(0.06)	(0.66)	(0.54)	(1.31)	(1.47)	(1.16)	(0.06)	(0.15)
Winter	-0.018	0.020	0.004	0.003	-0.010	-0.020	-0.004	-0.005
	(0.78)	(1.24)	(0.29)	(0.33)	(1.44)	(1.29)	(0.41)	(0.33)
Immigrant	0.096**	-0.068**	0.007	0.000	0.006	-0.069***	0.038	-0.084***
	(2.05)	(2.51)	(0.28)	(0.03)	(0.49)	(2.81)	(1.39)	(3.22)
Other earner	-0.056	0.175***	-0.036**	0.074***	0.018**	0.148***	0.007	0.102***

	(1.48)	(13.77)	(2.05)	(9.47)	(2.43)	(11.58)	(0.73)	(7.50)
Agriculture & fishing	0.329***		0.214***		0.039		0.038	
	(5.29)		(6.07)		(1.37)		(1.13)	
Manufacturing	-0.307***		-0.186***		-0.043		-0.062***	
	(6.51)		(8.54)		(1.63)		(2.61)	
Construction	0.202***		0.130***		-0.048		-0.049*	
	(5.25)		(6.07)		(1.47)		(1.88)	
Distribution	-0.070**		-0.005		-0.037*		-0.062***	
	(2.11)		(0.22)		(1.65)		(2.78)	
Transport & communication	-0.047		-0.031		-0.051		-0.071**	
	(1.35)		(1.37)		(1.59)		(2.48)	
Banking & finance	-0.028		0.034*		-0.030		-0.051***	
	(0.84)		(1.68)		(1.58)		(2.63)	
Public admin	-0.366***		-0.184***		-0.084*		-0.108***	
	(6.74)		(7.90)		(1.73)		(3.09)	
Dependent children	0.007	0.003	0.021***	0.002	0.006	-0.043***	0.014	-0.075***
	(0.71)	(0.40)	(3.54)	(0.36)	(1.01)	(5.95)	(1.18)	(11.35)
Dependent children <5		0.019		0.002		-0.136***		-0.108***
		(0.96)		(0.23)		(7.61)		(8.56)
Limbs	**-0.029**	**0.308*** **	**-0.002**	**0.053*** **	**0.019***	**0.249*** **	**-0.006**	**0.086*** **
	(0.43)	**(15.28)**	**(0.05)**	**(4.80)**	**(1.85)**	**(12.97)**	**(0.28)**	**(3.91)**
Sight/hearing	**-0.092**	**0.299*** **	**0.013**	**0.045*** **	**0.016**	**0.297*** **	**-0.011**	**0.095*** **
	(1.25)	**(9.40)**	**(0.27)**	**(4.47)**	**(0.79)**	**(8.46)**	**(0.46)**	**(3.93)**
Skin, breathing and organs	**-0.038**	**0.309*** **	**-0.005**	**0.065*** **	**0.022***	**0.286*** **	**-0.015**	**0.089*** **
	(0.55)	**(14.77)**	**(0.13)**	**(3.37)**	**(1.71)**	**(13.52)**	**(0.63)**	**(3.30)**
Other	**0.016**	**0.164*** **	**-0.011**	**0.041*** **	**0.027***	**0.181*** **	**0.001**	**0.066*** **
	(0.29)	**(6.40)**	**(0.26)**	**(3.88)**	**(1.66)**	**(7.71)**	**(0.07)**	**(2.82)**
Number of health problems	**0.020**	**-0.090*** **	**0.000**	**-0.004**	**-0.001**	**-0.065*** **	**-0.006**	**-0.018*** **
	(1.04)	**(23.41)**	**(0.03)**	**(1.05)**	**(0.23)**	**(18.65)**	**(1.32)**	**(3.12)**

Notes: Marginal effects relate to coefficient estimates in Table 5.6. See notes to Table 5.4. The controls for within group differences are highlighted in **bold.**

CHAPTER SIX

THE BIAS ASSOCIATED WITH SELF-REPORTED DISABILITY

6.1 Introduction

The growth in interest and empirical evidence relating to the impact of disability on labour market outcomes in the UK is documented in Section 2.4.2 of Chapter 2. However, these studies utilise, almost exclusively, self-reported information from surveys such as the LFS (Kidd *et al.*, 2000 and Jones *et al.*, 2006b), BHPS (Bell and Heitmueller, 2005), GHS (Blackaby *et al.*, 1999) and the FRS (Madden, 2004).[145] While there are obvious advantages in using information from these large scale surveys, it has meant that the current UK evidence is conditional on the assumption that 'global' self-reported measures of disability coincide with true disability. This appears controversial, given the literature that exists on the potential bias associated with the use of 'global' self-reported health information to analyse the retirement decision (see Section 2.3). Indeed, there are no obvious reasons why the empirical concerns formalised by Bound (1991), in relation to either the subjective individual nature of reporting (measurement error) or the influence of labour market status on reporting (justification bias), should only relate to individuals nearing the age of retirement. Moreover, the only other known UK study to consider this issue, O'Donnell (1998), using data from the 1985 OPCS survey, rejects the accuracy of self-reported information for working age men.

This Chapter, by using detailed information on health available in the HSE, is able to consider the potential bias associated with self-reported disability when estimating the impact of disability on labour market participation for the entire working age

[145] In practice, nearly all these studies split the population by disability status, but the problem of endogeneity may transfer to sample selection bias in this situation. Only Madden (2004) considers this.

population.[146] In addition to providing evidence for England, the extensive range of health information can be used to investigate important issues raised in recent analysis of this issue. These include consideration of the suitability of alternative instruments for disability, given the concerns that self-reported, more objective, health information also suffers from justification bias (Lindeboom and Kerkhofs, 2002 and Baker *et al.*, 2004) and that endogeneity between work and disability may result from a direct relationship (Ettner, 2000). More specifically, this analysis uses a range of variables, depending on the assumptions imposed on the form of endogeneity, to instrument global self-reported health in a labour market participation equation. In doing so, it tests the accuracy of current estimates of the impact of disability on participation in England.

Since the empirical issues in measuring disability are discussed in Chapter 2, a brief summary focusing on the current context is included in Section 6.2. Section 6.3 outlines the data from the HSE and discusses the econometric approach employed here. Section 6.4 presents and analyses the key results and the final section (6.5) briefly concludes.

6.2 Measurement of Disability

Although the sources of bias relating to self-reported health are extensive (see Deschryvere 2005), the two main issues were formalised by Bound (1991). An individual's assessment of disability is likely to be subjective and, as such, self-reported responses may differ between individuals who have the same 'true' disability status. This measurement error in self-reported disability will cause a downward bias on the estimate of disability on participation. However, there is an additional source of bias. The justification hypothesis suggests that there are additional incentives for those who are not in work to report a disability, for example, to justify their economic status. This creates a positive correlation between the errors in a labour force participation equation and in a self-reported health equation, which Bound (1991) shows will cause an upward bias on the influence of self-reported health on participation. As such, estimates based on self-reported

[146] The Health Surveys in the UK are undertaken independently by country and, as such, samples, questions and time periods differ. The analysis is thus restricted to England.

disability may over or underestimate the impact of 'true' disability, depending on the relative influence of these two sources of bias. However, what Bound (1991) also shows is that authors who tried to resolve these issues by replacing self-reported information with more objective measures (see, for example, Parsons, 1980, 1982) are also subject to bias. This bias arises from an alternative source of measurement error because objective measures are less than perfectly correlated with work capacity. Objective health measures will, therefore, underestimate the effect of 'true' disability on labour market participation.

Empirical studies examining this issue have generally proceeded in two main ways. Firstly, both self-reported and more objective measures have been applied to identify upper and lower bounds of the impact of health on labour market outcomes (see, for example, Dwyer and Mitchell, 1999). More frequently, however, more objective health measures have been used to instrument self-reported health (Stern, 1989, Bound *et al.* 1999, Dwyer and Mitchell, 1999 and Au *et al.*, 2005). As Bound (1991) shows, using more objective information to instrument self-reported health will lead to a correct estimate of health on participation, but may tend to underestimate the impact of economic influences. Examples of instruments in this literature include parental health and mortality (Dwyer and Mitchell, 1999), weight/height ratio or BMI (Campolieti, 2002) and, medical conditions and functional limitations (Campolieti, 2002 and Au *et al.* 2005). Alternatively, studies have used comparisons between workers' (who are assumed to have unbiased reports) and non-workers' objective and subjective health information to identify the self-reporting bias (for example, Lindeboom and Kerkhofs, 2002). Despite a growing number of studies, the empirical evidence is inconclusive. Several studies find that the non-employed tend to over-report disability (Kerkhofs and Lindeboom, 1995, O'Donnell, 1998, Lindeboom and Kerkhofs, 2002 and Kreider and Pepper, 2007) whilst others find that self-reported disability is an unbiased measure of true disability (Stern 1989, Dwyer and Mitchell 1999, Benitez-Silva *et al.* 2004 and Larsen and Datta Gupta, 2004).

There is a debate over what constitutes an appropriate instrument for disability. The majority of instruments relate to 'more objective' measures of health; however this covers a range of measures, some of which are self-reported (see Section 2.3 for a discussion). Bound *et al.* (1995) and Au *et al.* (2005), amongst others, argue that more specific self-reported conditions are the less likely they are to suffer from justification bias. Instruments used in this type of analysis have, therefore, included self-reported information on the presence of medical conditions and/or the ability to perform certain tasks (Bound *et al.* 1999, Disney *et al.*, 2006), health indices (Au *et al.*, 2005) and health risk factors (for example, BMI) (Campolieti, 2002). The objectivity of these more objective instruments may vary considerably. Measures which make reference to outside standards, such as the ability to perform a set task, or that make use of information provided by a third party, such as the presence of a medical condition, would seem to be less susceptible to individual misreporting. However, Baker *et al.* (2004) find that self-reported information on specific conditions also suffers from justification bias. In this case, therefore, self-reported health information is correlated with participation and becomes inappropriate to use as an instrument. As such, it is preferable to use true objective information such as physician reported conditions or measurements (see Stern, 1989, Bound *et al.*, 1995 and Campolieti, 2002), subsequent mortality rates (Bound, 1991) and medical records (Baker *et al.* 2004).

Whilst these objective measures will not suffer from justification bias, there are other, more traditional, mechanisms through which disability and work may be endogenous. Deschryvere (2005) refers to these forms of endogeneity as Type I and treats them as distinct from endogeneity associated with measurement which is referred to as Type II. Firstly, there may be common unobservables which affect both disability and work, and, secondly, there may be a direct relationship between working and health. Under these circumstances even objective health measures become endogenous. As a result, Ettner (2000) advocates instruments relating to genetic and environmental influences, such as parental health, previous health assessments and regional health indicators, as instruments for any self-reported measure of disability.

6.3. Data and Methodology

6.3.1. The Econometric Model

The econometric model follows Campolieti (2002) closely, which adopts a similar framework to Bound *et al.* (1995), amongst others. The first equation models the decision to participate in the labour market[147]:

$$p^{*}_{i}=\gamma\, Y_{i} + \lambda \eta_{i} + \varepsilon_{i} \qquad (6.1)$$

where p^{*}_{i} is the latent variable determining labour market participation, Y_i includes exogenous controls for personal and household characteristics and η_i is the continuous measure of 'true' disability which is unobserved. The second equation models true disability status as:

$$\eta_{i} = \beta\, Y_{i} + \alpha\, Z_{i} + \upsilon_{i} \qquad (6.2)$$

where Z_i includes various controls for health status, which are assumed to be exogenous and, therefore, uncorrelated with p^{*}_{i}. Finally, the third equation models observed self-reported disability status as:

$$d^{*}_{i}=\phi\, Y_{i} + \psi\, \eta_{i} + \mu_{i} \qquad (6.3)$$

where d^{*}_{i} is a global self-reported measure of disability which depends on true disability and personal and household characteristics.

As Campolieti (2002) shows, by substituting equation (6.2) into equation (6.3), the disability reporting equation can be expressed as ($\psi = 1$):

$$d^{*}_{i}=(\phi+\beta)\, Y_{i} + \alpha\, Z_{i} + \varpi_{i} \qquad (6.4)$$

where $\varpi_{i} = \upsilon_{i} + \mu_{i}$. Equation (6.4) can be used to predict $\hat{d}^{*}_{i}$ which is used to instrument η_i in equation (6.1) as follows:

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[147] The participation, rather than employment, decision has been the focus of this literature, and, therefore, the analysis differs slightly from previous Chapters.

$$p^*_i = \gamma\, Y_i + \lambda\, \hat{d}^*_i + \varepsilon_i' \quad (6.5)$$

As Bound (1991) notes, whilst the estimate of λ is consistent, if the self-reported information depends on the exogenous characteristics, $\hat{\gamma}$ will be a biased estimate.[148]

In practice, the latent variables are not observed. Instead, binary variables are observed, which are related to the latent variables as follows: [149]

$$d_i = \begin{cases} =1 & if \quad d_i^* > 0 \\ =0 & if \quad d_i^* \leq 0 \end{cases} \qquad p_i = \begin{cases} =1 & if \quad p_i^* > 0 \\ =0 & if \quad p_i^* \leq 0 \end{cases}$$

Therefore, the participation equation has a binary dependent variable and an endogenous binary variable. In this situation, Campolieti (2002) estimates equations (6.4) and (6.5) as probit models and uses the predicted probability of disability in a two step probit estimator (2SPM). However, Maddala (1983), Wooldridge (2002) and Bhattacharya *et al.* (2006) show that, unlike for continuous variables, the application of this two stage procedure for two dichotomous variables does not, in general, produce consistent estimates of the structural parameters required. Maddala (1983) shows the estimates are only consistent if equation (6.5) is actually specified in terms of $\tilde{d}_i$, where $\tilde{d}_i$ is the probability that $d_i^* > 0$. Otherwise, the most appropriate method to estimate the model is a bivariate probit model, which is equivalent to maximum likelihood estimation of a recursive simultaneous equation model for dichotomous choice (see Maddala, 1983, Greene, 1998 and Bhattacharya *et al.* 2006). As such, equation (6.4) is estimated jointly with (6.5), using a bivariate probit, where disability replaces its predicted value in equation (6.5) as follows:[150]

$$\begin{aligned} p_i &= \gamma' Y_i + \lambda' d_i + \varepsilon_i'' \\ d_i &= \beta' Y_i + \alpha' Z_i + \varpi' \end{aligned} \quad (6.6)$$

[148] As in previous analysis, this issue is not explored here, since the focus of the Chapter is the impact of disability.
[149] The use of binary measures to replace the unobserved continuous measures will give rise to an additional source of measurement error (Bound, 1991).
[150] See Brown *et al.* (2005) for an application of this model to the endogeneity between diabetes and employment.

Moreover, Knapp and Seaks (1998) show that a likelihood ratio test for the significance of ρ (where corr $(\varpi_i^{'} \varepsilon_i^{''}) = \rho$) is a simple test for the exogeneity of self-reported disability.[151]

Despite the absence of continuous variables, other studies have continued to use the two stage least squares (2SLS) procedure applied to a linear probability model (LPM) (see Au *et al.*, 2005), which is supported by Angrist (2001). The sensitivity of the bivariate probit results is tested, therefore, by estimating both 2SLS and the 2SPM models. As discussed above, there is no consensus on which variables are the most appropriate instruments for disability. A suitable instrument is correlated with disability but not with participation. The application of 2SLS, while ignoring the binary nature of the dependent variable, facilitates the examination of the appropriateness of instruments (see Evans and Schwab, 1995 and Conway and Kutinova, 2006 for application to the LPM). Correlation between the instrument and disability is examined using an F test for the joint significance of the instruments in the disability equation.[152] Since the models contain more instruments than endogenous variables, the Sargan test for over-identification is used to examine if the instruments are correlated with the errors in the participation equation.

6.3.2 The Health Survey for England

The HSE is a nationally representative annual cross sectional survey commissioned by the Department of Health.[153] The aim of the survey is to provide detailed information on the health of the adult population, aged 16 and over, living in private households in England. The survey contains a set of 'core' questions and, each year, additional modules are included in the survey, which focus on particular aspects of ill-health or groups in the population (for example, ethnic minorities). Data from 2003 are chosen for this analysis since, in this year, the entire sample is from the general population. The data contains core self-reported and objective information on health status,

[151] Fabbri *et al.* (forthcoming) compare the finite sample properties of a range of alternative statistics and support the use of a likelihood ratio test.

[152] Typically, a value of 10 or more provides evidence that the group of instruments is correlated with disability.

[153] The survey is carried out by the Joint Survey Unit of the National Centre of Social Research and the Department of Epidemiology and Public Health at University College London. Data are accessed from the Data Archive www.data-archive.ac.uk.

including information collected from a nurse visit. However, in 2003, the survey also contains detailed information on cardiovascular disease and the behavioural risk factors associated with cardiovascular disease such as drinking, smoking and eating habits.

Whilst this data source, unlike many surveys that focus on labour market outcomes, provides the necessary objective health information to instrument self-reported health, it has more limited labour market information.[154] In particular, there is no information on an individual's labour market earnings and the cross sectional nature of the data precludes the analysis of changes in health stock (see, for example, Bound *et al.* 1999 and Disney *et al.*, 2006). This analysis is, therefore, restricted to the decision to participate (as described above) and, in this respect, follows more closely the work of Stern (1989), Bound *et al.* (1995) and Campolieti (2002).[155]

In contrast to the above studies, which focus on older workers, the sample consists of working age individuals. An individual is classed as disabled if they answer positively to:

Do you have any long-standing illness, disability or infirmity? By long-standing I mean anything that has troubled you over a period of time, or that is likely to affect you over a period of time?

and

Does this illness or disability/do any of these illnesses or disabilities limit your activities in any way?

This longstanding limiting definition of disability represents the global measure (d_i). Participation (p_i) is defined using activity status in the last week and the active population includes the employed and the unemployed. The exogenous variables (Y_i) are standard in the literature and include personal characteristics (age, marital status,

[154] As a result, the survey has had relatively limited use in labour market analysis, with the exceptions of MacDonald and Shields (2004) and Morris (2007).
[155] The endogeneity of health and earnings in the UK is considered by Contoyannis and Rice (2001), using data from the BHPS.

ethnicity, educational qualifications), household measures (housing tenure, number of children, household size), a set of regional controls and a rural/urban area indicator.[156]

The more objective health information, which is used to instrument disability, is separated into three tiers on the basis of potential endogeneity. Information in *Tier 1* includes more specific self-reported information on physical and mental wellbeing. Consistent with Au *et al.* (2005), composite index measures are used which capture multiple aspects of the restriction and, thus, reduce measurement error.[157] The two measures are EQ-5D, which captures the incidence and severity of specific capacities such as mobility and self care, and the general health questionnaire (GHQ12) score, which contains information about psychological wellbeing derived from questions about levels of anxiety and depression.[158]

Instruments in *Tier 2* contain more objective information which, while still being self-reported, relates more closely to outside standards or information provided by a third party. Variables in this group include information on physician prescribed medication, physician diagnosed conditions and physical measurements provided by an independent third party. In contrast to the previous literature, controls for BMI have not been included since they are also potentially endogenous with labour market activity.[159,160] Instruments in *Tier 3* contain information that does not capture individual health directly, but genetic and regional controls correlated with individual health. Even if work and health are related by Type I and Type II endogeneity, these variables should remain uncorrelated with participation. Instruments that relate to genetic influences include variables indicating a family history of cardiovascular

[156] Full details of all variables are included in Table 6.1.

[157] Au *et al.* (2005) use Health Utilities Index Mark 3.

[158] The EQ-5D index value is based on self-completion on five dimensions of health, namely mobility, self-care, usual activities, pain/discomfort, anxiety/depression. Severity is also monitored for each dimension. More information about this measure is available from http://www.euroqol.org/. There is a substantial clinical literature which identifies the validity of EQ-5D across a range of different patient groups (see, for example, Pickard *et al.*, 2007). The questions are still largely subjective, for example, individuals are asked to rate their pain/discomfort as no pain, moderate pain or extreme pain. The GHQ12 value reflects responses to 12 questions about general level of happiness, depression, anxiety and sleep disturbance over the past four weeks. Individuals are asked to respond using one of the four options: not at all, no more than usual, rather more than usual, much more than usual.

[159] Whilst the HSE contains measurements from blood samples, for example, cholesterol and fibrinogen, the sample size is restricted considerably for these measures and, therefore, they are not used.

