The Labour Supply and Retirement of Older Workers: An Empirical Analysis

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Abstract

This thesis examines the labour supply of older workers, their movement into retirement, and any movement out of retirement and back into work. In particular the labour force participation, labour supply and wage elasticity and other income elasticity of work hours are estimated for older workers and compared to younger workers. The thesis goes on to look at the movement into retirement for older workers as a whole by examining cohorts by gender, wave and age. The thesis also presents a descriptive and quantitative examination of the changes in income and happiness that occur as an individual retires. Finally the thesis examines the reasons why an individual may return to work from retirement.

The results of the findings suggest: that younger workers are significantly more responsive to wage and household income changes than older workers; that there are gradual movements into retirement for workers as a whole but sudden movements into retirement for individuals; that there are significant changes in income and happiness as individuals retire that depend on certain traits; and that life satisfaction is significantly affected by an individual's pre-retirement wage and whether they retire late or not. There is also an important role for pensions both in terms of the fall in income as an individual retires and in the probability that a retiree will return to work.

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Introduction to The Labour Supply and Retirement of Older Workers: An Empirical Analysis

1.1: Introduction

Information on the labour supply and consequent retirement of the older worker is becoming extremely relevant in today's society. Governments across the world are endeavouring to improve the positions of their state pensions and many nations are increasing the age at which individuals can receive the state pension. Politically pensions are a topic of increasing debate both here and abroad as governments must attempt to protect their pension systems from rising life expectancy and reducing workforces. In the UK the government has begun a national debate on pension reform, with the whole country invited to put forward their opinions on what a pension system should do (See for example: http://www.thepensionservice.gov.uk/aboutus/2005/june/national-pensions-debate.asp).

A new act of parliament, the Pensions Act 2004, has also reformed the pension system in the UK in an attempt to protect the private pension system in the UK from the improving longevity of the individual, and to also tempt older individuals to defer their state pension for up to five years and in so doing attempt to increase the labour supply of the older worker. (see: http://www.dwp.gov.uk/lifeevent/penret/penreform/guidepensionsact04.pdf).

In the USA there are also fears over the increase in older individuals and the reduction in the labour force on pensions. Then Federal Reserve Chairman Alan Greenspan, in an address to the Senate's Special Committee on Ageing, stated that "...a thorough review of our commitments...is urgently needed. The necessary adjustments will become ever

more difficult and larger the longer we delay." (Statement of Alan Greenspan before the Special Committee on Aging, United States Senate, March 15, 2005)

Added to the increased political importance of pensions and retirement is the EU council directive 2000/78/EC, which requires all member states to have removed all forms of discrimination from the workplace. This directive was enforceable for age and disability discrimination from December 2nd 2006. Therefore another obstacle for the employment of the older worker will be removed.

In the UK there are a growing proportion of older people in the population. Based on 2002 population projections, 26.23% of the population will be aged 60 or more in the year 2021. This figure has risen from 23.45% based on 1998 population projections (Shaw, 2000 & 2004). Therefore older individuals will become an important part of the economy if they continue to work or an increased burden on the working age population if they retire.

While the working age population will increase in the years to come, the proportion of working age population to the total population is not projected to change to a great extent. The most recent projections suggest that 62.1% of the population will be of working age in 2006, while by 2021, 62.3% of the population will be of working age (Shaw, op cit.).[1] However, the average age of the working population will be increasing over this period. Between 1991 and 2001 the labour force's average age increased from 37.5 to 39.0 years. By 2021 projections suggest that the average age will be 40 years. Projections suggest that in 2005 approximately 27.5% of the working age population are aged 50-64. By 2010 this figure will be closer to 29% and by 2020 almost one third of the working age population will be older workers (Dixon, 2003).