[160] Whilst the influence of disability on participation from a specification which uses measures relating to BMI, diet, smoking and physical activity as instruments is of similar magnitude to the results presented here, they fail the Sargan test of instrument validity and are, therefore, not reported.

disease (CVD) and parental mortality.[161] A variable relating to whether the respondents' mother smoked during their childhood provides a control for environmental factors. Regional health measures from the NHS performance indicators, such as density of medical provision and rates of death from cancer, accidents and suicides, were mapped into the HSE to control for current environment.[162] However, these variables were not strongly correlated with individual disability status. Instead, information at a more disaggregate geographic level on relative deprivation, measured by the 2004 Index of Multiple Deprivation (IMD), is included to capture the influence of the immediate environment. The IMD is made up of 7 domains including health deprivation and disability; education, skills and training; housing and services; the living environment; crime; income and employment. The final two domains, which, in part, reflect labour market outcomes, may be correlated with individual activity. However, the controls for the relative position of the local area, in terms of overall deprivation used here, are not a significant determinant of individual activity in a simple probit model.[163]

6.4. Results

6.4.1 Descriptive Statistics

Just over 20 percent of the working age population are classified as disabled, using the activity-limiting definition in the HSE. Consistent with previous evidence from labour market surveys, the participation gap is substantial, with the disabled participation rate being less than 65 percent of the non-disabled. The mean values of the personal and household characteristics (Table 6.1) confirm that the disabled, on average, are older and are less likely to hold formal qualifications. As expected, average index values indicate lower physical (EQ-5D) and mental (GHQ12) health for the disabled.[164] The more specific medical information, such as diagnosed conditions, also confirms the relationship between ill-health and disability. For example, the disabled are more likely to have been diagnosed with high blood pressure or diabetes. Interestingly, the data also suggest that the mean values of

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[161] As Ettner (2000) notes, the presence of informal care may result in correlation between parental health and own labour market outcomes.

[162] Regional health information is available from NHS performance indicators at the Health Authority Level. See http://www.performance.doh.gov.uk/nhsperformanceindicators/2002/hangp_d.html.

[163] All the models are also estimated without the IMD controls and the same conclusions hold.

regional and genetic indicators differ by disability status. The disabled are less likely to live in areas with low levels of relative deprivation, are more likely to report a family history of CVD, to have lost their natural mother or father, and to have had a mother who smoked during their childhood.

6.4.2 Participation Equations

Tables 6.2-6.4 present the results for the participation equation for each of the estimation strategies, namely, using 2SLS, a 2SPM and the bivariate probit model.[165] The first column in Tables 6.2 and 6.3 represents a naïve model of labour force participation which assumes self-reported disability is exogenous. As is well established in the literature, the 'global' measure of disability has a significant negative effect on participation in both models, with the marginal effect indicating disability reduces participation by about 25 percent.[166] The controls for personal, household and regional characteristics conform to their usual patterns, with age, education, ethnicity, housing tenure, region of residence and the presence of dependent children all having a significant effect on participation.

Columns 2-4 in Table 6.2 represent the 2SLS procedure using instrument *Tiers 1-3* respectively. For each specification the Durbin-Wu-Hausman test is able to reject the null hypothesis of the exogeneity of disability and, therefore, supports the use of an IV procedure relative to the estimates in column 1. In all cases, the F tests indicate the instruments are jointly significant in the first stage regression (the coefficient estimates from the first stage are presented in appendix Table A6.1). As is expected, measures of ill-health have a positive association with disability, and, in the *Tier 3* specification, a family history of CVD, having a mother who smoked during childhood and living in relative deprivation all increase the probability of disability. Controlling for the EQ-5D value in the *Tier 1* specification reduces the influence of

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[164] EQ-5D is measured continuously in the range -0.59 to 1. The maximum value (1) indicates full health, whereas 0 represents death. Negative values (which only represent 1 percent of the sample) are thought to indicate a health state worse than death. GHQ12 is measured on a scale from 0 to 12. A higher value is consistent with greater psychological distress.

[165] Since information relating to some of the instruments is only collected for those who accept the nurse visit, the samples change between specifications. However, if the same models are estimated on a constant (smaller) sample, the key results still hold. Therefore, it is the change in specification and not sample that is driving the main results.

[166] As would be expected, given the broader definition of disability than either the work-limited or DDA definitions in the LFS, the marginal effect of disability on participation in the HSE is lower than estimates from the LFS.

personal and regional characteristics on disability; however, in the specifications for *Tier 2* and *Tier 3*, these characteristics have their typical influence; for example, disability is positively associated with age and negatively associated with education.

Table 6.2 also reports the Sargan over-identification test for instrument validity. In all cases the null hypothesis cannot be rejected at the 5 percent level, indicating they are uncorrelated with participation.[167] Using *Tier 1* variables as instruments for disability increases the (absolute) impact of disability on participation to -0.54. Estimation using *Tier 2* instruments further increases the impact of disability to -0.59 and with *Tier 3* instruments the estimate is -0.51, although this final estimate is less precise with a far greater standard error.[168] However, the influence of personal and household characteristics on participation is relatively unaffected by the introduction of an IV strategy.

Table 6.3 presents the estimates and the marginal effects from the 2SPM. Again, the marginal effect of disability on participation increases substantially when using an IV strategy. The marginal effect of disability rises from -0.25 in the probit model to over -0.43 in the 2SPM. The marginal effects for disability with *Tier 1* and *Tier 2* instruments are of slightly smaller magnitude to the LPM, although for *Tier 3* the marginal effect rises to -0.75.

Table 6.4 presents the preferred set of estimates from the bivariate probit model which jointly estimates disability and participation equations. The influence of the instruments in the disability equation is consistent with the discussion for the LPM and the 2SPM. The marginal effects relate to the probability of a positive outcome in the activity equation.[169] The impact of disability on participation is of a similar magnitude to the previous equations and increases from -0.53 to -0.65 with the change in instruments from *Tier 1* to *Tier 3*. The significance of ρ in the bivariate probit model confirms the endogeneity of self-reported disability, identified above. The positive correlation would suggest that, after controlling for the direct effect of

[167] The *Tier 2* instruments do reject the null hypothesis at the 10 percent level.
[168] Excluding the IMD variables from this specification increases the influence of disability (to -0.71).
[169] The marginal effects are more complicated in a recursive bivariate probit model than for a simple probit since the variables may have a direct effect on activity and an indirect effect through their influence on the probability that disability equals 1 (see Greene, 1998). The marginal effects are calculated using the method presented in Kassouf and Hoffmann (2006).

disability on participation, unobservables that affect disability positively also have a positive effect on activity.[170]

The evidence suggests that failing to instrument disability actually leads to an underestimate of the impact of disability on labour market participation amongst the working age population in England. This key result is independent of which of the three proposed methods or groups of instruments is chosen. The results are consistent with the evidence for Canada, from Campolieti (2002) and Au *et al.* (2005).[171] In contrast to expectations, it suggests that previous evidence in the UK may have actually underestimated the impact of disability. In the context of the discussion by Bound (1991), the results are consistent with the bias caused by measurement error outweighing the influence of justification bias.

It is worth briefly considering how the magnitude of the estimates from England compare to estimates of the impact of disability in other countries. The estimates from Canada indicate the marginal effect of disability on participation increases from -0.38 to -0.46 after instrumenting. Moreover, using an alternative model, the marginal effect of disability in the US (-0.53) is found to be less than a comparable estimate from Canada (-0.60). Campolieti (2002) highlights the potential role of free healthcare and the structure of disability benefits as possible contributing factors to the difference observed between the US and Canada. The above analysis, using the HSE, is repeated for males aged between 45 and 64 to make the sample more comparable with Campolieti (2002). The marginal effect from the simple probit model on the sample of older workers (-0.34) is greater than the estimate for the entire sample, as would be expected. Similarly, instrumenting disability using the 2SPM (applied by Campolieti, 2002) increases the influence of disability on participation to (a maximum) -0.58 when using *Tier 2* instruments. Since the specification differs somewhat from Campolieti (2002), it is not appropriate to compare these results directly; however, they are broadly similar.

[170] The positive correlation is a result of the model specification; it is, more intuitively, negative and significant if disability is not directly controlled for in the activity equation.
[171] Au *et al.* (2005), who use self assessed health rather than disability, find that the IV estimates of the impact of health on employment in Canada are about twice original estimates. Ettner (2000) finds instrumenting health increases the effect on employment only slightly. Larsen and Datta Gupta (2004) also find the panel IV estimates are greater than the random effects estimates.

6.5 Conclusion

Using data from the HSE, this Chapter examines disability measurement issues amongst the entire working age population in a country where, despite having a large disabled population of working age, the endogeneity of disability and work has received limited empirical attention.

The econometric methodology follows previous analysis, but is modified to take into account recent contributions to the literature (Ettner, 2000, Baker *et al.* 2004, Au *et al.* 2005); as such, a range of instruments is used to examine the sensitivity of the results to considering different forms of endogeneity. There is evidence to suggest disability is endogenous to labour market participation, but accounting for this does not remove the strong negative influence of disability on participation. Regardless of the choice of instruments or the precise methodology applied, the influence of disability on participation is found to be underestimated when using 'global' self-reported measures. This result is consistent with evidence from Campoleiti (2002) and Au *et al.* (2005) in Canada and, following the arguments of Bound (1991), would suggest that the impact of measurement error in self-reported information outweighs any effect of justification bias.

Given the widespread concern of the overestimation of the impact of disability on labour market outcomes in the UK by academics and policymakers, this result is important. This study, therefore, reinforces the importance of disability as a determinant of labour market participation amongst the entire working age population in England.

Future research needs to test the robustness of these conclusions to different data sources, instruments and methodologies. While the HSE is an excellent source of more objective information, and the results are consistent across groups of instruments, when Type I endogeneity is considered, the availability of instruments becomes severely restricted. It is also not possible to consider two issues in the recent literature using data from the HSE, namely the dynamic effect of disability and the influence of financial incentives in the model. Further research could explore these issues using data from English Longitudinal Study of Ageing (ELSA) on a restricted sample of older workers and, potentially in the future, using the proposed inclusion of more detailed health measures in the UK Household Longitudinal Study (UKHLS). Moreover, the design of these studies may also facilitate important international comparisons of the influence of disability on labour market outcomes.

Table 6.1. Descriptive Statistics

Variable name	Definition	Mean	Mean Disabled	Mean Non-disabled
Participate	Dummy variables equals 1 if individual was economically active in the last week, 0 otherwise	0.783	0.547	0.844
Disabled	Dummy variable equals 1 if individual self-reports a limiting long-standing illness, 0 otherwise	0.205		
	Y_i			
Male	Dummy variable equals 1 if male, 0 otherwise	0.474	0.478	0.472
Age	Age in years	39.853	44.810	38.571
Degree	Dummy variable equals 1 if individual's highest qualification is NVQ4/NVQ5/Degree or equivalent, 0 otherwise	0.198	0.143	0.212
Higher education	Dummy variable equals 1 if individual's highest qualification is Higher education below degree, 0 otherwise	0.117	0.105	0.120
A level	Dummy variable equals 1 if individual's highest qualification is NVQ3/GCE A Level equivalent, 0 otherwise	0.146	0.111	0.155
O level	Dummy variable equals 1 if individual's highest qualification is NVQ2/GCE O Level equivalent, 0 otherwise	0.277	0.257	0.282
NVQ 1	Dummy variable equals 1 if individual's highest qualification is NVQ1/CSE other grade equivalent, 0 otherwise	0.053	0.062	0.051
Other	Dummy variable equals 1 if individual's highest qualification is other, 0 otherwise	0.031	0.038	0.030
Adults	Number of adults (aged 16+) in the household.	2.282	2.138	2.319
Children	Number of children (aged 2-15) in the household.	0.627	0.532	0.652
Infants	Number of children (aged less than 2) in the household.	0.080	0.043	0.089
House owned	Dummy variable equals 1 if housing tenure is owned outright, 0 otherwise	0.177	0.206	0.170
House mortgaged	Dummy variable equals 1 if housing tenure is mortgaged, 0 otherwise	0.565	0.432	0.599
White	Dummy variable equals 1 if individual's ethnic status is white, 0 otherwise	0.904	0.920	0.900
Single	Dummy variable equals 1 if individual is single, 0 otherwise	0.242	0.197	0.253
Married	Dummy variable equal1 if individual is married or cohabiting, 0 otherwise	0.656	0.636	0.662
Rural	Dummy variable equals 1 if resident in rural area, 0 otherwise	0.231	0.221	0.233
North East	Dummy variable equals 1 if resident in the North East, 0 otherwise	0.061	0.078	0.057
North West	Dummy variable equals 1 if resident in the North West, 0 otherwise	0.145	0.154	0.141
Yorkshire & Humberside	Dummy variable equals 1 if resident in Yorkshire and Humberside, 0 otherwise	0.097	0.106	0.095

East Midlands	Dummy variable equals 1 if resident in East Midlands, 0 otherwise	0.094	0.111	0.089
West Midlands	Dummy variable equals 1 if resident in West Midlands, 0 otherwise	0.108	0.126	0.104
East of England	Dummy variable equals 1 if resident in the East of England, 0 otherwise	0.118	0.101	0.123
London	Dummy variable equals 1 if resident in London, 0 otherwise	0.136	0.112	0.142
South West	Dummy variable equals 1 if resident in the South West, 0 otherwise	0.092	0.080	0.095
Tier 1				
EQ	EQ-5D social preference weight	0.890	0.671	0.945
GHQ12	GHQ score (12 point scale)	1.300	2.690	0.952
Tier 2				
Medicine[172]	Number of medicines currently prescribed by doctor, 0 otherwise	0.849	2.124	0.524
Bone	Dummy variable equals 1 if individual has broken a bone in the last year, 0 otherwise	0.031	0.038	0.029
Blood Pressure	Dummy variable equals 1 if doctor diagnosed high blood pressure, 0 otherwise.	0.159	0.284	0.152
Heart Attack	Dummy variable equals 1 if doctor diagnosed heart attack, 0 otherwise	0.012	0.043	0.004
Angina	Dummy variable equals 1 if doctor diagnosed angina, 0 otherwise	0.016	0.060	0.005
Stroke	Dummy variable equals 1 if doctor diagnosed stroke, 0 otherwise	0.007	0.022	0.003
Diabetes	Dummy variable equals 1 if doctor diagnosed diabetes, 0 otherwise	0.023	0.050	0.015
Murmur	Dummy variable equals 1 if doctor diagnosed heart murmur, 0 otherwise	0.028	0.049	0.022
Irregular	Dummy variable equals 1 if doctor diagnosed irregular heart rhythm, 0 otherwise	0.045	0.094	0.033
Other heart	Dummy variable equals 1 if doctor diagnosed other heart condition, 0 otherwise	0.015	0.042	0.008
Height	Valid height measurement in centimetres	168.647	167.883	168.841
Tier 3				
Mother	Dummy variable equals 1 if natural mother alive, 0 otherwise	0.742	0.629	0.771
Father	Dummy variable equals 1 if natural father alive, 0 otherwise	0.592	0.447	0.629
Family CVD	Dummy variable equals 1 if family history of CVD, 0 otherwise	0.100	0.147	0.089
Mother smoke	Dummy variable equals 1 if mother smoked when informant was a child, 0 otherwise	0.424	0.477	0.410
IMD1	Dummy variable equals 1 if Super Output Area (SOA) of residence is in the least deprived quintile of the 2004 IMD, 0 otherwise	0.213	0.167	0.224
IMD2	Dummy variable equals 1 if SOA of residence is in the second least deprived quintile of the 2004 IMD, 0 otherwise	0.201	0.175	0.208
IMD3	Dummy variable equals 1 if SOA of residence is in the third least deprived quintile of the 2004 IMD, 0 otherwise	0.194	0.182	0.197

Notes: Figures relate to estimation samples.

[172] This variable is collected from a nurse visit. Since some respondents refuse the nurse visit, the sample size for this variable is smaller.

Table 6.2. Labour Market Participation Linear Probability Model

	LPM	2SLS		
		Tier 1	*Tier 2*	*Tier 3*
Constant	0.017	0.102**	0.052	0.095*
	(0.36)	(2.00)	(0.89)	(1.71)
Disabled	**-0.242*** **	**-0.539*** **	**-0.592*** **	**-0.509*** **
	(26.98)	**(27.90)**	**(18.84)**	**(3.41)**
Male	0.107***	0.103***	0.099***	0.108***
	(15.05)	(13.35)	(11.33)	(13.82)
Age	0.034***	0.035***	0.037***	0.035***
	(16.73)	(15.95)	(14.74)	(14.77)
Age Squared/100	-0.047***	-0.046***	-0.048***	-0.045***
	(18.57)	(16.85)	(15.28)	(16.54)
Degree	0.175***	0.136***	0.134***	0.143***
	(14.47)	(10.19)	(8.75)	(7.06)
Higher education	0.165***	0.133***	0.135***	0.133***
	(12.17)	(9.02)	(8.09)	(6.76)
A level	0.141***	0.111***	0.124***	0.111***
	(10.82)	(7.83)	(7.69)	(6.26)
O level	0.122***	0.096***	0.098***	0.100***
	(11.03)	(7.87)	(7.15)	(6.48)
NVQ 1	0.110***	0.094***	0.087***	0.091***
	(6.33)	(4.92)	(4.04)	(4.64)
Other	0.090***	0.062***	0.047*	0.058**
	(4.21)	(2.62)	(1.78)	(2.23)
White	0.055***	0.051***	0.058***	0.056***
	(4.27)	(3.43)	(3.35)	(3.98)
Single	-0.027*	-0.041**	-0.031*	-0.044***
	(1.80)	(2.49)	(1.65)	(2.67)
Married	0.012	-0.008	-0.011	-0.014
	(0.95)	(0.56)	(0.72)	(0.89)
Children	-0.054***	-0.054***	-0.054***	-0.054***
	(13.38)	(12.51)	(10.97)	(12.61)
Infants	-0.143***	-0.153***	-0.168***	-0.151***
	(10.93)	(10.65)	(10.05)	(10.07)
Adults	0.017***	0.013***	0.016***	0.014***
	(4.05)	(2.86)	(3.20)	(2.95)
House owned	0.058***	0.024*	0.021	0.022
	(4.90)	(1.85)	(1.35)	(1.07)
House mortgaged	0.145***	0.102***	0.104***	0.113***
	(16.05)	(10.18)	(8.77)	(5.67)
North East	-0.073***	-0.063***	-0.070***	-0.055***
	(4.35)	(3.49)	(3.39)	(2.80)
North West	-0.043***	-0.034**	-0.038**	-0.034**
	(3.33)	(2.41)	(2.50)	(2.43)
Yorkshire & Humberside	-0.025*	-0.014	-0.020	-0.011
	(1.72)	(0.90)	(1.17)	(0.65)
East Midlands	-0.008	0.009	0.004	0.010
	(0.52)	(0.57)	(0.21)	(0.54)
West Midlands	-0.012	0.000	-0.005	0.009
	(0.85)	(0.00)	(0.28)	(0.51)
East of England	0.001	-0.000	-0.009	-0.001
	(0.05)	(0.01)	(0.57)	(0.07)
London	-0.065***	-0.067***	-0.063***	-0.068***

	(4.77)	(4.52)	(3.61)	(4.62)
South West	-0.029**	-0.036**	-0.038**	-0.026
	(1.98)	(2.28)	(2.20)	(1.60)
Rural	-0.010	-0.018*	-0.013	-0.012
	(1.16)	(1.91)	(1.28)	(1.21)
Observations	10951	10243	8198	10237
Adj R^2	0.220	0.120	0.085	0.150
F test (slopes zero)	115.86	98.34	70.36	73.86
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
Sargan N^*R^2 $\chi^2(k)$		0.879	17.078	6.812
(p-value)		(0.348)	(0.073)	(0.339)
F (instruments in first stage)		1752.42	102.71	6.18
(p-value)		(0.00)	(0.00)	(0.00)
Durbin-Wu-Hausman χ^2 test		383.204	191.203	3.537
(p-value)		(0.00)	(0.00)	(0.06)

Notes: Z statistics reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level respectively. The influence of disability is highlighted in **bold**.

Table 6.3. Labour Market Participation Two stage Probit Model

	Probit		2SPM					
			Tier 1		*Tier 2*		*Tier 3*	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Constant	-1.981***		-1.763***		-1.910***		-1.420***	
	(10.14)		(8.54)		(8.20)		(6.78)	
Disabled	**-0.841*****	**-0.254*****	**-1.790*****	**-0.433*****	**-1.959*****	**-0.466*****	**-2.948*****	**-0.746*****
	(24.02)	**(21.29)**	**(24.45)**	**(23.57)**	**(17.24)**	**(16.80)**	**(6.41)**	**(6.39)**
Male	0.507***	0.124***	0.503***	0.120***	0.482***	0.113***	0.465***	0.116***
	(15.76)	(16.28)	(14.87)	(15.42)	(12.78)	(13.20)	(14.12)	(14.56)
Age	0.138***	0.034***	0.145***	0.035***	0.150***	0.036***	0.138***	0.035***
	(16.27)	(16.39)	(16.17)	(16.27)	(14.92)	(14.99)	(15.27)	(15.33)
Age Squared/100	-0.190***	-0.047***	-0.192***	-0.047***	-0.195***	-0.046***	-0.173***	-0.044***
	(18.15)	(18.31)	(17.44)	(17.60)	(15.80)	(15.92)	(16.23)	(16.35)
Degree	0.634***	0.129***	0.514***	0.106***	0.514***	0.104***	0.386***	0.087***
	(12.23)	(15.16)	(9.35)	(11.13)	(8.27)	(9.92)	(5.46)	(6.20)
Higher education	0.597***	0.116***	0.508***	0.100***	0.517***	0.099***	0.354***	0.078***
	(9.99)	(13.24)	(8.12)	(10.30)	(7.40)	(9.46)	(4.91)	(5.74)
A level	0.449***	0.095***	0.355***	0.075***	0.418***	0.085***	0.243***	0.056***
	(8.37)	(10.01)	(6.30)	(7.24)	(6.54)	(7.77)	(3.83)	(4.19)
O level	0.384***	0.087***	0.316***	0.071***	0.310***	0.069***	0.219***	0.053***
	(8.79)	(9.57)	(6.78)	(7.28)	(6.03)	(6.47)	(4.09)	(4.30)
NVQ 1	0.351***	0.074***	0.296***	0.062***	0.268***	0.056***	0.217***	0.050***
	(4.97)	(5.99)	(3.96)	(4.63)	(3.27)	(3.77)	(2.94)	(3.27)
Other	0.257***	0.056***	0.187**	0.041**	0.102	0.023	0.045	0.011
	(3.11)	(3.57)	(2.09)	(2.31)	(1.07)	(1.12)	(0.50)	(0.51)
White	0.205***	0.055***	0.203***	0.053***	0.210***	0.054***	0.225***	0.062***
	(3.90)	(3.63)	(3.44)	(3.19)	(3.13)	(2.89)	(4.14)	(3.84)
Single	-0.153**	-0.040**	-0.211***	-0.054***	-0.159**	-0.040**	-0.224***	-0.060***
	(2.39)	(2.31)	(3.11)	(2.96)	(2.09)	(2.00)	(3.42)	(3.26)
Married	0.026	0.007	-0.036	-0.009	-0.033	-0.008	-0.122**	-0.030**
	(0.50)	(0.50)	(0.64)	(0.65)	(0.53)	(0.54)	(2.02)	(2.06)

Children	-0.223***	-0.055***	-0.235***	-0.057***	-0.231***	-0.055***	-0.218***	-0.055***
	(12.95)	(13.00)	(13.01)	(13.09)	(11.51)	(11.57)	(12.44)	(12.48)
Infants	-0.580***	-0.144***	-0.616***	-0.149***	-0.677***	-0.161***	-0.626***	-0.158***
	(10.76)	(10.78)	(10.85)	(10.88)	(10.38)	(10.41)	(10.91)	(10.92)
Adults	0.046**	0.011**	0.035*	0.008*	0.050**	0.012**	0.025	0.006
	(2.55)	(2.55)	(1.81)	(1.81)	(2.30)	(2.30)	(1.35)	(1.35)
House owned	0.180***	0.042***	0.076	0.018	0.061	0.014	-0.067	-0.017
	(3.78)	(4.02)	(1.50)	(1.54)	(1.06)	(1.08)	(0.95)	(0.93)
House mortgaged	0.567***	0.146***	0.439***	0.110***	0.443***	0.109***	0.301***	0.078***
	(15.15)	(14.79)	(11.02)	(10.76)	(9.64)	(9.37)	(4.58)	(4.50)
North East	-0.277***	-0.077***	-0.252***	-0.068***	-0.302***	-0.081***	-0.157**	-0.042*
	(3.92)	(3.56)	(3.45)	(3.15)	(3.68)	(3.31)	(2.07)	(1.96)
North West	-0.156***	-0.041***	-0.124**	-0.031**	-0.161**	-0.041**	-0.116**	-0.030*
	(2.74)	(2.61)	(2.08)	(2.00)	(2.49)	(2.37)	(2.00)	(1.92)
Yorkshire &	-0.083	-0.021	-0.051	-0.013	-0.100	-0.025	-0.007	-0.002
Humberside	(1.31)	(1.27)	(0.78)	(0.76)	(1.39)	(1.34)	(0.10)	(0.10)
East Midlands	-0.026	-0.007	0.029	0.007	0.005	0.001	0.109	0.026
	(0.41)	(0.40)	(0.44)	(0.44)	(0.07)	(0.07)	(1.50)	(1.57)
West Midlands	-0.034	-0.009	0.005	0.001	-0.050	-0.012	0.088	0.022
	(0.55)	(0.54)	(0.07)	(0.07)	(0.69)	(0.68)	(1.32)	(1.37)
East of England	0.019	0.005	0.022	0.005	-0.032	-0.008	0.004	0.001
	(0.30)	(0.31)	(0.35)	(0.35)	(0.44)	(0.43)	(0.06)	(0.06)
London	-0.267***	-0.073***	-0.278***	-0.074***	-0.281***	-0.074***	-0.290***	-0.081***
	(4.50)	(4.16)	(4.46)	(4.09)	(3.91)	(3.57)	(4.80)	(4.42)
South West	-0.109*	-0.028	-0.145**	-0.037**	-0.154**	-0.039**	-0.133**	-0.035*
	(1.70)	(1.63)	(2.21)	(2.10)	(2.13)	(2.01)	(2.00)	(1.91)
Rural	-0.052	-0.013	-0.081**	-0.020**	-0.060	-0.015	-0.071*	-0.018*
	(1.36)	(1.34)	(2.07)	(2.03)	(1.39)	(1.37)	(1.81)	(1.77)
Observations	10951		10243		8198		10237	
Log Likelihood	-4470.8706		-4064.6026		-3253.34		-4380.2584	
LR χ^2 (k) (p-value)	2508.78 (0.00)		2335.69 (0.00)		1765.12 (0.00)		1784.00 (0.00)	
Pseudo R^2	0.2191		0.2232		0.2134		0.1692	

Notes: See notes to Table 6.2.

Table 6.4. Disability and Labour Market Participation Bivariate Probit Model

	Tier 1			*Tier 2*			*Tier 3*		
	Activity		Disability	Activity		Disability	Activity		Disability
	Coefficient	Marginal Effect	Coefficient	Coefficient	Marginal Effect	Coefficient	Coefficient	Marginal Effect	Coefficient
Constant	-1.629***		1.546***	-1.738***		-2.216***	-1.451***		-1.456***
	(8.13)		(6.28)	(7.72)		(4.79)	(7.30)		(6.98)
Disabled	**-1.616*** **	**-0.534**		**-1.828*** **	**-0.602**		**-1.975*** **	**-0.654**	
	(30.35)			**(27.71)**			**(25.71)**		
Male	0.478***	0.120	0.046	0.452***	0.114	0.034	0.458***	0.120	-0.011
	(14.63)		(1.38)	(12.41)		(0.70)	(14.07)		(0.38)
Age	0.135***	0.035	0.024**	0.138***	0.035	0.056***	0.126***	0.034	0.038***
	(15.64)		(2.49)	(14.24)		(5.51)	(14.73)		(4.28)
Age Squared/100	-0.181 ***	-0.046	-0.010	-0.180 ***	-0.046	-0.053***	-0.165***	-0.044	-0.017
	(16.87)		(0.86)	(14.93)		(4.31)	(15.22)		(1.60)
Degree	0.484***	0.107	-0.052	0.479***	0.106	-0.249***	0.439***	0.103	-0.291***
	(9.10)		(0.92)	(8.03)		(4.24)	(8.32)		(5.77)
Higher education	0.474***	0.101	0.017	0.476***	0.101	-0.168***	0.396***	0.091	-0.209***
	(7.86)		(0.27)	(7.12)		(2.66)	(6.61)		(3.80)
A level	0.341***	0.077	-0.033	0.393***	0.088	-0.132**	0.290***	0.070	-0.194***
	(6.26)		(0.55)	(6.40)		(2.10)	(5.41)		(3.57)
O level	0.297***	0.071	-0.037	0.288***	0.069	-0.090*	0.255***	0.064	-0.155***
	(6.58)		(0.73)	(5.83)		(1.75)	(5.72)		(3.49)
NVQ 1	0.286***	0.064	0.085	0.257***	0.059	-0.046	0.236***	0.057	-0.055
	(3.97)		(1.08)	(3.28)		(0.57)	(3.39)		(0.80)
Other	0.171**	0.040	-0.206**	0.093	0.023	-0.159	0.099	0.025	-0.196**
	(1.98)		(2.06)	(1.01)		(1.59)	(1.19)		(2.30)
White	0.177***	0.048	0.137**	0.193***	0.053	0.057	0.196***	0.056	0.074
	(3.10)		(2.05)	(3.00)		(0.81)	(3.76)		(1.30)
Single	-0.201***	-0.054	-0.035	-0.157**	-0.042	-0.014	-0.206***	-0.058	-0.038

	(3.08)		(0.53)	(2.16)		(0.20)	(3.29)		(0.63)
Married	-0.032	-0.008	-0.140**	-0.049	-0.013	-0.124**	-0.085*	-0.022	-0.161***
	(0.59)		(2.55)	(0.84)		(2.15)	(1.65)		(3.26)
Children	-0.222***	-0.057	0.005	-0.212***	-0.054	0.027	-0.206***	-0.055	-0.009
	(12.79)		(0.25)	(11.03)		(1.39)	(12.04)		(0.53)
Infants	-0.584***	-0.149	-0.118*	-0.623***	-0.159	-0.204***	-0.550***	-0.147	-0.239***
	(10.61)		(1.71)	(9.94)		(2.74)	(10.25)		(3.72)
Adults	0.030*	0.008	-0.012	0.046**	0.012	-0.025	0.029*	0.008	-0.034**
	(1.65)		(0.59)	(2.24)		(1.19)	(1.67)		(1.98)
House owned	0.077	0.019	-0.217***	0.051	0.013	-0.302***	0.012	0.003	-0.357***
	(1.57)		(4.03)	(0.93)		(5.36)	(0.25)		(7.41)
House mortgaged	0.423***	0.111	-0.231***	0.414***	0.109	-0.370***	0.376***	0.103	-0.408***
	(10.88)		(5.53)	(9.36)		(8.48)	(9.31)		(10.87)
North East	-0.240***	-0.067	0.059	-0.276***	-0.079	0.212***	-0.178**	-0.051	0.147**
	(3.39)		(0.78)	(3.52)		(2.73)	(2.57)		(2.13)
North West	-0.111*	-0.029	-0.029	-0.140**	-0.038	0.074	-0.103*	-0.028	0.031
	(1.93)		(0.48)	(2.28)		(1.22)	(1.86)		(0.55)
Yorkshire	-0.047	-0.012	0.083	-0.083	-0.022	0.122*	-0.019	-0.005	0.113*
& Humberside	(0.75)		(1.25)	(1.21)		(1.81)	(0.30)		(1.83)
East Midlands	0.019	0.005	0.180***	-0.003	-0.001	0.182***	0.048	0.013	0.205***
	(0.29)		(2.77)	(0.05)		(2.70)	(0.76)		(3.37)
West Midlands	0.000	0.000	0.118*	-0.046	-0.012	0.189***	0.051	0.013	0.172***
	(0.01)		(1.86)	(0.67)		(2.85)	(0.86)		(2.96)
East of England	0.027	0.007	-0.054	-0.035	-0.009	-0.011	0.009	0.002	-0.007
	(0.45)		(0.84)	(0.52)		(0.16)	(0.15)		(0.12)
London	-0.254***	-0.071	-0.074	-0.253***	-0.071	0.010	-0.255***	-0.074	-0.085
	(4.23)		(1.13)	(3.70)		(0.14)	(4.41)		(1.43)
South West	-0.127**	-0.034	-0.040	-0.140**	-0.038	-0.048	-0.097	-0.027	-0.085
	(2.01)		(0.60)	(2.04)		(0.69)	(1.55)		(1.34)
Rural	-0.074*	-0.019	-0.039	-0.055	-0.014	-0.062	-0.055	-0.015	-0.024
	(1.95)		(0.98)	(1.32)		(1.49)	(1.48)		(0.64)
EQ			-3.589***						

		(33.71)				
GHQ12		0.030***				
		(4.66)				
Medicine				0.266***		
				(22.21)		
Bone				0.065		
				(0.73)		
Angina				0.503***		
				(3.46)		
Blood Pressure				-0.058		
				(1.36)		
Heart Attack				0.057		
				(0.34)		
Stroke				0.455***		
				(2.67)		
Diabetes				-0.156		
				(1.57)		
Murmur				0.220**		
				(2.33)		
Irregular				0.253***		
				(3.43)		
Other Heart				0.252*		
				(1.89)		
Height				0.001		
				(0.32)		
Family CVD						0.131***
						(2.91)
Mother						-0.022
						(0.60)
Father						-0.024
						(0.65)
Mother smoke						0.061**

						(2.12)
IMD1						-0.198***
						(4.48)
IMD2						-0.151***
						(3.65)
IMD3						-0.104***
						(2.61)
ρ	0.637***		0.704***		0.697***	
	LR($\rho = 0$) : $\chi^2(1)$ =259.709		LR($\rho = 0$) : $\chi^2(1)$ =163.576		LR($\rho = 0$) : $\chi^2(1)$ =55.975	
(p-value)	(p=0.00)		(p=0.00)		(p=0.00)	
Observations	10243		8198		10237	
Log Likelihood	-7665.279		-6592.318		-8809.7679	
Wald $\chi^2(k)$ (p-value)	5431.17 (0.00)		4155.32 (0.00)		4500.63 (0.00)	

Notes: See notes to Table 6.2. Standard errors cannot be routinely calculated for marginal effects in a bivariate probit model.

CHAPTER SIX

APPENDIX

Table A6.1. Disability Linear Probability Model

	Tier 1	*Tier 2*	*Tier 3*
Constant	0.997***	-0.087	0.184***
	(20.63)	(0.75)	(3.45)
Male	0.005	0.001	-0.011
	(0.80)	(0.05)	(1.41)
Age	0.002	0.011***	0.005**
	(1.10)	(4.55)	(2.01)
Age Squared/100	0.002	-0.010***	0.002
	(0.67)	(3.27)	(0.81)
Degree	-0.015	-0.064***	-0.085***
	(1.25)	(4.44)	(6.29)
Higher education	-0.002	-0.052***	-0.075***
	(0.13)	(3.34)	(5.00)
A level	-0.006	-0.032**	-0.061***
	(0.48)	(2.12)	(4.23)
O level	-0.007	-0.028**	-0.057***
	(0.67)	(2.18)	(4.64)
NVQ1	0.016	-0.019	-0.032*
	(0.96)	(0.92)	(1.68)
Other	-0.047**	-0.050**	-0.072***
	(2.26)	(2.02)	(3.05)
White	0.023*	0.011	0.021
	(1.74)	(0.64)	(1.43)
Single	-0.010	-0.004	-0.020
	(0.70)	(0.23)	(1.21)
Married	-0.031***	-0.033**	-0.055***
	(2.61)	(2.23)	(3.97)
Children	-0.000	0.008	-0.003
	(0.02)	(1.64)	(0.59)
Infants	-0.015	-0.030*	-0.035**
	(1.17)	(1.92)	(2.43)
Adults	-0.003	-0.005	-0.010**
	(0.88)	(1.01)	(2.15)
House owned	-0.046***	-0.074***	-0.098***
	(4.03)	(5.31)	(7.46)
House mortgaged	-0.051***	-0.090***	-0.106***
	(5.97)	(8.43)	(10.61)
North East	0.008	0.049**	0.034*
	(0.48)	(2.51)	(1.83)
North West	-0.006	0.012	0.001
	(0.47)	(0.85)	(0.07)
Yorkshire &	0.013	0.027*	0.023
Humberside	(0.96)	(1.66)	(1.46)
East Midlands	0.042***	0.040**	0.052***
	(3.06)	(2.45)	(3.24)
West Midlands	0.025*	0.041**	0.041***
	(1.93)	(2.57)	(2.68)

East of England	-0.007	-0.005	-0.003
	(0.55)	(0.30)	(0.18)
London	-0.013	0.003	-0.023
	(1.00)	(0.18)	(1.48)
South West	-0.014	-0.019	-0.032*
	(1.01)	(1.20)	(1.95)
Rural	-0.009	-0.013	-0.004
	(1.15)	(1.30)	(0.44)
EQ	-0.975***		
	(50.28)		
GHQ12	0.006***		
	(4.27)		
Medicine		0.081***	
		(27.21)	
Bone		0.017	
		(0.73)	
Angina		0.102***	
		(2.65)	
Blood Pressure		-0.009	
		(0.83)	
Heart Attack		-0.004	
		(0.09)	
Stroke		0.112**	
		(2.32)	
Diabetes		-0.052*	
		(1.83)	
Murmur		0.058**	
		(2.29)	
Irregular		0.076***	
		(3.76)	
Other heart		0.055	
		(1.54)	
Height		0.000	
		(0.54)	
Family CVD			0.035***
			(2.58)
Mother			-0.008
			(0.74)
Father			-0.005
			(0.49)
Mother smoke			0.016**
			(2.06)
IMD1			-0.057***
			(4.83)
IMD2			-0.042***
			(3.73)
IMD3			-0.030***
			(2.69)
Observations	10243	8198	10237
F-test (slopes zero)	165.48	49.62	28.48
(p-value)	(0.00)	(0.00)	(0.00)
Adj R^2	0.3102	0.1800	0.0814

Notes: Z statistics reported in parenthesis. ***, ** and * denote significance at the 1%, 5% and 10% level respectively.

Table A6.2. Disability Probit Model

	Coefficients		
	Tier 1	*Tier 2*	*Tier 3*
Constant	1.797***	-2.308***	-1.320***
	(7.16)	(4.74)	(6.24)
Male	0.023	-0.001	-0.046
	(0.69)	(0.03)	(1.52)
Age	0.021**	0.054***	0.031***
	(2.15)	(5.17)	(3.50)
Age Squared/100	-0.006	-0.051***	-0.009
	(0.53)	(3.97)	(0.82)
Degree	-0.031	-0.234***	-0.275***
	(0.54)	(3.92)	(5.38)
Higher education	0.020	-0.176***	-0.220***
	(0.33)	(2.71)	(3.92)
A level	0.004	-0.105	-0.182***
	(0.07)	(1.64)	(3.29)
O level	-0.017	-0.084	-0.157***
	(0.34)	(1.61)	(3.49)
NVQ1	0.073	-0.040	-0.063
	(0.91)	(0.48)	(0.89)
Other	-0.169*	-0.155	-0.210**
	(1.65)	(1.52)	(2.41)
White	0.126*	0.042	0.061
	(1.86)	(0.59)	(1.05)
Single	-0.020	-0.002	-0.034
	(0.29)	(0.03)	(0.55)
Married	-0.121**	-0.095	-0.147***
	(2.16)	(1.62)	(2.95)
Children	0.005	0.031	-0.006
	(0.24)	(1.60)	(0.36)
Infants	-0.100	-0.168**	-0.204***
	(1.43)	(2.24)	(3.17)
Adults	-0.015	-0.022	-0.039**
	(0.73)	(1.04)	(2.17)
House owned	-0.211***	-0.287***	-0.342***
	(3.84)	(5.00)	(6.95)
House mortgaged	-0.241***	-0.365***	-0.396***
	(5.64)	(8.20)	(10.33)
North East	0.028	0.191**	0.114
	(0.35)	(2.39)	(1.62)
North West	-0.048	0.038	-0.007
	(0.78)	(0.60)	(0.13)
Yorkshire &	0.057	0.103	0.079
Humberside	(0.85)	(1.51)	(1.27)
East Midlands	0.183***	0.167**	0.197***
	(2.78)	(2.44)	(3.21)
West Midlands	0.104	0.170**	0.153***
	(1.62)	(2.53)	(2.60)
East of England	-0.047	-0.021	-0.019
	(0.73)	(0.30)	(0.32)
London	-0.077	0.014	-0.093
	(1.16)	(0.20)	(1.52)

South West	-0.089 (1.28)	-0.083 (1.17)	-0.126* (1.95)
Rural	-0.037 (0.91)	-0.057 (1.35)	-0.017 (0.45)
EQ	-3.789*** (34.36)		
GHQ12	0.026*** (3.80)		
Medicine		0.278*** (22.08)	
Bone		0.075 (0.78)	
Angina		0.360** (2.30)	
Blood Pressure		-0.048 (1.03)	
Heart Attack		0.050 (0.28)	
Stroke		0.408** (2.12)	
Diabetes		-0.206* (1.88)	
Murmur		0.247** (2.45)	
Irregular		0.270*** (3.42)	
Other heart		0.243* (1.70)	
Height		0.002 (0.57)	
Family CVD			0.107** (2.20)
Mother			-0.015 (0.38)
Father			-0.023 (0.58)
Mother smoke			0.071** (2.32)
IMD1			-0.208*** (4.45)
IMD2			-0.150*** (3.39)
IMD3			-0.099** (2.33)
Observations	10243	8198	10237
LR χ^2 (k) (p-value)	2949.97 (0.00)	1372.80 (0.00)	855.51 (0.00)
LR χ^2 (instruments)	793.79 (0.00)	387.32 (0.00)	25.39 (0.00)
Pseudo R^2	0.2875	0.1660	0.0834
Log Likelihood	-3655.3491	-3449.5008	-4699.8535

Notes: See notes to Table A6.1.