Despite all this the employment rate of older male individuals in the population has fallen. Whereas the proportion of women aged between 55 and 60 in employment has

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[1] Also note that the number of working age individuals in 2021 will be boosted by the increase in pension age for women. This is discussed in more detail in section 1.4.1.

remained at close to 50% between 1979 and 1997, nearly 80% of men aged 55-65 were in employment in 1979, but under 60% were employed in 1997.[2] Most of this increase is because of increases in economic inactivity rather than unemployment. Early retirement, long-term sickness and changes in labour demand could all possibly account for the massive change in the economic inactivity of the older worker. (Campbell, 1999)

All these factors contribute to the aim of this thesis, to examine the retirement and labour supply of the older worker. The extent of what factors cause older workers to supply their labour or conversely to retire is an important analysis for any future policy. It is important both to assess the causes of retirement and the factors which affect labour supply. Also linked to these arguments is to find the probability of an individual moving out of retirement and back into work. This is important in terms of policy so that the government can know which factors are important in determining whether someone moves back into work after retiring. It is also relevant given the ability for individuals to defer their state pension from 2005.[3]

At the same time it is important to assess what happens to retirees in terms of health, happiness and income as they move into retirement. Retirement will have a major financial impact on individuals, especially if the retirement choice is forced upon them through compulsory redundancies for example. However, retirement is also meant to be a time when individuals can spend more time doing what they enjoy, and they should therefore be more happy in their lives compared to before they retired. However, health or income may affect their choices of lifestyle once retired and so may impact on their happiness.

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[2] Disney and Hawkes (2003) highlight that since 1998 there has been an increase in the number of older individuals in work. In the 4th quarter of 2002 there were 653,000 more over 50's in employment than in the 4th quarter of 1998. This increase is fairly evenly split between men and women. However, the authors attribute most of the increase to the improved economic climate.
[3] See Section 1.4.2 below.

Given the above paragraphs the aims of the thesis can be outlined as:

- Examine the labour force participation and labour supply of older workers in the UK.

- Compare how older workers and younger workers react to wage and income changes.

- Descriptively analyse the retirement process for individuals and for older workers as a whole.

- Examine descriptively what happens to income and happiness as individuals retire.

- Quantitatively study the changes to happiness as individuals retire.

- Examine what the causes are of moving out of retirement and back into employment.

The rest of this chapter is organised as follows: firstly attention is turned to the term 'retirement' and the various meanings of this phrase are discussed before explaining how retirement is measured in this thesis; second there a review of the UK pension system, and a discussion of the changes to the system in the last ten years; third there is a discussion in the changes in the work place and other laws that are affecting older people and their ability to find work; fourth there is an introduction to the dataset used throughout this thesis, the British Household Panel Survey (BHPS); and finally there is a overview of the remaining chapters in this thesis that will explore the issues raised in the aims of this thesis.

1.2: What is retirement?

Before this thesis can go on to analyse the labour supply and retirement of older workers, what must first be answered is just what is retirement? The simple explanation of retirement will be the one found in most textbooks and is where an individual withdraws permanently from the labour market. It will also be synonymous with an individual starting to receive a pension, either state provided or private from an occupation or savings. Retirement may come about for a number of reasons: an individual may be at an age where they cannot do the work they could before; or where they can retire with an adequate income to keep them going through retirement; or where they are forced out of the labour market through illness or loss of job.

However, is this all retirement is? For some it may mean moving into a lower paying, less stressful job that is only part time and then withdrawing from the labour market somewhere in the future. So for these people they may consider themselves retired or partially retired. It may also be true that some of these individuals may still consider themselves as employed, further causing problems in the measurement of retirement. For others it may be entering part time or less stressful work and continuing in this for as long as possible and considering themselves retired. For others still it may be completely withdrawing from the labour market as in the textbook measure of retirement. Other problems arise in measuring retirement, since just looking at labour participation rates can be misleading. As mentioned above some may retire from employment, others may move to part time jobs, while others still may retire from the labour market during periods of *un*employment. (Lumsdaine & Mitchell, 1999) Another issue that adds on to the issue of when you are retired is whether or not it is a permanent state, that is once you move in to retirement you are then always retired from that point on. As we will see in this thesis more and more individuals will actually return to work after retirement. All of

the above suggests that retirement is not a straightforward thing to measure as what one person considers as retirement may not be the same for another.[4]

For the purposes of this thesis then retirement is seen as a subjective measure with an individual reporting whether they are retired or not. While different individuals have different meanings of retirement this will still give us the most comprehensive view of those in retirement. The dataset that is analysed throughout this thesis, the British Household Panel Survey (BHPS), actually links retirement with employment so that an individual cannot be retired if they are working. So the dataset will in some ways restrict the number of perceived retirees in that those who are working but who consider themselves retired will not actually be reported as retired.