CHAPTER SEVEN

THE EMPLOYMENT EFFECT OF THE DISABILITY DISCRIMINATION ACT

7.1 Introduction

Section 2.5.2 of Chapter 2 highlights the ongoing research into the impact of the ADA. Despite the positive aims of the legislation, there has been no evidence of a positive impact on labour market outcomes of the disabled, rather the consensus appears to be that the impact was negative. The introduction of the DDA in the UK in 1995 shares many features with the ADA and, despite research on its impact being far more limited, the first study to evaluate its employment effects finds no evidence of a positive effect (Bell and Heitmueller, 2005). In contrast, the evidence presented in Chapter 3, albeit using a different methodology, dataset and geographical coverage, is more supportive of an influence of the DDA, especially in terms of employment. As such, the aim of this Chapter is to reconsider this issue using data from the HSE and, thus, contribute to the limited body of evidence concerning the impact of the DDA in the UK. [173]

This analysis not only uses a different dataset from the earlier investigation, but, unlike Chapter 3, the availability of information before and after the DDA facilitates the application of a difference in difference methodology, which has been central to this literature and has been applied in this context by, amongst others, Acemoglu and Angrist (2001) and Bell and Heitmueller (2005). Moreover, since studies in the US continue to highlight the sensitivity of the earlier findings to factors including the definition of disability, benefit income and business cycles, it is also important that these factors are considered in the UK. Two issues, in particular, are considered

[173] Whilst similar surveys are undertaken in other parts of the UK, they are not consistent in terms of questionnaire design, sampling methods and periodicity. The analysis is thus restricted to the HSE, since it is updated annually and provides the longest time period for the evaluation of the DDA.

during this analysis. Firstly, in response to the sensitivity identified by Kruse and Schur (2003), the robustness of the results to changes in reporting and in the composition of the disabled, post-DDA, is tested. Indeed, the main advantage of the HSE, relative to more detailed labour market surveys, is the availability of more objective health information, where reporting is likely to be less sensitive to changes in legislation. The second main sensitivity analysis follows Acemoglu and Angrist (2001) and uses the inclusion of the small firm exemption in the DDA (1996-2004) to test if the employment effects are consistent with the coverage of the legislation. If the employment change is greater in (larger) firms, who are covered by the DDA, this provides evidence to distinguish the policy effect from a more general trend amongst the disabled.

The remainder of this Chapter is structured as follows. Section 7.2 briefly summarises the key evidence and estimation issues identified in previous economic analysis of the ADA and DDA. Section 7.3 outlines the data and methodology used in the present study. The main results are discussed in Section 7.4 and the final section, 7.5, concludes.

7.2 Background

Prior to the introduction of the DDA in the UK, the Disabled Persons Employment Act of 1944 made it the duty of employers with over 20 employees to employ a quota (3 percent) of disabled people, where disability was defined by being registered disabled. In addition, employment as electric passenger lift attendant and car park attendant were available only to the registered disabled (see Malisoff, 1952). However, individual employers could apply for a reduction in their quota and in some industries a 'special percentage' was also applicable (see Malisoff, 1952). Partly as a result of this, the effectiveness of the legislation has been widely questioned (see Woodhams and Corby, 2003, 2007 for discussion). Indeed, they suggest it "was never effectively policed" (Woodhams and Corby, 2007, p558) and, reflecting this, only a handful of prosecutions that were brought under the Act.

The employment component of the DDA (*Part II*), which replaced the Disabled Persons Employment Act, was introduced in December 1996. Unlike the previous legislation, the basis of the 1995 Act was equality of treatment and the legislation made it unlawful to discriminate against disabled applicants or employees in terms of hiring, in the conditions of employment or in the opportunities made available for advancement and promotion.[174] The Act also makes it the duty of the employer to make reasonable accommodation to remove workplace disadvantage concerning employment arrangements (such as hours of work) or physical features of the workplace. It was designed to give the disabled more protection and, thus, improve the situation of the disabled.[175] Indeed, in sharp contrast to the situation under the previous legislation, between 2nd December 1996 (the date of enforcement) and 1st September 2000, 8,908 cases were brought under the employment component of the DDA (Leverton, 2002) indicating more widespread enforcement.

The key features of the employment component of the DDA are similar to those of the ADA introduced in the US.[176] Previous analysis in the US highlights that while the legislation may reduce barriers to employment and raise the relative wages of the disabled, it may have important unanticipated negative effects through the additional costs posed on employers (see DeLeire, 2000, Acemoglu and Angrist, 2001). As Acemoglu and Angrist (2001) show, the increased costs of adapting the workplace and workplace practices, and from increased cost of firing (which arise from the increased risk of legal action), will reduce employment.[177] It is worth noting that Acemoglu and Angrist (2001) argue that it is accommodations where the marginal cost exceeds the marginal benefit (through, for example, an increase in productivity among the disabled) that are induced under the Act, since employers would, optimally, undertake accommodations where the net benefit is positive. Furthermore, they highlight that the anti-discrimination element of the Act may reinforce these negative employment effects, since employers are not able to adjust the wages of the disabled in response to these accommodations. Moreover, as Schwochau and Blanck (2000) note, if employers are forced to pay equal wages to the groups when there are unobservable differences in productivity, this is also likely to exacerbate the decline in hiring amongst the disabled.

[174] For full details see http://www.opsi.gov.uk/acts/acts1995/1995050.htm.

[175] Under both the 1944 Disabled Persons Act and the 1995 DDA it would seem that firms may have an incentive to hire the least severely disabled either to fill their quota (if enforced) or to minimise the costs of the adjustment element of the 1996 legislation.

[176] Prior to the ADA, disability discrimination related protection varied between states (see Jolls and Prescott, 2004).

[177] They do note, however, that hiring costs will have a positive employment effect.

Indeed, the original evidence presented in the US, identified a negative employment effect of the ADA (DeLeire 2000, Acemoglu and Angrist 2001). However, there has been considerable debate whether the decline in the employment rate of the disabled can be directly attributed to the ADA.[178] In particular, Kruse and Schur (2003) conclude that the analysis of the employment effects of disability legislation is confounded by changes in the composition of those reporting disabilities, the role of disability income (see, also, Bound and Waidmann, 2002) and the relative effects of business cycles on workers with and without disabilities.[179]

The most obvious issue in relation to measurement is defining the disabled population in surveys in the same manner as the legislation; Kruse and Schur (2003), using fourteen alternative measures of disability, find the definition of disability has an important influence on the estimated impact of the ADA. However, since disability is dynamic, evaluation may be further complicated by changes in the composition of the disabled. As Kruse and Schur (2003) and Schwochau and Blanck (2003) discuss, the introduction of the legislation, in increasing the accessibility of workplaces, may cause some individuals not to report a disability, or to report a disability as non-work-limiting. In contrast, the introduction of the ADA may, by reducing the stigma associated with disability, encourage individuals to report their disability. The former would result in the disabled population being more severely disabled after the ADA, which may increase the estimated impact of disability on labour market outcomes.[180] In contrast, the latter effect will work in the opposite direction if individuals who flow into disability are less severely disabled. Kruse and Schur (2003) find that the reporting of work-limiting disabilities increased post-ADA, which was partly due to an increase in functional limitations and partly due to

[178] This is despite a range of sensitivity analysis conducted by Acemoglu and Angrist (2001), including the small firm exemption of the DDA and analysis of non-disability benefit claimants.
[179] This study is able to consider the influences of changes in composition and cyclical effects; however, since individual disability income is not observed in the HSE, the issue of benefit income cannot be considered here. In April 1995 the main disability benefit for individuals who are unable to work was changed from invalidity to incapacity benefit. The increased stringency of testing that accompanied incapacity benefit may have encouraged more disabled individuals into work. Thus, the change is expected to have a positive influence on employment, although it may also influence the reporting of a disability. Moreover, the proportion who receive incapacity benefits is relatively small (using data from the LFS, about 14 percent of individuals with a long-term health problem are in receipt of incapacity benefit), limiting the effect on overall labour market outcomes.
[180] Within the UK, Berthoud (2006) and Jones (2006a) both find that the severity of a disability has a negative effect on the probability of employment for a disabled individual.

an increase in reporting amongst those with such limitations. The increase in reporting, also, coincided with some increase in severity.

In terms of identifying cyclical effects, Kruse and Schur (2003) include regional unemployment rates and time trends in their model. Whilst they find evidence that the disabled suffer disproportionately in downturns, their estimated policy effects are robust to the additional controls.

7.3 Data and Methodology

7.3.1 Data

As discussed in Section 6.3.2, the HSE is a nationally representative annual cross sectional survey, of about 18,000 individuals, commissioned by the Department of Health. It was first undertaken in 1991 and the data are available between 1991-2004.[181] However, in this Chapter the annual data are pooled across time to create a repeated cross sectional data set that extends before and after the change in legislation.[182] Disability is defined in the DDA as *a physical or mental impairment which has a substantial and long-term adverse effect on his or her ability to carry out normal day-to-day activities*. However, as has been the case in many surveys (see the discussion relating to the LFS in Section 3.3.1), questions on limiting longstanding illness which are more closely related to the DDA definition have only been introduced after the DDA, making a before and after comparison using this definition impossible. Instead, the definition of disability used in the analysis relates to longstanding illness where individuals respond positively to: [183]

[181] The data from 1991 and 1992 are based on a smaller sample size than the subsequent years; these years are included to increase the time span of the data, but the main results are not sensitive to the inclusion of the additional data.

[182] The HSE contains different modules each year; however, the analysis is based on information from core questions that are available throughout the period. The different modules also frequently involve over sampling from a particular group in the population. To remove these sharp changes in sample composition, only the representative general population component of each year sample is included in the analysis. This is consistent with the sample used for publication of time series trends in the HSE (www.ic.nhs.uk/pubs/hlthsvyeng2004upd). However, the resultant sample sizes vary considerably by year, since in some years the survey is entirely of the general population and in other years the general population is about half of the total sample.

[183] The criticisms of any self-reported measure apply here (see Bound, 1991).

Do you have any long-standing illness, disability or infirmity? By long-standing I mean anything that has troubled you over a period of time, or that is likely to affect you over a period of time?

This definition is broader than the DDA definition and 37 percent of the working age sample have a longstanding illness.[184] Using the additional information on whether the disability limits daily activity, available in the latter part of the sample, it would suggest that about 55 percent of those with a longstanding illness are limited in their activities.[185] Thus, as shown in Figure 7.1, some individuals in the broad disabled (treatment) group used in the analysis will not actually be covered by the DDA and will, therefore, not be affected by its provisions; this may lead to an underestimate of the true effect of the DDA. However, where possible, the trends between the two disability measures are compared over the latter part of the sample.[186] The definition of disability is different to Acemoglu and Angrist (2001) who use work-limiting disability but is similar to the long-standing illness measure in the FRS used by Bell and Heitmueller (2005), who consider four alternative measures of disability.

7.3.2 The Employment Effect

The sample is restricted to individuals of working age and excludes students and the self-employed. The specification of the model adapts the difference in difference approach applied in this context by Acemoglu and Angrist (2001). Employment for individual i and time period t (E_{it}) is modelled using a probit model:[187]

$$E_{it} = X_{it}\beta + \alpha D_{it} + \delta T_{it} + \phi(D_{it} * postDDA) + \varepsilon_{it} \qquad (7.1)$$

X_{it} contains information on the determinants of employment, including personal characteristics, such as age, marital status, age of leaving full-time education and

[184] The focus of the survey on health may also increase the reporting of disability.
[185] After 1997, those individuals who respond positively to longstanding illness are also asked: *Does this illness or disability/do any of these illnesses or disabilities limit your activities in any way?*.
[186] It should be noted that employers may also experience difficulties in identifying if an individual is DDA disabled and covered by the legislation.
[187] The models are also estimated separately by gender, but, since the results are consistent across genders, the overall results are reported.

ethnicity, and household characteristics such as size and housing tenure.[188] D_{it} is a dummy variable indicating disability status and, therefore, α captures the direct effect of disability on employment. Annual time series dummy variables are denoted T_{it} and $post\ DDA$ is a dummy variable that identifies observations after the introduction of the DDA, that is, 1997-2004. The impact of the DDA, relative to the previous legislation is, thus, given by the difference in difference parameter ϕ.[189] Controlling for characteristics, this measures the change in employment that is specific to the disabled group over the post-DDA period. Alternative specifications are also estimated, including a full set of disability time period interaction terms to identify a year by year effect.

The impact of the DDA on the disabled will only be accurately measured if the control group, the non-disabled, is unaffected by the legislation. Acemoglu and Angrist (2001) highlight that, theoretically, the provisions of the ADA may have spillover effects onto the non-disabled. However, they find no empirical evidence to support this in the US. Theoretically, direction of any spillover effect is ambiguous. Some firms may reduce hiring of both disabled and non-disabled individuals in response to the additional adjustment costs, whereas other firms may seek to avoid costly adjustments by substituting non-disabled for disabled labour. If the non-disabled are affected positively (negatively) by the DDA, the difference in difference parameter will underestimate (overestimate) a positive effect of the DDA and overestimate (underestimate) a negative effect, relative to the true impact of the DDA on the disabled.

Employment (E_{it}=1) is defined as being in paid employment during the last week. However, there were two changes to the question over the sample period.[190] As

[188] See Table 7.1 for variable descriptions and means. Since, unlike Bell and Heitmueller (2005), the HSE does not contain longitudinal information, there are no controls for unobserved heterogeneity.

[189] Only if compliance with, and enforcement of, the 1944 legislation was insufficient to give the legislation any impact will the interaction term measure purely the effect of introduction of the DDA.

[190] Between 1991-1994 individuals are asked *Were you in paid employment or self employment in the week ending last Sunday?*. After 1995, individuals were asked *Which of these descriptions applies to what you were doing last week, that is in the last seven days ending last Sunday?* of which *in paid employment or self employment* is one of the options. After 1998, two additional options were included in the response to the above question (*on a government scheme for employment training* and *doing unpaid work for a business that you own or a relative owns*). However, the definition of *in paid employment or self employment* was unaffected by this change.

would be expected, given the introduction of alternative options to paid employment from 1995, there appears to have been a slight dip in the employment rate (see Figure 7.2). There is no visible evidence that the latter, more minor, change, which, given the additional categories, may also be expected to reduce employment, has had any effect on employment rates.[191] Indeed, the employment rate appears to continue on an upward trend between 1997-1998. The inclusion of time series dummy variables in the econometric analysis should capture the change in reporting that is constant between the disabled and non-disabled groups; however, any difference in the change in reporting between the two groups will appear in the interaction term and, thus, may affect the policy measure. The sensitivity of the results is tested to the change in definition in 1995 and the main results are robust to restricting the sample to 1995-2004.

Given Kruse and Schur's (2003) concerns about the differential business cycle effect, equation (7.1) is also estimated including GDP_t and an interaction term $(GDP_t * D_{it})$ where GDP_t refers to annual GDP growth, and, thus, the interaction captures disability specific cyclical effects.[192]

7.3.3 Sensitivity Analysis

The Coverage of the DDA

The sign on the difference in difference parameter, ϕ, is a measure of the impact of the DDA on the employment rate of the disabled. However, it will also capture the effect of other group specific shocks that occur during the same period.[193] As a further test of the results, the coverage of the DDA is used to identify if the employment effects are consistent with the predicted effect of the legislation. In a similar manner to the ADA, small firms (fewer than 20 employees) are exempt from

[191] Less than 0.5 percent of the sample (either disabled or non-disabled) have responses in either of the two additional groups, supporting the limited impact.

[192] GDP data are obtained from ONS time series data, identifier IHYP, and measure year on year GDP growth at 2003 prices. The conclusions, with respect to the influence of the DDA, are robust to the alternative of the annual employment rate from the LFS being used as a cyclical control.

[193] There have been a series of policy measures designed to increase the employment rate of the disabled, for example, the New Deal for Disabled (July 2001) and the Disabled Persons Tax Credit (which replaced Disability Working Allowance October 1999); however, these should all have a positive influence on the employment rate of the disabled.

the DDA.[194] Thus, if the adjustment costs are significant in the UK, the predictions of Acemoglu and Angrist (2001), who state "we might expect the ADA to have had the largest effect on employment in firms that are sufficiently large to be covered by the ADA provisions but small enough to be vulnerable to an increase in costs" (pp. 943-944), would also apply to the UK.

For those individuals who are employed, the size of the firm is grouped into 3 bands: small firms have between 1-24 employees, medium firms between 25-499 and large firms 500 or more.[195] Similar to equation (7.1), the following multinominal logit model is estimated:[196]

$$F_{it} = X_{it}\beta' + \alpha' D_{it} + \delta' T_{it} + \phi'(D_{it} * postDDA) + \varepsilon'_{it} \tag{7.2}$$

where F_{it} has 4 groups, non-employment and the three firm size groups, and all other variables are as described above. As Greene (2000) shows, if Z_{it} denotes the vector of explanatory variables in equation (7.2) and the associated vector of coefficients is given by γ_j, the probability that individual i chooses category j in this model is given by:

[194] From December 1996 to December 1998 the small firm exemption covered firms with less than 20 employees; from December 1998 this was modified to firms with less than 15 employees. In October 2004 the exemption was removed. The first change (amendment of section 7) is documented in Statutory Instrument 1998 No. 2618 The Disability Discrimination (Exemption for Small Employers). The latter change (repeal of section 7) is documented in Statutory Instrument 2003 No. 1673 The Disability Discrimination Act 1995 (Amendment) Regulations 2003.

[195] The exact wording of the question changes over the period from: *How many employees work at the establishment?* to (in 1994): *Including yourself about how many people are employed at the place where you usually work?*. Due to the bounds in the responses, the firm size split, at 25, does not exactly match the original DDA exemption of 20. Indeed since firms with between 20 and 25 employees, may actually face the largest adjustment costs the effect on small firms will be overestimated in this model. Moreover, there is an additional measurement error created by multi-establishment firms. A small establishment may be part of a larger firm and, therefore, covered by the legislation. There is no information in the HSE to identify these cases. However, this will again lead to an overestimate of the impact in small firms and, thus, an underestimate of the impact in medium sized firms.

[196] The model relies on the assumption of the Independence of Irrelevant Alternatives (IIA). The Small-Hsiao test is unable to reject the null hypothesis of independence in all specifications. The results are more mixed from the Hausman test, but the sensitivity of the results to this assumption is tested by using a multinomial probit model. The results are robust to the choice of model.

$$P_{ij} = \frac{e^{\gamma_j' Z_i}}{\sum_{k=0}^{3} e^{\gamma_k' Z_i}}, \qquad j = 0,1,2,3 \tag{7.3}$$

To identify the model, being employed in a medium sized firm is used as the base category, where $\gamma_0 = 0$. Three log-odds ratios can be identified from equation (7.3) and are given by: $\ln\left[\frac{P_{ij}}{P_{i0}}\right] = \gamma_j' Z_i$. Thus, the coefficients represent the effect of an explanatory variable on the log-odds ratio of choosing category j relative to the base group. Since the coefficients are quite difficult to interpret, the marginal effects associated with each variable are also computed as follows: $\frac{\partial P_{ij}}{\partial Z_i} = P_{ij}[\gamma_j - \sum_{k=0}^{3} P_{ik}\gamma_k]$.

If the adjustment costs of the DDA dominate, the marginal effect of the disability DDA interaction term will be positive for the non-employment category and the employment losses will be concentrated in medium sized firms.[197] That is, the marginal effect on the interaction in medium sized firms would be negative and greater (in absolute terms) than in small firms, which are likely to be unaffected by the legislation.

The Composition of the Disabled

Kruse and Schur (2003) suggest that the introduction of the DDA itself may have changed the composition of the disabled and, thus, in equation (7.1) changes in the composition, unrelated to X_{it}, may be captured by ϕ. For example, increases in reporting of disability that reduce the average severity may cause ϕ to be positive. However, to assess the policy, it is important to identify what effect the DDA has had on the employment probability of a given disabled individual. In contrast to most surveys, the HSE has additional information on health which facilitates the testing of changes in the reporting of disability and changes in the composition of the disabled over time.

[197] In terms of the coefficients, relative to the base group of workers in medium sized firms, ϕ' would be positive for all other groups.

Changes in reporting of disability can be modelled using the following probit model:

$$D_{it} = X_{it}\gamma + Z_{it}\varphi + \eta(postDDA) + \mu_{it} \tag{7.4}$$

where all variables are defined above, with the exception of Z_{it}, which are controls for more objective health information such as BMI, being prescribed medicine and an index of mental well being (GHQ12).[198] The BMI is a measure of measuring height adjusted obesity and, this measure, together with physician diagnosed conditions and/or prescriptions, and composite measures of health, have been widely used as more objective health measures to instrument disability in empirical analysis (see Section 6.3.2). These more objective measures should be insensitive/less sensitive to changes in stigma and environment brought by the policy change. As such, η measures any change in the reporting of disability after the introduction of the DDA.

7.4 Results

7.4.1 Employment Effects

The employment gap between the disabled and non-disabled groups is visible in Figure 7.2, which plots the employment rates by disability status over time. On average, the probability of employment is about 60 percent for the disabled compared to more than 75 percent for the non-disabled.[199] Before 1999, the trend in employment is similar between the two groups, although the employment declines are more pronounced for the disabled. In the latter, post-DDA, period, the employment rate of the disabled does not match the non-disabled as closely; in particular, between 1999 and 2000 the employment gap widens due to a fall in the employment rate of the disabled. However, after 2000 the employment growth is higher for the disabled, narrowing the employment gap over the final part of the sample. Reassuringly, the 'U' shaped appearance of employment between 1998-

[198] Whilst each HSE contains an extensive range of more objective and truly objective information on health, the modular nature of the survey means that much of this information is not collected every year. As such, a restricted specification is estimated on information that is available throughout the sample period. Several alternative specifications are estimated on a restricted time period but with an enhanced set of objective health measures, but the conclusions with respect to the DDA remain the same.

[199] This employment gap is relatively narrow compared to other studies that use work-limiting disability (and the results in Chapter 3) and is consistent with the use of a broad measure of disability.

2002, identified for the disabled, is also evident for the activity-limited disabled. However, it seems there is less consistency in the patterns between the two disability measures after 2002.

The descriptive statistics for the variables included in the econometric analysis are included in Table 7.1. The difference in personal characteristics between disability groups is largely consistent with the patterns identified in Chapter 3 and is not repeated here. However, Table 7.1 also includes the health measures included in Z_{it} and some features are worthy of note. The average BMI is higher for the disabled, indicating they are more likely to be overweight.[200] The average GHQ12 score, which aims to provide information about non-psychotic psychiatric morbidity, is significantly higher for the disabled as may be expected, given mental health problems will be the cause of disability for some individuals in this group. The disabled are also more likely to be currently prescribed medicine from their doctor (62 percent), compared to the non-disabled population (22 percent).

The marginal effects from four alternative specifications of the difference in difference procedure in equation (7.1) are presented in Table 7.2.[201] The basic specification is presented in column 1, specification (2) includes controls for personal characteristics, the cyclical controls are added in specification (3) and specification (4) replaces the difference in difference term with a full set of disability time series interaction terms. Since the employment effects of personal characteristics are well established, the discussion focuses on the impact of the DDA. The direct effect of disability, as expected, is negative across all specifications. Conditional on characteristics, having a disability (as measured by longstanding illness) reduces the probability of employment by at least 10 percent. The controls for the period indicate the probability of employment was higher in the latter part of the sample period. However, the interaction term, which is the difference in difference or policy effect, is negative and significant across the specifications.[202] The inclusion of personal and household characteristics (column 2) only reduces the

[200] Typically, a value <18.5 is taken to represent underweight, 18.5-24.9 normal, 25-29.9 overweight, 30-39.9 obese and 40+ very obese.
[201] The coefficients are presented in Table A7.1.
[202] The term is also negative and significant for both genders when estimated separately.

estimated policy effect slightly. The marginal effect indicates the DDA reduced the employment of the disabled by about 3 percent, which is similar to the estimate of 4 percent identified by Bell and Heitmueller (2005). The inclusion of the cyclical controls in column 3 suggests the employment rate of the disabled is sensitive to the economic cycle. However, the sign of the influence is counterintuitive and contrasts with the evidence from Kruse and Schur (2003). Importantly, the negative influence of the policy is robust to the inclusion of these controls.

The specification in column 4 modifies the analysis, slightly, by replacing the policy period effect with a full set of time series interaction dummies. Relative to the omitted group (1996, the year of policy introduction), and, unlike the period prior to the DDA, the policy interaction terms are negative after 1997 and they are significant between 1999 and 2001. The evidence is consistent with a negative policy effect, which appears to lag behind the introduction of the DDA and may reflect delays in the awareness and implementation of the legislation within firms. However, there is also evidence that the negative impact has been relatively short-lived; from 2002 the interaction terms are not significant. This is consistent with evidence relating to the ADA from Jolls and Prescott (2004) who find the accommodation component of the ADA had only a short term negative impact on employment.

7.4.2 Sensitivity Analysis

Firm Size Effects

Table 7.3 presents the marginal effects from two specifications of the multinominal logit model specified in equation (7.2).[203] The basic specification (1) does not include controls for personal and household characteristics, whereas these are included in specification (2).[204] Consistent with the previous discussion, the disabled are significantly more likely to be non-employed and, conditional on employment, are, particularly, more likely to be employed in large relative to other sized firms. The disability interaction term confirms that non-employment has increased more for the disabled, but suggests that the majority of the decline in employment has occurred in medium sized firms. Indeed, there is no significant effect of the legislation on the

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[203] Coefficient estimates are presented in Table A7.2. The results are qualitatively similar if the multinomial logit is estimated only on the three firm size groups.

[204] Two further specifications are presented in Table A7.3, the first contains cyclical controls and the second a full set of time period and disability interactions.

probability of employment in either small or large firms. The inclusion of characteristics in column 2 does not alter the main results. The results are consistent with the predictions of Acemoglu and Angrist (2001), who argue that if the adjustment costs of the ADA are important employment will decline most in the firms with the greatest adjustment costs. Moreover, the conclusion is robust to the inclusion of controls for the economic cycle.[205] The negative employment effect identified above is consistent with the costs of adaptation varying by firm size and, therefore, supports the influence of the DDA. More specifically, due to the presence of the small firm exemption, medium size firms are predicted to face the largest adjustment costs as a result of the DDA. It is medium sized firms where employment losses are observed, consistent with the adjustment cost element of the DDA having a negative influence on employment of the disabled.

Following Acemoglu and Angrist (2001) the analysis by firm size can be used to consider the impact of the DDA on the non-disabled. The absence of spillover effects would be consistent with no change composition of employment in terms of firm size among the non-disabled. However, after 1996, among the non-disabled, non-employment declines and employment increases in medium and large firms. There is no evidence of employment growth in small firms, who are exempt from the DDA. As such, it appears that, any spillover effects seem to be positive, that is, firms covered by the DDA appear to be substituting non-disabled for disabled labour. Although interpretation should be cautious, given the range of influences on the employment of the non-disabled, if the DDA did have positive spillover effects, the negative difference in difference effect would be an overestimate of the impact of the negative influence of the DDA on the disabled.

The Composition of the Disabled

Data from the HSE suggests disability has increased significantly between 1991 and 2004 (see Figure 7.1) and, consistent with this increase, the proportion reporting poor or very poor general health and the proportion prescribed medicine also increased

[205] The specification which controls for disability year interactions does not suggest the declines in employment were predominately among medium sized firms, although the absence of employment growth in medium sized firms post DDA is in contrast with the trend prior to the introduction of the DDA.

significantly over time.[206] The proportion with activity-limiting disability follows a more stable pattern over time, which is consistent with the evidence presented in Chapter 3, that increases in disability were concentrated amongst the non-work-limited group. The descriptive statistics (in Table 7.1) also suggest that the increase in the size of the disabled group has been accompanied by an increase in the average number of conditions, which is often used as a proxy for severity. Consistent with this, there has been an increase in those who report they are disabled and permanently unable to work. As such, it is possible the fall in employment is due to the change in the composition of the disabled.

Marginal effects estimated from equation (7.4), which identifies the determinants of disability, are presented in Table 7.4.[207] Whilst the controls for characteristics are relatively limited, the estimates are consistent with previous evidence. For example, the probability of disability increases with age, reflecting the fact that many disabilities are age onset, and falls with the level of educational attainment, as measured by school leaving age. For those whose disability is birth onset, their disability may directly limit their access to education. However, the disadvantage associated with low educational attainment is also likely to increase the risk of age onset disability. This is consistent with evidence from Jenkins and Rigg (2004) who find disability is a consequence as well as a cause of disadvantage. As expected, the measures of (ill) health have a positive effect on disability.[208] Importantly, consistent with the above discussion (and Kruse and Schur, 2003), reporting of disability is found to be higher after the introduction of the DDA. Controlling for measures of health reduces the size of the effect, but it remains positive and significant after the DDA and indicates that reporting increased by nearly 2 percent in the post-DDA period. Whilst the measures of health available consistently throughout the period capture only aspects of disability, the evidence suggests that disability has increased, partly because the measures of health have deteriorated and, partly, because disability reporting, conditional on the given health measures, has increased. Either

[206] Table 7.1 also shows an increase in average BMI over the period, but the average GHQ12 score shows an improvement in mental well-being.
[207] The coefficient estimates are presented in Table A7.5.
[208] It is actually the deviation from the 'normal' group that is probably a better measure of ill-health, rather than the BMI itself, but this analysis suggests that a high BMI (or obesity) is more associated with disability than being underweight.

of the two influences may cause the composition of the disabled group to change over time, which may affect the employment results from equation (7.1).[209]

Kruse and Schur (2003) test the sensitivity of their employment results by changing the definition of disability. In a similar manner, equation (7.1) is re-estimated, but more specific measures of health replace disability. These measures of health provide more control for changes in the composition of the treatment group and, therefore, provide a robustness test of the main results. The results are presented in Table 7.5 where, in column 1, disability is replaced by a dummy variable indicating currently prescribed medicine and, in column 2, the health control is an index of mental wellbeing (GHQ12). This latter measure is, in particular, more able to control for changes in composition, since it includes an element of severity.[210] In both cases, the conclusions discussed above hold, ill-health (whether mental or related to physician prescribed medicine) has a negative influence on the probability of employment and the employment probabilities of this group have suffered relative to more healthy individuals in the post-DDA period.[211]

7.5 Conclusion

Whilst the DDA was designed to enhance the employment opportunities of the disabled, the theoretical and empirical evidence from the US would suggest that the impact of the policy may be ambiguous. Whilst the difficulties involved in estimating the impact of the DDA should be acknowledged, the existing empirical evidence in the UK by Bell and Heitmueller (2005) suggests that the introduction of the DDA also had adverse consequences on the employment rate of the disabled.

This Chapter adds to the UK evidence, by using a similar methodology on data from the HSE, a survey that is unexplored in this context. Despite using different data and a different time period for the analysis, the evidence confirms that of Bell and Heitmueller (2005); there is no evidence to suggest the DDA has improved the employment rate of the disabled. In fact, the evidence suggests that, following the

[209] Similar analysis of the number of conditions suggests that, after controlling for changes in characteristics, the severity of disability has also increased post-DDA.
[210] Since this information is not collected in 1996, the sample period differs from previous estimation.
[211] This conclusion holds if the number of conditions (a proxy for severity) replaces disability in the equation.

DDA, there was a period when the policy may have had a negative effect. Therefore, despite being introduced in a more favourable macroeconomic climate and the financial support provided through the Access to Work Scheme[212], there is growing evidence that the negative consequences of this type of legislation are not restricted to the US. Moreover, tests using the small firm exemption confirm that these employment losses were concentrated in medium sized firms, which is consistent with the adjustment costs of the DDA being a significant negative influence. The evidence also suggests that the composition of the disabled group has changed over time, with higher rates of disability after the DDA. Despite this, analysis on the basis of more objective health information suggests the results are not sensitive to the precise measure of health. Individuals in poor health are found to have a lower employment probability after the DDA, confirming the above results. This is particularly reassuring given the definition of disability is broader than the DDA definition. Future research may also want to consider how the influence of the DDA has impacted on specific disability types. Identification of such differences may aid understanding of the channels through which the effect operates.

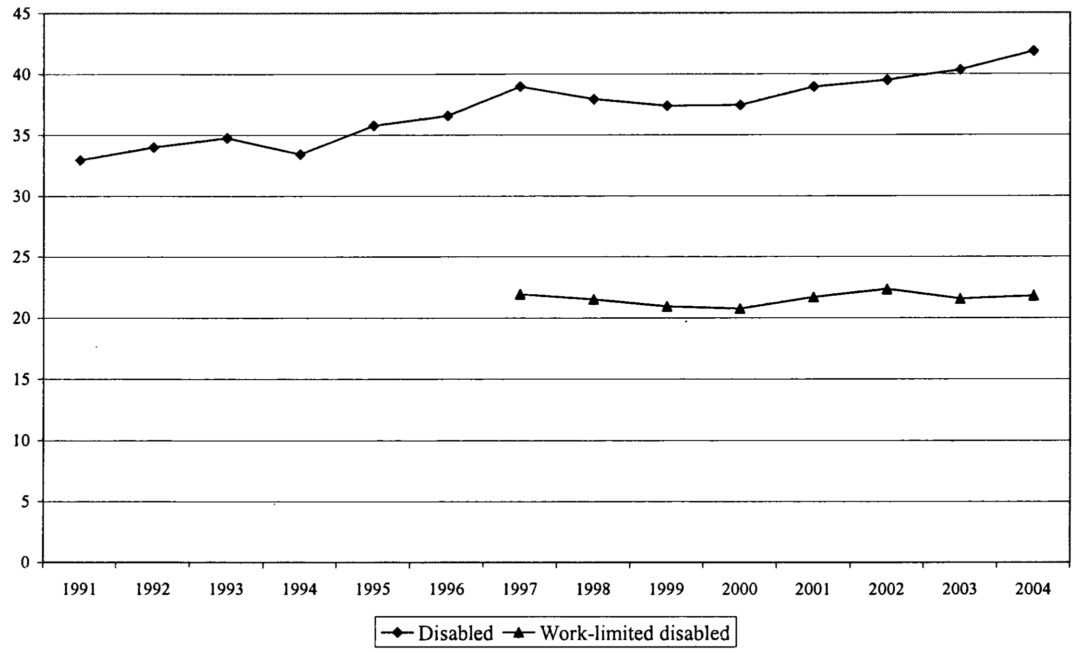
The analysis demonstrates the possibilities for using data sets that are not primarily designed for labour market analysis, to overcome the absence of more specific health information. However, as a result, the analysis is unable to control for disability benefit income or, more particularly, changes in the benefit regime which may have contributed to the change. Furthermore, the nature of the data, which is primarily intended for cross sectional analysis, is also restrictive, given the repeated cross sectional analysis undertaken here. More specifically, there are a number of modifications to the precise nature of the questions over time; this is of particular concern for the definition of the dependent variable. In addition, changes in the size of the general population element of the sample mean the composition of the sample is not balanced across time.

Despite the consistency of the results with Bell and Heitmueller (2005), identifying the influence of the DDA on labour market outcomes clearly warrants further research, particularly since the evidence (in Chapter 3) from the LFS, the largest

[212] Bell and Heitmueller (2005) highlight the low uptake amongst this scheme.

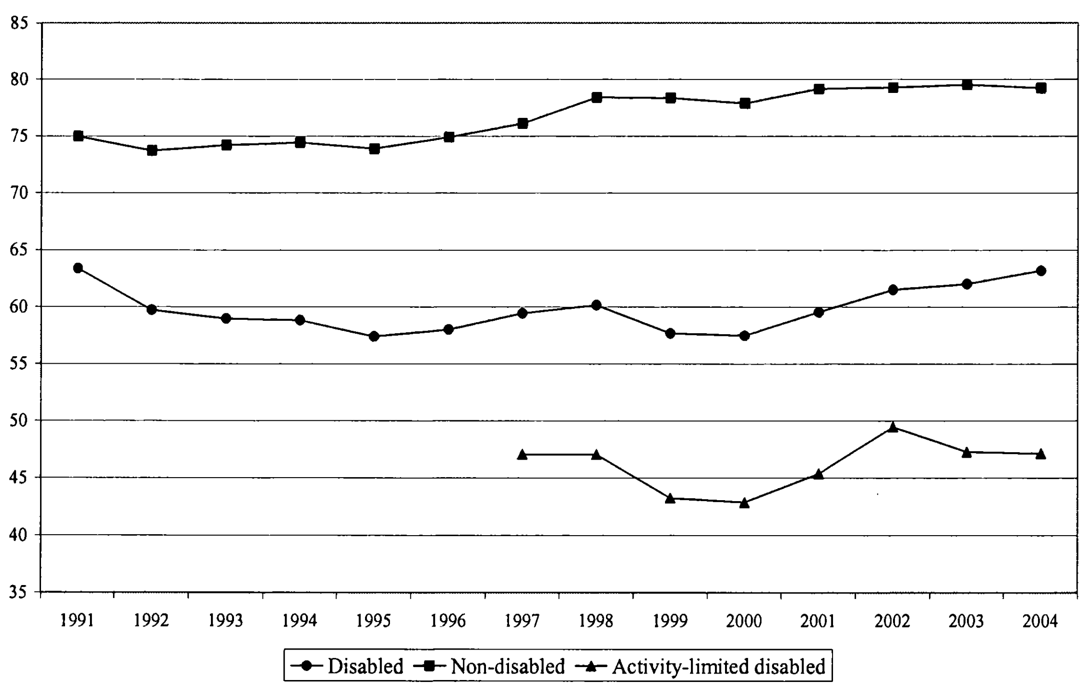
government household survey, does not support these conclusions. In addition to seeking other UK data sources to evaluate the employment effects, it may be informative to consider the measure of employment more carefully, since adjustments may occur at the intensive and/or extensive margin. Moreover, consideration of dynamic effects may also provide evidence on the source of these job losses. Information about changes in hiring and/or firing will provide more information on how the DDA influences employment.

Figure 7.1. Disability Rates, 1991-2004



Notes: Data from HSE. The sample is restricted to the working age population and excludes students and self-employed. Disability is defined as having a long-standing illness, disability or infirmity. Activity limitation is having a long-standing illness, disability or infirmity that limits your activities in any way. This is only available after 1996.

Figure 7.2. Employment Rates by Disability Status, 1991-2004.



Notes: See notes to Figure 7.1.

Table 7.1. Descriptive Statistics

Variable name	Definition	Mean	Mean Disabled	Mean Non-disabled	Mean Pre-DDA	Mean Post - DDA
Employment	Dummy variable equals 1 if individual was employed in the last week, 0 otherwise	0.703	0.595	0.766	0.689	0.714
Disabled	Dummy variable equals 1 if individual self-reports a long-standing illness, 0 otherwise	0.372			0.350	0.390
Activity-limited disabled	Dummy variable equals 1 if individual self-reports a long-standing illness that limits activities, 0 otherwise	0.216				0.216
PostDDA	Dummy variable equals 1 if the observation is in the post-DDA period (after 1996), 0 otherwise	0.538				
X_i						
Male	Dummy variable equals 1 if male, 0 otherwise.	0.458	0.478	0.446	0.462	0.454
Age 16-24	Dummy variable equals 1 if individual is aged between 16-24, 0 otherwise	0.122	0.081	0.146	0.133	0.112
Age 25-34	Dummy variable equals 1 if individual is aged between 25-34, 0 otherwise	0.257	0.189	0.296	0.273	0.244
Age 35-44	Dummy variable equals 1 if individual is aged between 35-44, 0 otherwise	0.256	0.238	0.266	0.244	0.265
Age 45-54	Dummy variable equals 1 if individual is aged between 45-54, 0 otherwise	0.223	0.271	0.195	0.216	0.230
Agefted16	Dummy variable equals 1 if individual completed full-time education at age 16, 0 otherwise	0.335	0.305	0.352	0.330	0.339
Agefted17	Dummy variable equals 1 if individual completed full-time education at age 17, 0 otherwise	0.095	0.087	0.099	0.096	0.093
Agefted18	Dummy variable equals 1 if individual completed full-time education at age 18, 0 otherwise	0.104	0.057	0.113	0.097	0.109
Agefted19	Dummy variable equals 1 if individual completed full-time education aged 19 or more, 0 otherwise	0.201	0.170	0.219	0.180	0.219

Adults	Number of adults (aged 16+) in the household.	2.256	2.221	2.283	2.284	2.238
House owned or mortgaged	Dummy variable equals 1 if housing tenure is owned outright or mortgaged, 0 otherwise	0.732	0.700	0.750	0.730	0.733
Social housing	Dummy variable equals 1 if renting from local authority or housing association, 0 otherwise	0.173	0.214	0.149	0.177	0.170
White	Dummy variable equals 1 if ethnic status is white, 0 otherwise	0.930	0.937	0.927	0.940	0.922
Married	Dummy variable equals 1 if individual is married, 0 otherwise	0.593	0.609	0.584	0.616	0.574
Single	Dummy variable equals 1 if individual is single, 0 otherwise	0.292	0.247	0.318	0.291	0.292
Z_i						
GHQ12[213]	GHQ score (12 point scale)	1.558	2.142	1.209	1.646	1.482
Medicine[214]	Dummy variable equals 1 if medicine is currently prescribed by doctor, 0 otherwise	0.373	0.625	0.223	0.339	0.403
BMI	Valid Body Mass Index value. This is a measure of body fat based on height and weight measurements.	26.178	26.920	25.736	25.707	26.582
Number of health problems[215]	Number of separate longstanding illnesses recorded (maximum 6).	0.562	1.506		0.498	0.617

Notes: The questions used to derive marital status, ethnicity and housing tenure change slightly over time. The derived variables use the most consistent definitions available.

[213] The GHQ12 score is a measure of psychological well-being and is based on measures such as happiness, stress, anxiety and sleep disturbance. It is collected on a four point scale which captures severity. This was not collected in 1996.

[214] This information is collected at the nurse visit. In 1999 and 2004 only a small sub sample of the general population is included in the nurse visit. As such, the number of valid cases is reduced in these years. Excluding the observations from 1999 and 2004 does not alter any of the main results.