1.3: The UK pension system

As well as the other issues that affect the retirement decisions of individuals in the UK the pension system that they face will be one of the main factors in their decision. Therefore attention is now turned to briefly outline the current state of the UK pension system and what it was like during the time that this thesis analyses older workers and their retirement, namely 1991-2003. In large part this section of the thesis draws on the work of Disney, Emmerson and Wakefield (2001) and the comprehensive work of Blake (2003).

As we will see since 1980 the unfunded state provision of pensions has been gradually reduced in favour of private funded provision so as not to have a major pension crisis. The Thatcher led Conservative government in 1980 first linked state pension growth to prices rather than national average earnings, while the Major led Conservative

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[4] For further discussion of what exactly retirement is, see Banks and Smith (2006) and references therein.

government raised the state pension age for women from 60 to 65 which is to be phased in from 2010 to 2020 (Social Security Act, 1980; Pensions Act, 1995).[5]

1.3.1: Current UK pension system.

There are three tiers to the UK pension system. The first tier is the basic state pension which everybody is entitled to and which is increased through National Insurance contributions as you work. The second tier consists of pensions that can be provided by the state, employers or private sector financial institutions. State second pension entitlement is the immediate option available in the second tier to all individuals who will automatically build up entitlement if they are earning above the lower earnings limit. This occurs unless they are a member of an employer's occupational pension scheme or they have a personal or stakeholder pension scheme which has been contracted out of the state second pension. If the individual has a contracted out pension from an employer then both the employee and the employer will receive rebates on their National Insurance contributions. If the individual has a personal pension then the National Insurance contribution rebate is paid into their retirement savings account by the Department for Work and Pensions on the behalf of the employer, who may or may not also match the contributions of the employee.[6] The third tier of the pension system comes in the form of voluntary saving for retirement by individuals. Individuals can add voluntary payments to occupational pension schemes and to personal pension schemes which receive tax relief up to a limit. Individuals can also pay into personal pension saving schemes as well as being a member of an occupational pension scheme or the state second pension, and again they would receive tax relief up to a limit on any contributions they make.

Currently the Labour government promises a minimum income guarantee for pensioners which was introduced in 1999. This means that the benefit income of the

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[5] Also see chapter 1.4.1 of this thesis for more discussion of the increase in state pension age.
[6] It will usually be the case that an employer will not match individual contributions to personal pension schemes if they have their own occupational pension scheme.

poorest pensioners is increased greatly, and the introduction of the pension credit in 2003 helped this even further. The pension credit is an untaxed benefit which makes up the difference between all income pensioners currently receive and the minimum income guarantee level, which is currently £119.05 for a single person and £181.70 for a couple.[7] The Pensions Act 2004 improved protection for those in defined benefit occupational pension plans by creating a pension protection fund to compensate any individuals whose employer went out of business and whose pension fund was thus under funded. The Financial Assistance Scheme was also created by the Act which aimed to assist those that had already lost out before the pension protection fund was set up because their occupational pension scheme was under funded. A new Pensions Regulator to take over from the Occupational Pensions Regulatory Authority was also created in the Act, with the new regulator having increased powers and was aimed to increase awareness of pensions. The Act also created the ability of individuals to defer their state pension and receive extra benefits from this.[8,9] A 2006 White Paper, *'Security in retirement: towards a new pension system'*, puts forward new personal accounts to save for retirement and all individuals will either be enrolled in this scheme or the employers occupational scheme automatically. The Paper also proffers the return of linking the basic state pension to national average earnings, allowing the state second pension to gradually become a flat rate addition to the basic state pension, and reducing the number of years needed to qualify for the full basic state pension to 30. As well as improving the regulation of pensions further, the White Paper also puts forward that the state pension age should increase with average life expectancy, rising to 66 by 2026, and 68 by

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[7] See
http://www.direct.gov.uk/en/MoneyTaxAndBenefits/PensionsAndRetirement/StatePension/DG_10014671
[8] See section 1.4.2 for details.
[9] See http://www.dwp.gov.uk/lifeevent/penret/penreform/guidepensionsact04.pdf for more details on the Pensions Act 2004.