[215] Health problems are classified into 41 categories in the HSE: 1 = Cancer (neoplasm) including lumps, masses, tumours and growth; 2 = Diabetes. Incl. Hyperglycemia; 3 = Other endocrine/metabolic; 4 = Mental illness/anxiety/depression/nerves; 5 = Mental handicap; 6 = Epilepsy/fits/convulsions; 7 = Migraine/headaches; 8 = Other problems of nervous system; 9 = Cataract/poor eye sight/blindness; 10 = Other eye complaints; 11 = Poor hearing/deafness; 12 =Tinnitus/noises in the ear; 13 = Meniere's disease/ear complaints causing balance problems; 14 = Other ear complaints; 15 = Stroke/cerebral haemorrhage/cerebral thrombosis; 16= Heart attack/angina; 17 = Hypertension/high blood pressure/blood pressure; 18 = Other heart problems; 19= Piles/haemorrhoids incl. Varicose Veins in anus; 20= Varicose veins/phlebitis in lower extremities; 21= Other blood vessels/embolic; 22 = Bronchitis/emphysema; 23 = Asthma; 24= Hayfever; 25 = Other respiratory complaints; 26 = Stomach ulcer/ulcer/abdominal hernia/rupture; 27 = Other digestive complaints (stomach, liver, pancreas, bile duct); 28 = Complaints of bowel/colon (large intestine, caecum, bowel); 29 = Complaints of teeth/mouth/tongue; 30 = Kidney complaints; 31 = Urinary tract infection; 32 = Other bladder problems/incontinence; 33 = reproductive system disorders; 34 = Arthritis/rheumatism/fibrositis; 35 = Back problems/slipped disc/spine/neck; 36 = Other problems of bones/joints/muscles; 37 = Infectious and parasitic disease; 38 = Disorders of blood and blood forming organs; 39 = Skin complaints; 40 = Other complaints; 41= Unclassifiable.

Table 7.2. Employment Probit Model Marginal Effects.

	Marginal Effect (1)	Marginal Effect (2)	Marginal Effect (3)	Marginal Effect (4)
Disabled	-0.154***	-0.120***	-0.095***	-0.130***
	(34.06)	(25.49)	(9.43)	(13.32)
1991	0.018*	0.039***	0.090*	0.016
	(1.69)	(3.72)	(1.88)	(1.21)
1992	-0.002	-0.015	0.021	-0.028**
	(0.20)	(1.45)	(0.58)	(2.04)
1993	-0.001	-0.004	0.003	-0.011
	(0.21)	(0.66)	(0.29)	(1.32)
1994	0.000	-0.002	-0.023	-0.004
	(0.01)	(0.31)	(1.04)	(0.47)
1995	-0.008	-0.009	-0.011	-0.010
	(1.31)	(1.42)	(1.61)	(1.22)
1996	0.026***	0.023***	0.020**	0.010
	(3.35)	(2.92)	(2.36)	(1.02)
1998	0.042***	0.039***	0.032***	0.036***
	(6.44)	(5.88)	(3.39)	(4.46)
1999	0.038***	0.035***	0.032***	0.044***
	(4.92)	(4.48)	(3.79)	(4.48)
2000	0.028***	0.022***	0.009	0.026**
	(3.59)	(2.74)	(0.56)	(2.57)
2001	0.045***	0.044***	0.048***	0.044***
	(6.89)	(6.75)	(5.99)	(5.49)
2002	0.055***	0.049***	0.057***	0.043***
	(7.10)	(6.21)	(4.91)	(4.16)
2003	0.058***	0.057***	0.058***	0.048***
	(8.98)	(8.78)	(8.67)	(5.93)
2004	0.060***	0.057***	0.050***	0.044***
	(7.37)	(6.95)	(4.84)	(4.02)
PostDDA*disabled	**-0.034*** **	**-0.029*** **	**-0.027*** **	
	(5.57)	**(4.65)**	**(4.33)**	
Age 16-24		0.152***	0.152***	0.152***
		(29.82)	(29.82)	(29.88)
Age 25-34		0.197***	0.197***	0.197***
		(46.78)	(46.78)	(46.82)
Age 35-44		0.218***	0.218***	0.218***
		(58.12)	(58.15)	(58.21)
Age 45-54		0.198***	0.198***	0.198***
		(54.38)	(54.40)	(54.45)
Married		0.087***	0.087***	0.087***
		(10.36)	(10.36)	(10.37)
Single		0.020**	0.020**	0.020**
		(2.24)	(2.25)	(2.25)
Male		0.056***	0.056***	0.057***
		(6.31)	(6.31)	(6.31)
Agefted16		0.035***	0.035***	0.035***
		(8.59)	(8.61)	(8.60)
Agefted17		0.064***	0.064***	0.064***
		(12.38)	(12.39)	(12.36)
Agefted18		0.085***	0.085***	0.085***
		(16.86)	(16.88)	(16.86)

Agefted19		0.097***	0.097***	0.097***
		(22.86)	(22.86)	(22.85)
White		0.175***	0.175***	0.175***
		(26.29)	(26.28)	(26.25)
Adults		0.024***	0.024***	0.024***
		(12.80)	(12.82)	(12.80)
House owned or mortgaged		0.150***	0.150***	0.150***
		(26.94)	(26.94)	(26.95)
Social housing		-0.154***	-0.154***	-0.154***
		(23.73)	(23.73)	(23.72)
Married*female		-0.140***	-0.140***	-0.140***
		(13.27)	(13.27)	(13.27)
Single*female		0.011	0.011	0.011
		(1.01)	(1.01)	(1.02)
GDP			0.017	
			(1.23)	
GDP*disabled			-0.009***	
			(2.70)	
Disabled*1991				**0.061***** **(2.98)**
Disabled*1992				**0.031** **(1.53)**
Disabled*1993				**0.017** **(1.32)**
Disabled*1994				**0.004** **(0.32)**
Disabled*1995				**0.002** **(0.16)**
Disabled*1997				**0.002** **(0.16)**
Disabled*1998				**-0.022** **(1.57)**
Disabled*1999				**-0.051***** **(2.88)**
Disabled*2000				**-0.038**** **(2.21)**
Disabled*2001				**-0.028**** **(2.02)**
Disabled*2002				**-0.012** **(0.68)**
Disabled*2003				**-0.006** **(0.47)**
Disabled*2004				**0.003** **(0.20)**
Observations	99810	99034	99034	99034
Log Likelihood	-59111.14	-51896.08	-51891.92	-51883.41
LR $\chi^2(k)$	3382.75	16782.11	16790.41	16807.43
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)
Pseudo R^2	0.0278	0.1392	0.1393	0.1394

Notes: Z statistics reported in parenthesis. ***, **, * denote significant at the 1%, 5% and 10% level respectively. The policy influence is highlighted in **bold**.

Table 7.3. Employment by Firm Size Multinomial Logit Model Marginal Effects.

	Marginal Effect (1)				Marginal Effect (2)			
	Non-employment	Small Firm	Medium Firm	Large Firm	Non-employment	Small Firm	Medium Firm	Large Firm
1991	-0.019*	0.010	-0.004	0.013	-0.041***	0.011	0.008	0.023**
	(1.83)	(0.93)	(0.31)	(1.52)	(3.95)	(0.97)	(0.64)	(2.47)
1992	0.001	-0.003	-0.008	0.010	0.013	-0.012	-0.013	0.012
	(0.08)	(0.31)	(0.76)	(1.25)	(1.19)	(1.20)	(1.22)	(1.51)
1993	0.000	-0.012**	-0.004	0.016***	0.003	-0.015**	-0.004	0.016***
	(0.01)	(2.10)	(0.56)	(3.05)	(0.39)	(2.42)	(0.64)	(3.22)
1994	0.000	-0.014**	0.001	0.013**	0.002	-0.018***	0.002	0.014***
	(0.03)	(2.41)	(0.17)	(2.53)	(0.33)	(2.91)	(0.25)	(2.69)
1995	0.008	0.004	-0.009	-0.004	0.010	0.003	-0.010	-0.003
	(1.33)	(0.68)	(1.34)	(0.76)	(1.46)	(0.47)	(1.38)	(0.64)
1997	-0.027***	-0.010	0.024***	0.013**	-0.024***	-0.012	0.024***	0.012*
	(3.58)	(1.37)	(2.84)	(2.06)	(3.11)	(1.52)	(2.74)	(1.91)
1998	-0.043***	0.007	0.019***	0.017***	-0.041***	0.005	0.019**	0.017***
	(6.69)	(1.12)	(2.60)	(3.13)	(6.15)	(0.73)	(2.54)	(3.07)
1999	-0.040***	0.001	0.017*	0.022***	-0.038***	0.001	0.016*	0.021***
	(5.16)	(0.18)	(1.92)	(3.21)	(4.81)	(0.09)	(1.80)	(3.14)
2000	-0.030***	-0.010	0.024***	0.016**	-0.025***	-0.010	0.022**	0.013**
	(3.81)	(1.38)	(2.77)	(2.40)	(3.03)	(1.32)	(2.39)	(2.07)
2001	-0.046***	0.002	0.021***	0.022***	-0.046***	0.002	0.023***	0.021***
	(7.11)	(0.37)	(2.92)	(3.95)	(7.02)	(0.31)	(3.09)	(3.74)
2002	-0.056***	0.000	0.028***	0.028***	-0.052***	-0.003	0.029***	0.026***
	(7.39)	(0.06)	(3.17)	(4.02)	(6.60)	(0.40)	(3.10)	(3.78)
2003	-0.059***	0.001	0.023***	0.035***	-0.060***	0.002	0.026***	0.032***
	(9.36)	(0.15)	(3.19)	(5.93)	(9.28)	(0.23)	(3.46)	(5.50)
2004	-0.061***	0.005	0.029***	0.028***	-0.059***	0.008	0.029***	0.023***
	(7.71)	(0.59)	(3.01)	(3.73)	(7.30)	(0.89)	(2.91)	(3.16)
PostDDA*disabled	**0.036*** **	**-0.008**	**-0.030*** **	**0.001**	**0.032*** **	**-0.007**	**-0.028*** **	**0.003**

	(5.88)	**(1.33)**	**(4.71)**	**(0.28)**	**(4.96)**	**(1.10)**	**(4.18)**	**(0.57)**
Disabled	0.153***	-0.053***	-0.067***	-0.032***	0.121***	-0.046***	-0.053***	-0.022***
	(33.97)	(13.04)	(14.62)	(9.80)	(25.24)	(10.36)	(10.74)	(6.49)
Age 16-24					-0.146***	0.058***	0.066***	0.022***
					(29.88)	(7.23)	(7.61)	(3.46)
Age 25-34					-0.191***	0.012**	0.110***	0.070***
					(46.64)	(2.05)	(16.32)	(13.16)
Age 35-44					-0.213***	0.030***	0.121***	0.062***
					(58.08)	(5.28)	(19.20)	(12.59)
Age 45-54					-0.193***	0.033***	0.107***	0.053***
					(54.67)	(5.86)	(17.02)	(10.73)
Married					-0.086***	0.006	0.054***	0.026***
					(10.02)	(0.71)	(6.12)	(4.57)
Single					-0.021**	0.009	0.015	-0.003
					(2.41)	(1.02)	(1.56)	(0.55)
Male					-0.057***	-0.040***	0.069***	0.028***
					(6.40)	(4.31)	(6.69)	(3.96)
Agefted 16					-0.035***	0.010**	0.015***	0.011***
					(8.76)	(2.33)	(3.25)	(3.14)
Agefted 17					-0.066***	0.004	0.026***	0.036***
					(12.97)	(0.77)	(3.99)	(7.24)
Agefted 18					-0.087***	-0.001	0.037***	0.051***
					(17.59)	(0.22)	(5.87)	(9.91)
Agefted 19					-0.100***	-0.031***	0.069***	0.063***
					(23.80)	(6.98)	(12.91)	(14.91)
White					-0.181***	0.055***	0.112***	0.014***
					(26.01)	(10.38)	(19.51)	(3.53)
Adults					-0.025***	0.021***	0.009***	-0.005***
					(13.00)	(11.88)	(4.76)	(3.87)
House owned or mortgaged					-0.154***	-0.005	0.122***	0.036***
					(26.96)	(0.94)	(23.42)	(10.82)
Social housing					0.152***	-0.053***	-0.046***	-0.054***

					(22.91)	(9.71)	(6.74)	(14.16)
Married*female					0.138***	-0.022**	-0.074***	-0.042***
					(12.81)	(2.28)	(7.01)	(6.24)
Single*female					-0.010	-0.034***	0.027**	0.017**
					(0.98)	(3.39)	(2.24)	(2.00)
Observations	99594				98833			
Log Likelihood	-130748.53				-121997.51			
LR $\chi^2(k)$ (p-value)	3462.12 (0.00)				18932.99 (0.00)			
Pseudo R^2	0.0131				0.0720			

Notes: See notes to Table 7.2.

Table 7.4. Disability Probit Model Marginal Effects

	Marginal Effect (1)	Marginal Effect (2)	Marginal Effect (3)
PostDDA	**0.034***** **(10.85)**	**0.012***** **(3.10)**	**0.017***** **(4.04)**
Age 16-24	-0.277*** (58.16)	-0.202*** (28.51)	-0.208*** (27.36)
Age 25-34	-0.263*** (57.45)	-0.174*** (27.96)	-0.176*** (26.11)
Age 35-44	-0.194*** (42.18)	-0.111*** (18.19)	-0.120*** (18.21)
Age 45-54	-0.106*** (21.83)	-0.064*** (10.45)	-0.069*** (10.46)
Married	-0.035*** (6.55)	-0.032*** (4.83)	-0.017** (2.38)
Single	-0.004 (0.74)	-0.007 (0.98)	0.003 (0.37)
Male	0.015*** (4.58)	0.084*** (21.26)	0.091*** (21.12)
Agedfted16	-0.048*** (11.21)	-0.032*** (6.17)	-0.031*** (5.50)
Agefted17	-0.041*** (6.99)	-0.026*** (3.55)	-0.025*** (3.20)
Agefted18	-0.050*** (8.61)	-0.033*** (4.61)	-0.029*** (3.73)
Agefted19	-0.065*** (13.62)	-0.041*** (6.91)	-0.046*** (7.12)
White	0.014** (2.30)	-0.003 (0.32)	0.011 (1.20)
Adults	-0.010*** (5.19)	-0.009*** (3.82)	-0.006** (2.50)
House owned or mortgaged	-0.035*** (6.13)	-0.038*** (5.45)	-0.029*** (3.79)
Social housing	0.080*** (12.02)	0.049*** (6.03)	0.048*** (5.40)
Medicine		0.386*** (102.93)	0.375*** (91.17)
BMI		0.006*** (15.08)	0.006*** (13.74)
GHQ12			0.025*** (31.78)
Observations	99079	72947	62821
Log Likelihood	-62065.571	-40847.303	-34656.997
LR $\chi^2(k)$ (p-value)	6620.41 (0.00)	14791.65 (0.00)	13734.42 (0.00)
Pseudo R^2	0.0506	0.1533	0.1654

Notes: See notes to Table 7.2.

Table 7.5. Employment Probit Model with Health Controls Marginal Effects.

	Marginal Effect (1)	Marginal Effect (2)
1991	0.037***	0.043
	(3.38)	(0.97)
1992	-0.020*	-0.010
	(1.78)	(0.20)
1993	-0.010	0.002
	(1.46)	(0.05)
1994	-0.004	0.004
	(0.52)	(0.08)
1995	-0.007	-0.004
	(1.07)	(0.09)
1997	0.015*	0.022
	(1.78)	(0.49)
1998	0.031***	0.037
	(4.26)	(0.83)
1999	0.043**	0.037
	(2.54)	(0.84)
2000	0.014	0.021
	(1.59)	(0.46)
2001	0.041***	0.038
	(5.63)	(0.85)
2002	0.033***	0.046
	(3.71)	(1.04)
2003	0.055***	0.048
	(7.58)	(1.09)
2004	0.066***	0.044
	(2.78)	(1.01)
Medicine	-0.087***	
	(17.58)	
PostDDA*medicine	**-0.012***	
	(1.68)	
GHQ12		-0.019***
		(21.74)
PostDDA*GHQ12		**-0.005***
		(4.13)
Age 16-24	0.162***	0.176***
	(29.67)	(36.16)
Age 25-34	0.205***	0.222***
	(44.43)	(53.28)
Age 35-44	0.219***	0.237***
	(52.21)	(62.45)
Age 45-54	0.200***	0.208***
	(49.73)	(55.77)
Married	0.097***	0.066***
	(10.15)	(7.47)
Single	0.025**	0.006
	(2.51)	(0.62)
Male	0.033***	0.049***
	(3.26)	(5.16)
Agefted16	0.033***	0.032***
	(7.37)	(7.37)
Agefted17	0.057***	0.063***

	(9.70)	(11.47)
Agefted18	0.081***	0.085***
	(14.38)	(16.04)
Agefted19	0.094***	0.100***
	(19.66)	(22.08)
White	0.171***	0.149***
	(22.15)	(20.13)
Adults	0.025***	0.024***
	(11.86)	(12.34)
Home owned or mortgaged	0.153***	0.145***
	(24.22)	(24.29)
Social housing	-0.155***	-0.156***
	(20.90)	(22.34)
Married*female	-0.146***	-0.134***
	(12.34)	(11.96)
Single*female	0.006	0.015
	(0.54)	(1.37)
Observations	77809	85441
Log Likelihood	-40881.673	-44489.735
LR $\chi^2(k)$ (p-value)	12295.11 (0.00)	13931.93 (0.00)
Pseudo R^2	0.1307	0.1354

Notes: See notes to Table 7.2.

CHAPTER SEVEN

APPENDIX

Table A7.1. Employment Probit Model

	Coefficients (1)	Coefficients (2)	Coefficients (3)	Coefficients (4)
Constant	0.658***	-1.009***	-1.154***	-0.998***
	(47.41)	(29.73)	(9.40)	(28.21)
Disabled	-0.437***	-0.353***	-0.282***	-0.383***
	(34.54)	(25.93)	(9.59)	(13.57)
1991	0.053*	0.121***	0.299*	0.050
	(1.67)	(3.57)	(1.67)	(1.19)
1992	-0.006	-0.045	0.064	-0.081**
	(0.20)	(1.47)	(0.57)	(2.08)
1993	-0.004	-0.013	0.008	-0.033
	(0.21)	(0.66)	(0.29)	(1.33)
1994	0.000	-0.006	-0.069	-0.012
	(0.01)	(0.31)	(1.05)	(0.47)
1995	-0.024	-0.028	-0.032	-0.031
	(1.32)	(1.43)	(1.62)	(1.23)
1996	0.076***	0.070***	0.060**	0.031
	(3.29)	(2.86)	(2.32)	(1.01)
1998	0.125***	0.121***	0.098***	0.112***
	(6.27)	(5.69)	(3.31)	(4.33)
1999	0.115***	0.110***	0.099***	0.138***
	(4.77)	(4.33)	(3.68)	(4.29)
2000	0.084***	0.068***	0.027	0.080**
	(3.52)	(2.69)	(0.55)	(2.51)
2001	0.135***	0.139***	0.151***	0.139***
	(6.68)	(6.49)	(5.74)	(5.29)
2002	0.168***	0.155***	0.180***	0.133***
	(6.78)	(5.91)	(4.63)	(3.99)
2003	0.176***	0.181***	0.183***	0.152***
	(8.61)	(8.33)	(8.22)	(5.68)
2004	0.183***	0.182***	0.160***	0.138***
	(6.99)	(6.54)	(4.59)	(3.85)
PostDDA*disabled	**-0.097*** **	**-0.086*** **	**-0.081*** **	
	(5.64)	**(4.71)**	**(4.39)**	
Aged 16-24		0.530***	0.530***	0.531***
		(24.91)	(24.91)	(24.95)
Aged 25-34		0.668***	0.668***	0.669***
		(40.52)	(40.52)	(40.55)
Aged 35-44		0.755***	0.755***	0.756***
		(49.15)	(49.17)	(49.21)
Aged 45-54		0.686***	0.686***	0.687***
		(45.91)	(45.92)	(45.95)
Married		0.259***	0.259***	0.260***
		(10.46)	(10.46)	(10.48)
Single		0.059**	0.060**	0.060**
		(2.23)	(2.23)	(2.23)
Male		0.171***	0.171***	0.171***
		(6.27)	(6.27)	(6.28)
Agefted16		0.105***	0.106***	0.105***

		(8.49)	(8.51)	(8.50)
Agefted17		0.205***	0.205***	0.205***
		(11.65)	(11.66)	(11.63)
Agefted18		0.275***	0.275***	0.275***
		(15.50)	(15.51)	(15.50)
Agefted19		0.313***	0.313***	0.312***
		(21.27)	(21.27)	(21.26)
White		0.479***	0.479***	0.479***
		(27.98)	(27.96)	(27.93)
Adults		0.071***	0.071***	0.071***
		(12.80)	(12.83)	(12.80)
Home owned or mortgaged		0.429***	0.429***	0.430***
		(27.91)	(27.92)	(27.93)
Social housing		-0.432***	-0.432***	-0.432***
		(25.01)	(25.02)	(25.01)
Married*female		-0.406***	-0.406***	-0.406***
		(13.64)	(13.64)	(13.64)
Single*female		0.032	0.032	0.032
		(1.00)	(1.00)	(1.01)
GDP			0.052	
			(1.23)	
GDP*disabled			-0.026***	
			(2.70)	
Disabled*1991				**0.195*****
				(2.77)
Disabled*1992				**0.095**
				(1.48)
Disabled*1993				**0.051**
				(1.30)
Disabled*1994				**0.013**
				(0.32)
Disabled*1995				**0.007**
				(0.16)
Disabled*1997				**0.007**
				(0.16)
Disabled*1998				**-0.064**
				(1.60)
Disabled*1999				**-0.148*****
				(2.99)
Disabled*2000				**-0.112****
				(2.27)
Disabled*2001				**-0.084****
				(2.07)
Disabled*2002				**-0.035**
				(0.69)
Disabled*2003				**-0.019**
				(0.48)
Disabled*2004				**0.010**
				(0.20)

Notes: Coefficients relate to marginal effects presented in Table 7.2. See notes to Table 7.2.