2046.[10,11] This White Paper is to become a Bill and is currently going through Parliament.

1.3.2: Changes to the UK pension system 1991-2002

So the current pension system is outlined as above and is indeed going to be changing further in the not too distant future, but what changes occurred in the time frame that this thesis will be looking at, that is 1991-2002? In 1991 there was the basic state pension, which was the first tier of the UK pension system. The second tier consisted of the State-earnings related pension scheme (SERPS), employer's occupational pension schemes and personal pension schemes, while the third tier was voluntary saving by the individual. Any individual was automatically put in SERPS unless they opted out into an occupational or personal pension scheme. The Pensions Act 1995 set up the Occupational Pensions Regulatory Authority and required all occupational pension schemes to have a minimum funding requirement. The Act also increased the state pension age of women to 65, with the change from 60 beginning in 2010. The main changes to affect individuals in the economy though came in the Welfare Reform and Pensions Act 1999 after the advent of a new labour-led government in 1997. This created a minimum income guarantee for pensioners and also introduced the state second pension in place of SERPS.

1.4: Other factors affecting older workers

This section of the chapter looks at the other areas of government policy which are affecting the labour supply and retirement decisions of older workers. Firstly attention is turned to the increase in the state pension age and the discussions of this rising even

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[10] See section 1.4.1 again for more details.
[11] See http://www.dwp.gov.uk/pensionsreform/pdfs/white_paper_complete.pdf for the full version of the White Paper.

further, before outlining the removal of age discrimination in the workplace across the EU. The section finishes by looking at the introduction of the New Deal 50 plus by the current Labour government is discussed.

1.4.1: Increasing the state pension age

The current state pension age in the UK for men is 65 and for women it is 60. However, because of EC policy directive 79/7/EEC which deals with the equal treatment between men and women, the 1995 Pensions Act made for the state pension age of men and women to equalise at 65 years of age from 6th April 2020. The increase in the state pension age from 60 to 65 begins in 2010, and means that those born between 6th April 1950 and the 5th April 1955 will be entitled to their state pension between the ages of 60 and 65. So what we should see in the future is an increase in the employment of older women. However, that may not be the end to the increases in the state pension age. The Pensions Commission's two reports for the government also recommended further increases in the state pension age in the future.[12] (Pensions Commission, 2004 & 2005) From this the government's 2006 White Paper on pensions put forward that state pension age should rise in line with increases in the average life expectancy and so for both men and women it should rise to 66 over a two year period starting from 2024, to 67 from 2034-2036 and to 68 from 2044-2046. (Department for Work and Pensions, 2006) The Pensions Bill that came from this White Paper was included in the Queen's speech to the House of Commons on 15th November 2006 and has gone through two readings in Parliament and is now going through the Lords.[13]

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[12] See www.pensionscommission.org.uk/publications/2004/annrep/fullreport.pdf and www.pensionscommission.org.uk/publications/2005/annrep/main-report.pdf for the full reports. (Pensions Commission, 2004 & 2005)
[13] The current version of the Bill itself can be found at http://www.publications.parliament.uk/pa/cm200607/cmbills/012/2007012.pdf

1.4.2: Pension deferral

Another way in which the government is encouraging increased employment of older individuals is through creating incentives to continue in work that will see your pension actually increase in value. This was in part to make the decision about when to retire more flexible. The government has introduced increased weekly pension payments or a lump sum payment if you put off receiving your pension and continue working, which was available from 6th April 2005.[14] (The Pension Service, 2006) So for every 5 weeks you defer your state pension your state pension will go up by 1%, while you can claim a lump sum if you defer your state pension for at least 12 months. The pension advisory service provides a clear example of how this deferral might work: if you were to defer your state pension of £105 per week for 5 years then if you chose to start receiving your state pension you would receive £159.60 per week, while if you wanted a lump sum payment you would receive around £32,000 before tax.[15,16] It is also possible for those who are already claiming their pension to take up this option, although a deferral can only be taken once. So not only is it an incentive for those approaching retirement to continue in work it also means that there is an incentive for those who are already retired to consider returning to work, at least in some form, if they wish to take up the deferral scheme and do not want to lose any of their current lifestyle if it cannot be funded by other means.