Table A7.2. Employment by Firm Size Multinomial Logit Model (1)

	Coefficients (1)			Coefficients (2)		
	Non-employment	Small firm	Large firm	Non-employment	Small firm	Large firm
Constant	-0.342***	-0.328***	-1.066***	2.809***	0.480***	-0.841***
	(12.95)	(11.90)	(30.21)	(41.35)	(6.60)	(9.28)
1991	-0.058	0.050	0.110	-0.185***	0.019	0.148*
	(0.95)	(0.79)	(1.38)	(2.80)	(0.30)	(1.84)
1992	0.026	0.011	0.100	0.085	-0.008	0.133*
	(0.47)	(0.19)	(1.34)	(1.41)	(0.14)	(1.78)
1993	0.011	-0.041	0.127***	0.022	-0.046	0.139***
	(0.32)	(1.10)	(2.75)	(0.59)	(1.24)	(2.97)
1994	-0.004	-0.064*	0.094**	0.003	-0.077**	0.102**
	(0.12)	(1.69)	(2.01)	(0.08)	(2.03)	(2.14)
1995	0.055	0.043	-0.003	0.063*	0.039	0.002
	(1.57)	(1.15)	(0.06)	(1.67)	(1.03)	(0.04)
1997	-0.165***	-0.111**	0.029	-0.160***	-0.113**	0.026
	(3.75)	(2.39)	(0.51)	(3.39)	(2.42)	(0.45)
1998	-0.210***	-0.024	0.074	-0.212***	-0.034	0.075
	(5.50)	(0.61)	(1.50)	(5.19)	(0.85)	(1.52)
1999	-0.192***	-0.042	0.110*	-0.194***	-0.042	0.112*
	(4.19)	(0.88)	(1.88)	(3.96)	(0.88)	(1.90)
2000	-0.175***	-0.113**	0.049	-0.154***	-0.102**	0.043
	(3.86)	(2.36)	(0.83)	(3.16)	(2.11)	(0.73)
2001	-0.228***	-0.050	0.102**	-0.248***	-0.056	0.093*
	(5.92)	(1.28)	(2.07)	(6.01)	(1.41)	(1.87)
2002	-0.292***	-0.082*	0.122**	-0.288***	-0.092*	0.115*
	(6.18)	(1.69)	(2.06)	(5.70)	(1.88)	(1.93)
2003	-0.288***	-0.063	0.180***	-0.316***	-0.067*	0.162***
	(7.40)	(1.57)	(3.69)	(7.55)	(1.65)	(3.28)
2004	-0.314***	-0.060	0.118*	-0.322***	-0.048	0.092
	(6.27)	(1.18)	(1.88)	(6.00)	(0.92)	(1.46)
PostDDA*	**0.208*** **	**0.056**	**0.099** **	**0.193*** **	**0.054**	**0.101** **
disabled	**(6.27)**	**(1.53)**	**(2.18)**	**(5.41)**	**(1.44)**	**(2.22)**
Disabled	0.697***	-0.030	-0.058*	0.576***	-0.033	-0.026
	(28.74)	(1.09)	(1.68)	(21.81)	(1.17)	(0.76)
Aged 16-24				-0.865***	0.037	-0.008
				(20.67)	(0.85)	(0.15)
Aged 25-34				-1.159***	-0.247***	0.210***
				(35.61)	(6.97)	(4.77)
Aged 35-44				-1.312***	-0.209***	0.131***
				(43.11)	(6.32)	(3.15)
Aged 45-54				-1.186***	-0.158***	0.103**
				(39.90)	(4.84)	(2.46)
Married				-0.462***	-0.131***	0.059
				(9.72)	(2.60)	(1.00)
Single				-0.122**	-0.006	-0.071
				(2.37)	(0.11)	(1.11)
Male				-0.409***	-0.357***	0.028
				(7.69)	(6.21)	(0.40)
Agefted16				-0.175***	-0.005	0.042
				(7.26)	(0.19)	(1.27)
Agefted17				-0.343***	-0.053	0.193***

				(10.04)	(1.59)	(4.59)
Agefted18				-0.470***	-0.107***	0.252***
				(13.69)	(3.21)	(6.22)
Agefted19				-0.603***	-0.315***	0.258***
				(21.24)	(11.18)	(7.65)
White				-0.901***	-0.129***	-0.254***
				(26.08)	(3.34)	(5.75)
Adults				-0.118***	0.055***	-0.069***
				(10.80)	(5.22)	(5.10)
Home owned				-0.888***	-0.401***	-0.069*
or mortgaged				(29.21)	(12.92)	(1.79)
Social housing				0.616***	-0.089**	-0.377***
				(17.64)	(2.32)	(7.21)
Married*female				0.691***	0.130**	-0.138*
				(11.91)	(2.11)	(1.85)
Single*female				-0.113*	-0.217***	0.058
				(1.82)	(3.32)	(0.73)

Notes: Base group is medium sized firms. Coefficients relate to marginal effects presented in Table 7.3. See notes to Table 7.2.

Table A7.3. Employment by Firm Size Multinomial Logit Model (2)

	Coefficients (3)			Coefficients (4)		
	Non-employment	Small firm	Large firm	Non-employment	Small firm	Large firm
Constant	3.098***	0.508**	-0.814***	2.768***	0.436***	-0.875***
	(13.08)	(2.16)	(2.89)	(39.26)	(5.86)	(9.42)
GDP	-0.104	-0.010	-0.010			
	(1.28)	(0.13)	(0.10)			
GDP*disabled	0.051***	0.024	-0.005			
	(2.70)	(1.24)	(0.19)			
Year 1991	-0.542	0.007	0.103	-0.008	0.112	0.259***
	(1.57)	(0.02)	(0.25)	(0.10)	(1.47)	(2.74)
Year 1992	-0.135	-0.016	0.106	0.199***	0.108	0.185**
	(0.62)	(0.07)	(0.41)	(2.62)	(1.50)	(2.06)
Year 1993	-0.020	-0.048	0.133**	0.079*	0.012	0.145***
	(0.37)	(0.88)	(2.00)	(1.66)	(0.27)	(2.58)
Year 1994	0.129	-0.073	0.118	0.042	-0.019	0.151***
	(1.03)	(0.59)	(0.79)	(0.88)	(0.42)	(2.68)
Year 1995	0.071*	0.039	0.003	0.089*	0.072	0.071
	(1.86)	(1.01)	(0.06)	(1.85)	(1.58)	(1.22)
Year 1997	-0.140***	-0.111**	0.028	-0.087	-0.106*	0.022
	(2.81)	(2.25)	(0.46)	(1.49)	(1.92)	(0.32)
Year 1998	-0.167***	-0.031	0.081	-0.175***	0.005	0.120**
	(2.92)	(0.55)	(1.18)	(3.51)	(0.12)	(2.09)
Year 1999	-0.173***	-0.040	0.114*	-0.230***	-0.010	0.115*
	(3.32)	(0.79)	(1.83)	(3.72)	(0.18)	(1.65)
Year 2000	-0.070	-0.098	0.054	-0.148**	-0.056	0.097
	(0.77)	(1.08)	(0.49)	(2.43)	(0.99)	(1.41)
Year 2001	-0.273***	-0.056	0.088	-0.243***	-0.039	0.106*
	(5.39)	(1.13)	(1.47)	(4.82)	(0.85)	(1.85)
Year 2002	-0.339***	-0.091	0.107	-0.224***	-0.028	0.114

	(4.53)	(1.25)	(1.22)	(3.49)	(0.48)	(1.60)
Year 2003	-0.321***	-0.065	0.160***	-0.231***	0.007	0.224***
	(7.47)	(1.57)	(3.16)	(4.46)	(0.16)	(3.90)
Year 2004	-0.278***	-0.045	0.097	-0.190***	0.051	0.208***
	(4.15)	(0.70)	(1.23)	(2.74)	(0.81)	(2.76)
PostDDA*disabled	**0.182*** **	**0.048**	**0.102** **			
	(5.09)	**(1.29)**	**(2.23)**			
Disabled	0.438***	-0.099	-0.015	0.695***	0.109*	0.087
	(7.64)	(1.64)	(0.20)	(12.64)	(1.90)	(1.18)
Age 16-24	-0.865***	0.037	-0.008	-0.867***	0.037	-0.009
	(20.68)	(0.85)	(0.15)	(20.71)	(0.84)	(0.16)
Age 25-34	-1.159***	-0.247***	0.210***	-1.160***	-0.247***	0.209***
	(35.61)	(6.97)	(4.78)	(35.63)	(6.97)	(4.76)
Age 35-44	-1.313***	-0.209***	0.131***	-1.315***	-0.209***	0.130***
	(43.13)	(6.32)	(3.15)	(43.16)	(6.33)	(3.13)
Age 45-54	-1.187***	-0.158***	0.103**	-1.188***	-0.158***	0.102**
	(39.90)	(4.85)	(2.46)	(39.94)	(4.85)	(2.44)
Married	-0.462***	-0.131***	0.059	-0.464***	-0.133***	0.058
	(9.72)	(2.61)	(1.00)	(9.75)	(2.64)	(0.99)
Single	-0.122**	-0.006	-0.071	-0.123**	-0.008	-0.072
	(2.37)	(0.11)	(1.11)	(2.40)	(0.15)	(1.13)
Male	-0.410***	-0.357***	0.028	-0.409***	-0.356***	0.028
	(7.69)	(6.21)	(0.40)	(7.68)	(6.20)	(0.40)
Agefted16	-0.175***	-0.005	0.042	-0.175***	-0.005	0.041
	(7.27)	(0.19)	(1.27)	(7.26)	(0.20)	(1.27)
Agefted17	-0.343***	-0.054	0.193***	-0.343***	-0.054	0.194***
	(10.06)	(1.59)	(4.59)	(10.04)	(1.60)	(4.60)
Agefted18	-0.471***	-0.107***	0.252***	-0.471***	-0.107***	0.252***
	(13.70)	(3.22)	(6.22)	(13.68)	(3.21)	(6.22)
Agefted19	-0.603***	-0.315***	0.258***	-0.603***	-0.315***	0.258***
	(21.24)	(11.18)	(7.65)	(21.24)	(11.20)	(7.63)
White	-0.900***	-0.129***	-0.254***	-0.899***	-0.128***	-0.254***

	(26.07)	(3.34)	(5.75)	(26.04)	(3.31)	(5.74)
Adults	-0.118***	0.055***	-0.069***	-0.118***	0.055***	-0.069***
	(10.82)	(5.21)	(5.10)	(10.79)	(5.24)	(5.09)
House owned or mortgaged	-0.888***	-0.401***	-0.069*	-0.889***	-0.402***	-0.070*
	(29.22)	(12.93)	(1.79)	(29.23)	(12.94)	(1.81)
Social housing	0.616***	-0.089**	-0.377***	0.616***	-0.089**	-0.377***
	(17.65)	(2.32)	(7.21)	(17.64)	(2.32)	(7.21)
Married*female	0.691***	0.130**	-0.138*	0.692***	0.131**	-0.138*
	(11.92)	(2.12)	(1.84)	(11.93)	(2.13)	(1.84)
Single*female	-0.113*	-0.217***	0.058	-0.113*	-0.217***	0.058
	(1.82)	(3.32)	(0.73)	(1.82)	(3.31)	(0.73)
Disabled*1991				**-0.497*** **	**-0.302** **	**-0.378** **
				(3.63)	**(2.16)**	**(2.11)**
Disabled*1992				**-0.325*** **	**-0.390*** **	**-0.164**
				(2.62)	**(2.91)**	**(1.00)**
Disabled*1993				**-0.156** **	**-0.191** **	**-0.018**
				(2.03)	**(2.34)**	**(0.17)**
Disabled*1994				**-0.119**	**-0.192** **	**-0.165**
				(1.51)	**(2.30)**	**(1.59)**
Disabled*1995				**-0.082**	**-0.104**	**-0.233** **
				(1.05)	**(1.28)**	**(2.18)**
Disabled*1997				**0.020**	**0.024**	**0.104**
				(0.22)	**(0.25)**	**(0.87)**
Disabled*1998				**0.084**	**-0.072**	**-0.040**
				(1.07)	**(0.89)**	**(0.39)**
Disabled*1999				**0.256*** **	**-0.048**	**0.091**
				(2.64)	**(0.48)**	**(0.74)**
Disabled*2000				**0.152**	**-0.095**	**-0.074**
				(1.58)	**(0.93)**	**(0.59)**
Disabled*2001				**0.169** **	**-0.005**	**0.057**
				(2.13)	**(0.06)**	**(0.56)**
Disabled*2002				**0.027**	**-0.147**	**0.087**

				(0.28)	**(1.45)**	**(0.72)**
Disabled*2003				**-0.030**	**-0.175****	**-0.090**
				(0.37)	**(2.14)**	**(0.90)**
Disabled*2004				**-0.129**	**-0.236****	**-0.238***
				(1.25)	**(2.24)**	**(1.84)**
Observations	98833			98833		
Log Likelihood	-121992.53			-121965.04		
LR $\chi^2(k)$ (p-value)	18942.96 (0.00)			18997.95 (0.00)		
Pseudo R^2	0.0720			0.0723		

Notes: See notes to Table 7.2.

Table A7.4. Employment by Firm Size Multinomial Logit Model (2) Marginal Effects

	Marginal effects (1)				Marginal effects (2)			
	Non-employment	Small firm	Medium Firm	Large Firm	Non-employment	Small firm	Medium Firm	Large Firm
GDP	-0.019	0.005	0.011	0.003				
	(1.37)	(0.41)	(0.77)	(0.29)				
GDP*disabled	0.009***	0.001	-0.007*	-0.003				
	(2.63)	(0.39)	(1.91)	(1.23)				
1991	-0.097**	0.03	0.039	0.028	-0.018	0.013	-0.021	0.027**
	(2.16)	(0.49)	(0.60)	(0.59)	(1.33)	(0.99)	(1.51)	(2.42)
1992	-0.028	0.002	0.009	0.017	0.026*	0.000	-0.036***	0.01
	(0.80)	(0.07)	(0.22)	(0.60)	(1.85)	(0.02)	(2.79)	(1.04)
1993	-0.005	-0.012	0.000	0.017**	0.010	-0.008	-0.015*	0.013**
	(0.58)	(1.33)	(0.00)	(2.38)	(1.14)	(1.05)	(1.82)	(2.15)
1994	0.027	-0.026	-0.012	0.011	0.004	-0.011	-0.009	0.016***
	(1.16)	(1.33)	(0.52)	(0.68)	(0.50)	(1.51)	(1.11)	(2.61)
1995	0.011*	0.002	-0.01	-0.003	0.010	0.005	-0.018**	0.002
	(1.68)	(0.36)	(1.48)	(0.67)	(1.20)	(0.66)	(2.13)	(0.40)
1997	-0.021**	-0.012	0.022**	0.011*	-0.011	-0.015	0.017	0.009
	(2.49)	(1.56)	(2.37)	(1.74)	(1.06)	(1.62)	(1.60)	(1.19)
1998	-0.033***	0.002	0.014	0.016**	-0.038***	0.008	0.010	0.019***
	(3.48)	(0.26)	(1.39)	(2.11)	(4.57)	(1.08)	(1.14)	(3.02)
1999	-0.034***	0.000	0.014	0.020***	-0.046***	0.009	0.016	0.021***
	(4.05)	(0.03)	(1.47)	(2.90)	(4.67)	(0.92)	(1.51)	(2.68)
2000	-0.009	-0.015	0.013	0.012	-0.028***	-0.004	0.014	0.018**
	(0.58)	(1.04)	(0.77)	(0.98)	(2.75)	(0.43)	(1.34)	(2.32)
2001	-0.051***	0.004	0.026***	0.021***	-0.047***	0.005	0.021**	0.022***
	(6.33)	(0.47)	(2.77)	(3.12)	(5.72)	(0.59)	(2.35)	(3.33)
2002	-0.060***	0.000	0.033**	0.027***	-0.044***	0.005	0.017	0.022***
	(5.33)	(0.01)	(2.42)	(2.62)	(4.26)	(0.52)	(1.57)	(2.65)
2003	-0.061***	0.002	0.027***	0.032***	-0.051***	0.008	0.009	0.034***
	(9.20)	(0.31)	(3.41)	(5.35)	(6.20)	(1.03)	(1.01)	(4.98)

2004	-0.052***	0.006	0.024**	0.022**	-0.046***	0.015	0.002	0.029***
	(5.02)	(0.50)	(1.98)	(2.45)	(4.15)	(1.35)	(0.18)	(3.28)
PostDDA*disabled	**0.030*** **	**-0.007**	**-0.026*** **	**0.003**				
	(4.65)	**(1.13)**	**(3.94)**	**(0.71)**				
Disabled	0.096***	-0.048***	-0.034***	-0.014*	0.131***	-0.032***	-0.081***	-0.018***
	(9.31)	(5.09)	(3.18)	(1.92)	(13.20)	(3.50)	(8.04)	(2.58)
Age 16-24	-0.146***	0.058***	0.066***	0.022***	-0.146***	0.058***	0.066***	0.022***
	(29.81)	(7.22)	(7.61)	(3.46)	(29.94)	(7.23)	(7.63)	(3.46)
Age 25-34	-0.191***	0.012**	0.110***	0.070***	-0.192***	0.012**	0.110***	0.070***
	(46.23)	(2.05)	(16.31)	(13.15)	(46.64)	(2.07)	(16.33)	(13.15)
Age 35-44	-0.213***	0.030***	0.121***	0.062***	-0.213***	0.030***	0.122***	0.062***
	(57.41)	(5.28)	(19.19)	(12.59)	(58.12)	(5.28)	(19.23)	(12.59)
Age 45-54	-0.193***	0.033***	0.107***	0.053***	-0.193***	0.033***	0.107***	0.053***
	(54.12)	(5.86)	(17.00)	(10.73)	(54.72)	(5.87)	(17.04)	(10.72)
Married	-0.086***	0.006	0.054***	0.026***	-0.086***	0.006	0.054***	0.026***
	(10.02)	(0.71)	(6.12)	(4.57)	(10.04)	(0.69)	(6.15)	(4.58)
Single	-0.021**	0.009	0.015	-0.003	-0.021**	0.009	0.016	-0.003
	(2.41)	(1.02)	(1.56)	(0.55)	(2.42)	(0.99)	(1.60)	(0.55)
Male	-0.057***	-0.040***	0.069***	0.028***	-0.057***	-0.040***	0.069***	0.028***
	(6.40)	(4.31)	(6.69)	(3.97)	(6.40)	(4.30)	(6.70)	(3.96)
Agefted16	-0.035***	0.010**	0.015***	0.011***	-0.035***	0.010**	0.015***	0.011***
	(8.77)	(2.33)	(3.26)	(3.15)	(8.76)	(2.32)	(3.26)	(3.15)
Agefted17	-0.066***	0.004	0.026***	0.036***	-0.066***	0.004	0.026***	0.036***
	(12.97)	(0.77)	(3.99)	(7.24)	(12.95)	(0.76)	(3.99)	(7.25)
Agefted18	-0.087***	-0.001	0.037***	0.051***	-0.087***	-0.001	0.037***	0.051***
	(17.59)	(0.22)	(5.88)	(9.91)	(17.58)	(0.21)	(5.87)	(9.91)
Agefted19	-0.100***	-0.031***	0.069***	0.063***	-0.100***	-0.031***	0.069***	0.063***
	(23.77)	(6.98)	(12.91)	(14.90)	(23.78)	(7.00)	(12.92)	(14.90)
White	-0.181***	0.055***	0.112***	0.014***	-0.181***	0.055***	0.112***	0.014***
	(25.98)	(10.38)	(19.48)	(3.52)	(25.97)	(10.41)	(19.45)	(3.52)
Adults	-0.025***	0.021***	0.009***	-0.005***	-0.025***	0.021***	0.009***	-0.005***
	(13.03)	(11.87)	(4.77)	(3.86)	(13.01)	(11.89)	(4.74)	(3.86)
Home owned or mortgaged	-0.154***	-0.005	0.122***	0.036***	-0.154***	-0.005	0.123***	0.036***

	(26.92)	(0.94)	(23.36)	(10.82)	(26.95)	(0.93)	(23.45)	(10.81)
Social housing	0.152***	-0.053***	-0.046***	-0.054***	0.152***	-0.053***	-0.046***	-0.054***
	(22.91)	(9.71)	(6.74)	(14.16)	(22.90)	(9.71)	(6.74)	(14.17)
Married*female	0.138***	-0.022**	-0.074***	-0.042***	0.138***	-0.022**	-0.075***	-0.042***
	(12.81)	(2.28)	(7.01)	(6.24)	(12.82)	(2.27)	(7.02)	(6.24)
Single*female	-0.010	-0.034***	0.027**	0.017**	-0.010	-0.034***	0.027**	0.017**
	(0.98)	(3.39)	(2.24)	(2.00)	(0.98)	(3.38)	(2.24)	(2.00)
Disabled*1991					**-0.062*** **	**-0.016**	**0.094*** **	**-0.016**
					(3.11)	**(0.71)**	**(3.39)**	**(1.01)**
Disabled*1992					**-0.033***	**-0.045** **	**0.075*** **	**0.004**
					(1.70)	**(2.32)**	**(2.93)**	**(0.22)**
Disabled*1993					**-0.018**	**-0.024***	**0.033** **	**0.009**
					(1.39)	**(1.94)**	**(2.15)**	**(0.86)**
Disabled*1994					**-0.005**	**-0.023***	**0.036** **	**-0.008**
					(0.41)	**(1.74)**	**(2.32)**	**(0.82)**
Disabled*1995					**-0.002**	**-0.007**	**0.027***	**-0.018***
					(0.14)	**(0.56)**	**(1.77)**	**(1.92)**
Disabled*1997					**-0.001**	**0.000**	**-0.009**	**0.010**
					(0.08)	**(0.01)**	**(0.50)**	**(0.80)**
Disabled*1998					**0.023***	**-0.018**	**0.000**	**-0.005**
					(1.66)	**(1.41)**	**(0.03)**	**(0.51)**
Disabled*1999					**0.053*** **	**-0.030***	**-0.026**	**0.002**
					(2.91)	**(1.95)**	**(1.45)**	**(0.16)**
Disabled*2000					**0.040** **	**-0.026***	**-0.004**	**-0.010**
					(2.25)	**(1.65)**	**(0.24)**	**(0.88)**
Disabled*2001					**0.033** **	**-0.014**	**-0.019**	**0.000**
					(2.26)	**(1.12)**	**(1.27)**	**(0.03)**
Disabled*2002					**0.012**	**-0.031** **	**0.006**	**0.013**
					(0.68)	**(2.02)**	**(0.31)**	**(1.02)**
Disabled*2003					**0.009**	**-0.027** **	**0.022**	**-0.004**
					(0.62)	**(2.17)**	**(1.45)**	**(0.36)**
Disabled*2004					**-0.003**	**-0.028***	**0.044** **	**-0.014**
					(0.15)	**(1.73)**	**(2.21)**	**(1.18)**

Notes: See notes to Table 7.2. Coefficients presented in Table A7.3.

Table A7.5. Disability Probit Model

	Coefficients (1)	Coefficients (2)	Coefficient (3)
Constant	0.323*** (11.34)	-0.754*** (16.24)	-0.944*** (18.50)
PostDDA	**0.091***** **(10.83)**	**0.032***** **(3.10)**	**0.045***** **(4.04)**
Aged 16-24	-0.890*** (43.93)	-0.611*** (24.13)	-0.632*** (22.94)
Aged 25-34	-0.773*** (50.15)	-0.495*** (25.93)	-0.501*** (24.17)
Aged 35-44	-0.552*** (38.81)	-0.307*** (17.51)	-0.332*** (17.47)
Aged 45-54	-0.292*** (20.98)	-0.175*** (10.23)	-0.190*** (10.22)
Married	-0.092*** (6.56)	-0.084*** (4.85)	-0.045** (2.38)
Single	-0.012 (0.74)	-0.020 (0.98)	0.008 (0.37)
Male	0.039*** (4.59)	0.224*** (21.24)	0.242*** (21.10)
Agefted16	-0.129*** (11.12)	-0.087*** (6.14)	-0.085*** (5.47)
Agefted17	-0.112*** (6.87)	-0.070*** (3.51)	-0.068*** (3.17)
Agefted18	-0.137*** (8.41)	-0.090*** (4.54)	-0.079*** (3.68)
Agefted19	-0.178*** (13.31)	-0.111*** (6.82)	-0.124*** (7.01)
White	0.039** (2.29)	-0.007 (0.32)	0.029 (1.20)
Adults	-0.027*** (5.19)	-0.024*** (3.82)	-0.017** (2.50)
House owned or mortgaged	-0.092*** (6.17)	-0.101*** (5.49)	-0.076*** (3.81)
Social housing	0.208*** (12.20)	0.130*** (6.11)	0.127*** (5.47)
Medicine		1.036*** (97.13)	1.005*** (86.54)
BMI		0.017*** (15.08)	0.017*** (13.74)
GHQ12			0.067*** (31.83)

Notes: See notes to Table 7.2. Coefficients relate to marginal effects presented in Table 7.4.

Table A7.6. Employment Probit Model with Health Controls

	Coefficients (1)	Coefficients (2)
Constant	-1.035*** (26.82)	-1.019*** (6.87)
1991	0.117*** (3.25)	0.137 (0.93)
1992	-0.059* (1.81)	-0.029 (0.20)
1993	-0.030 (1.47)	0.007 (0.05)
1994	-0.011 (0.52)	0.012 (0.08)
1995	-0.022 (1.08)	-0.013 (0.09)
1997	0.046* (1.75)	0.069 (0.48)
1998	0.096*** (4.15)	0.117 (0.81)
1999	0.136** (2.43)	0.118 (0.81)
2000	0.044 (1.57)	0.065 (0.45)
2001	0.129*** (5.43)	0.119 (0.82)
2002	0.104*** (3.59)	0.145 (1.00)
2003	0.175*** (7.20)	0.152 (1.05)
2004	0.214** (2.56)	0.141 (0.97)
Medicine	-0.259*** (17.84)	
PostDDA*medicine	**-0.035*** **(1.69)**	
Aged 16-24	0.581*** (24.07)	0.649*** (28.47)
Aged 25-34	0.707*** (38.04)	0.785*** (44.58)
Aged 35-44	0.763*** (44.08)	0.847*** (51.47)
Aged 45-54	0.702*** (41.82)	0.742*** (46.12)
Married	0.289*** (10.28)	0.201*** (7.54)
Single	0.075** (2.48)	0.018 (0.62)
Male	0.101*** (3.25)	0.150*** (5.13)
Agefted16	0.102*** (7.29)	0.098*** (7.29)
Agefted17	0.181*** (9.20)	0.205*** (10.78)
Agefted18	0.264***	0.281***

	(13.26)	(14.69)
Agefted19	0.304***	0.325***
	(18.31)	(20.45)
White	0.471***	0.415***
	(23.62)	(21.48)
Adults	0.075***	0.075***
	(11.87)	(12.34)
House owned or mortgaged	0.440***	0.419***
	(25.18)	(25.23)
Social housing	-0.436***	-0.443***
	(22.08)	(23.64)
Married*female	-0.427***	-0.393***
	(12.69)	(12.30)
Single*female	0.019	0.046
	(0.53)	(1.35)
GHQ12		-0.058***
		(21.75)
PostDDA*GHQ12		**-0.014*** **
		(4.13)

Notes: See notes to Table 7.2. Coefficients relate to marginal effects presented in Table 7.5.

CHAPTER EIGHT

CONCLUSION

The empirical evidence presented in this thesis contributes to the relatively limited UK evidence on the impact of disability on labour market outcomes. Overall, the evidence confirms the significant and persistent employment and earnings disadvantage associated with disability in the UK. However, the research also investigates a wider range of labour market outcomes, such as hours and employment type, which are affected by disability status and, by examining a wider range of issues, attempts to further the understanding of the channels through which disability impacts on labour market performance. This Chapter highlights and uses the key results from each of the preceding empirical Chapters to develop overall conclusions, particularly on issues that feature across Chapters. This broader examination of the contribution of the thesis provides a more informative point to consider the fundamental assumptions on which the evidence is based and directions for future research.

Discrimination, Productivity and Preferences

The analysis of data from the LFS in Chapter 3 shows that in 2003, a 47 (37) percentage point gap exists in the probability of employment between work-limited disabled males (females) and non-disabled males (females). Despite important differences in educational attainment between disability groups, the difference in observable characteristics explains less than a quarter of the overall gap; hence, standard decomposition methods would attribute the remaining difference (over three quarters of the overall gap) to (albeit an upper bound measure of) discrimination. The results from the DeLeire (2001) decomposition, which identify a lower bound on discrimination, suggest these methods, which assume that the unobservable productivity difference between the groups is zero, are severely biased. In fact, the estimate of discrimination in employment is, essentially, zero and the unobserved productivity difference makes the most important contribution, accounting for 80 percent of the employment gap. Whilst the selectivity earnings gap is smaller, characteristics similarly explain less than half the differential for males (48 percent) or females (24 percent), again suggesting a sizeable effect of discrimination. The DeLeire (2001) decomposition finds that a far greater proportion of the unexplained component is the result of unobserved productivity differences than discrimination. Indeed, similar to DeLeire (2001), when using US data, wage discrimination in the UK is found to represent less than 10 percent of the wage gap in 2003.

The dramatic differences in results that arise from changes in the decomposition methodology have significant implications for the literature. Firstly, discrimination is unlikely to have the dominant role identified in previous studies (Blackaby *et al.*, 1999, Kidd *et al.*, 2000). Therefore, eliminating discrimination will not remove the disadvantage associated with being disabled and will not make a significant contribution to achieving government targets to increase the employment rate of the disabled. Secondly, the question arises, to what extent can policymakers reduce the size of the unobserved productivity effect? Whilst it is unrealistic to suggest this component can be eliminated, elements of current policy measures, such as workplace accommodations, may serve to reduce its effect.[216] Importantly, the applicability of these results may extend beyond the disability literature, since the analysis demonstrates the potential sensitivity of decomposition analysis to neglecting unobservables. Even in more developed literatures, such as gender, differences in preferences, motivation and productivity are likely to exist. In this respect, this study may motivate researchers to look for innovative ways to investigate, if not resolve, this issue.

Crowding into certain types of employment may also be the result of discrimination and, consistent with the US literature, the concentration of part-time employment amongst the disabled in the UK is identified in Chapter 4. In a similar manner to the analysis of employment and earnings, after controlling for observable characteristics, it is the work-limiting nature of disability that causes the concentration in part-time employment. Hence, by applying similar assumptions to DeLeire (2001), it is possible to attribute the higher incidence of disabled workers in part-time

[216] The Pathways to Work programme also contains an element of NHS help with condition management.

employment to differences in preferences, rather than to discrimination. The differences in preferences are thought to be driven by accommodating features of part-time employment, which may be more important for the disabled. Similarly, Chapter 5 identifies the concentration of the disabled in another non-standard form of employment, self-employment. One fifth of male disabled workers classify themselves as self-employed and, therefore, this provides an important source of income for the disabled, which has been neglected in the literature. After controlling for observable characteristics, the evidence, at least for males, confirms that self-employment is largely a voluntary decision. It is argued that self-employment may provide opportunities, in terms of the location and nature of work, which means, for some individuals, it facilitates access to employment. If the decisions to enter non-standard work are largely voluntary, then policymakers should view these non-standard forms of employment as an opportunity to facilitate disabled individuals, who would otherwise be unable to work, into work.

Measurement Issues

Despite widespread use of self-reported information on disability, international evidence, particularly relating to health and retirement, has questioned the use of self-reported information. Chapter 6 considers the influence of two prominent sources of bias, justification bias and measurement error, on the decision to participate in the labour market. This issue is investigated using data from the HSE, which has appropriate information to instrument disability, such as more objective health measures and regional and genetic controls. Consistent with recent evidence from Canada, accounting for the potential bias in self-reported disability actually leads to a greater impact of disability on labour market participation. This suggests, in contrast to expectations, that the influence of measurement error outweighs the influence of justification bias (see Bound, 1991). Importantly for this area of research, it confirms that the link between disability and labour market outcomes is not a result of mis-measurement. The situation may indeed be worse if 'true' disability was observed.

The DDA

The recognition that the ADA did not have a positive effect on labour market outcomes of the disabled in the US has stimulated interest and debate, particularly in countries which have subsequently introduced similar legislation. Attempts have been made throughout this thesis to consider the role of the DDA, which, after several years in existence, has had the potential to have a significant influence on labour market outcomes for the disabled. Chapter 3 documents evidence from the LFS that suggests the employment rate for the disabled has grown over the post DDA period. Moreover, the growth in employment is not explained by changes in characteristics of the disabled over time. This residual or unexplained effect would be consistent with a change of environment, such as the positive influence of the DDA. The results for earnings are less robust, but there seems to be some evidence of a slight reduction in the contribution of discrimination and a narrowing of the earnings gap for disabled men. Since the growth in male earnings over the period is not explained by changes in the composition of the group, there is, again, potential for the legislation to have had a positive effect. However, these results contrast with Bell and Heitmueller (2005) who find no evidence of positive effects using the FRS and the BHPS. As such, Chapter 7 revisits this issue, using data from the HSE and applying the same methodology as Bell and Heitmueller (2005). Consistent with their results, there is evidence of a negative short-run employment effect immediately after the introduction of the DDA. Moreover, following the literature which questions the sensitivity of the initial studies in the US, several robustness tests are applied to confirm that this effect is consistent with the influence of the DDA. Therefore, and notwithstanding the differences in the methodology, data and geographical coverage, the analysis in this thesis provides inconclusive evidence on the impact of the DDA.

Heterogeneity

The influence of within group heterogeneity has been considered in several Chapters and differences in labour market outcomes on the basis of disability type and severity are evident. Thus, conclusions made on the basis of the entire disabled group mask the true degree of disadvantage faced by some individuals. After controlling for observable characteristics, individuals with mental health problems have lower earnings, lower employment probabilities and higher probabilities of part-time employment, which illustrate the additional difficulties experienced by this group. The evidence is timely, given the recent emphasis on mental health (Shaw Trust, 2006) and supports the use of impairment specific policy alongside more general measures. As expected, severity also plays an important role, with those individuals with multiple health problems having lower employment probabilities, lower earnings and higher incidence of part-time employment. Therefore, it is likely that general policies, which aim to increase employment amongst the disabled, will be more effective for certain sub-groups that are 'nearer to the labour market'. More effective policy measures will relate to the specific needs of sub-groups of the disabled and, thus, acknowledge the existing differences in labour market performance within the group.

What emerges from this thesis, and is fundamental for future research on disability, is that attention needs to be paid to features of the disabled group that make it distinct from the rest of the population (and equally features of groups within the disabled population that generate within group heterogeneity). It is acknowledging and attempting to understand these differences in contributing to their inferior labour market outcomes that will provide useful information for policy development. Moreover, applying standard models and econometric techniques without paying attention to the differences that arise in this context may be inappropriate.

Limitations

The analysis in this thesis is not without limitations and many of the issues (and subsequent sensitivity analysis) are drawn out during the individual Chapters. Whilst the more specific issues, predominately relating to model specification and data limitations, are not repeated here, it is important to reiterate the main, overarching limitations of the analysis.

The results from the DeLeire (2001) decomposition, which is fundamental to Chapters 3, 4 and 5, are based on two main assumptions. Firstly, that the non-work-limited disabled have no difference in unobserved productivity relative to the non-disabled and, secondly, that discrimination is equal against the two disabled groups. In support of the first assumption, severity is an important influence on labour market outcomes for the work-limited disabled, but is frequently less important (and often insignificant) for the non-work-limited disabled. The second assumption is more difficult to test, but differences in the composition of the groups, in terms of the type of health problem and the differences in perceptions of discrimination, suggest that it is less likely to hold. However, if discrimination is positively related to the work-limiting nature of the disability, the estimates of discrimination are a lower bound and should be interpreted with this in mind.[217] It is also worth highlighting that any unobservable difference between the work-limited disabled and the non-work-limited disabled is attributed to the unobserved productivity effect (Chapter 3) or the workplace accommodation effect (Chapters 4 and 5). If there are differences in factors, such as discrimination or motivation between the groups, through, for example, the receipt of benefit income, this will be included in the unobserved productivity effect. Therefore, caution should be exercised when trying to interpret the determinants of this component.

As is typical with a difference in difference procedure (used in Chapter 7), the impact of the DDA is established under the assumption that unobservables are held constant. Despite introducing controls for changes in characteristics and the economic cycle, the procedure only identifies the true policy effect if there has been no other group specific shock. In practice, there has been a considerable change in the policy environment and in the awareness of the disabled group, which may have changed the outcomes of the disabled but which are unrelated to the specific provisions of the DDA. However, in support of the findings in Chapter 7, the timing of the effect and the impact by firm size is consistent with the impact of the DDA. Moreover, if anything, the change in environment is a result of an increase in policies which support the disabled and, therefore, these changes are anticipated to have a positive impact on the outcomes of the disabled. Thus, the negative influence of the DDA identified may even have been diluted by these changes.

Directions for future research

This thesis has considered country specific evidence on a range of key labour market indicators to monitor the recent situation of the disabled in the UK and, hence, evaluate the impact of the DDA. There are a number of complementary aspects of disability research that would provide further evidence and a number of other areas that would further extend understanding of how disability impacts on the labour market.

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[217] The exception to this is the estimate of the balance of discrimination relating to self-employment in Chapter 5.

Organisations such as Eurostat have recently recognised the need for more consistent measurement of disabilities across countries and several initiatives, such as the 2002 European ad-hoc module on disability, have advanced data collection.[218] Whilst the difficulties in undertaking international (relative to national) comparisons are magnified, particularly in relation to measurement (Banks *et al.*, 2004 and Kapteyn *et al.*, 2007), the benefits may also be significant.[219] An examination of labour market outcomes of the disabled in an international context is likely to contribute further understanding of the extent of, and reasons for, the disadvantage faced in the UK, and will be particularly important in attempting to identify the contribution of the legislative frameworks.

The evidence presented in this thesis has all been based on cross sectional (or repeated cross sectional) data and, as such, the dynamic effects of disability and the associated transitions have largely been ignored. Previous evidence in the UK has considered dynamic effects with respect to disability and employment and earnings (see, for example, Jenkins and Rigg, 2004). This type of analysis could, naturally, be extended to establish causal relationships between the timing of disability onset and transitions between employment types, such as part-time and self-employment. Moreover, an analysis of transitions over time is likely to be useful in informing how the DDA influences employment.

While the heterogeneity within the disabled group is identified and considered, where possible, during the course of this research, it is restricted by data availability. Unfortunately, current cross sectional or longitudinal data do not simultaneously cover all the different forms heterogeneity may take in terms of type, severity, duration and age of disability onset (including at birth). If a disability survey is commissioned in the UK, (see, Purdon 2005, for a feasibility study), it is essential that this contains retrospective questions relating to disability onset, a longitudinal element which traces changes in both the disability and labour market performance, and sufficient observations for the examination on the basis of disability type.

[218] This is essential if the European Commission is to monitor the EU Disability Action Plan, which was established after the 2003 European Year of the Disabled.
[219] See Hagan *et al.* (2006) for a recent international examination of health and retirement.

Despite growing analysis of disability using individual data, the current UK (and international) economic evidence neglects the important role employers have in determining labour market outcomes of the disabled. This type of analysis appears particularly appropriate given the requirement to make workplace adjustments under the DDA. The DWP has commissioned specific surveys, such as by Simm *et al.* (2007), who suggest that awareness of the Act is high and that there is widespread compliance with the accommodation element of the legislation. Moreover, Woodhams and Corby (2007) have undertaken their own survey of employers in 1995 and 2003, and find a large increase in the use of disability equality practices.[220] However, information in large scale matched employer-employee surveys, such as the Workplace Employee Relations Survey (WERS), remains underutilised and could provide evidence on the prevalence of employer provided accommodations and, possibly, even the impact of these accommodations on disabled employees and on the profitability of establishments. Moreover, it would be relatively straightforward to include additional questions in this survey relating to, for example, the nature and cost of the accommodation to enhance our understanding of the practical implications of this component of the legislation.

Finally, it is undoubtedly the case that disability benefits have an important role in the incentive to report disability and, subsequently, to participate in the labour market. However, existing research has largely considered the determinants of benefit receipt quite separately from the evidence relating to disability and labour market outcomes. While the two definitions of disability are distinct, there is a substantial overlap between these groups (see Prime Minister's Strategy Unit, 2005). Therefore, an integration of these two aspects of the disability literature is likely to be important in understanding the inter-relation between self-reported disability, employment and disability benefits.

It is this type of evidence that will aid policymakers who seek to encourage the disabled into employment in the UK, a country with one of the highest rates of working age disability.

[220] The perspectives of employers have been investigated, predominately in other disciplines (see, for example, Cunningham and James, 1998, Jackson *et al.*, 2000 and Goldstone, 2002).

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