1.4.3: Removing Ageism

EU policy directive 2000/78/EC required the removal of all forms of discrimination from the workplace by 1st December 2006.[17] The directive states that:

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[14] See http://www.thepensionservice.gov.uk/pdf/spd/spd1apr06.pdf for a complete explanation of state pension deferral. (The Pension Service, 2006)
[15] This is assuming a base interest rate of 4.5% on top of which the government pays an extra 2% giving an interest rate of 6.5%.
[16] See http://www.pensionsadvisoryservice.org.uk/state_pensions/deferral/ for more details
[17] See http://europa.eu.int/comm/employment_social/news/2001/jul/directive78ec_en.pdf for the full directive from the European Union. (The European Union, 2000)

"Discrimination based on religion or belief, disability, age or sexual orientation may undermine the objectives of the EC treaty, in particular the attainment of a high level of employment and social protection, raising the standard of living and the quality of life, economic and social cohesion and solidarity, and the free movement of persons."

and it goes on to state that:

"To this end, any direct or indirect discrimination based on......age....as regards the areas covered by this directive should be prohibited throughout the Community."

The UK government introduced new laws that came into force on 1st October 2006. The Employment Equality (Age) Regulations 2006 prevent any discrimination in the workplace on the basis of age.[18] The new law prevents any difference in treatment on the grounds of age in the workplace, but it does not prevent employers from having a retirement age. The regulations set a default retirement age of 65 however employers could have a retirement age below the default age so long as they could justify it. On the other hand the regulations also stated that employers must consider any request by an employee to work beyond the retirement age.[19] The only reason an employer could treat job applicants or workers in consideration of a promotion or transfer based on age would be if a trait relating to age is a genuine occupational requirement. (DTI, 2006)

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[18] Also see http://www.opsi.gov.uk/si/si2006/20061031.htm for an online text version of the Employment Equality (Age) Regulations 2006.
[19] See http://www.age2006.org/index.php?option=com_content&task=blogcategory&id=69&Itemid=40 and the links therein for an overview of what the new regulations mean.

1.4.4: New Deal 50 Plus

The current government has also introduced the New Deal 50 Plus, which began with pilot schemes in 9 Pathfinder areas in October 1999 and then went nationwide in April 2000. It is aimed at those people who are over 50, who have been out of work for over 6 months and who want to go back into employment. By joining the New Deal 50 plus an individual is: allocated a personal adviser who gives the individual personal help in their job search; able to gain working tax credits dependent on their income; able to apply for a training grant which is available to them once they are in work.[20]

How effective has the New Deal 50 plus been? Grierson (2002) provides a review of the New Deal 50 plus and looks at retention rates of those who got back into work through the New Deal 50 plus. Grierson highlights that between October 1999 and Junes 2002 over 75,000 people had taken the employment credit available to them through the New Deal 50 plus, with more than 95% of those being aged between 50 and 59 at the start of their claim. The author's analysis showed that 77% of those who had completed their employment credit at least 12 months ago had not returned to any type of benefit such as job seekers allowance and incapacity benefit.

1.4.5: What this means for older workers

What all of the above indicate is that there will be more and more older people in employment in the coming years. This may be because they need to continue working to increase their retirement income or because they choose to do so for some reason of enjoyment. The increase in the state pension age means that older women will have to work more, and it may be that in the future that the state pension age will increase again leading both men and women working longer. A state pension deferral encourages those in work to continue working past state pension age and those who are already retired to

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[20] See http://www.jobcentreplus.gov.uk/jcp/Customers/New_Deal/New_Deal_50_plus/ and http://www.agepositive.gov.uk/newdeal/index.asp and the links therein for more information on the New Deal 50 plus.

consider returning to work. The removal of all forms of discrimination including on the grounds of age means that older people should now be on an equal footing when it comes to getting a job or keeping a job and it will all come down to ability rather than anything else. The New Deal 50 plus means that older people who are unemployed and who are finding it difficult to get back into employment should have an increased chance of getting work. This also means that there should be an increase in the numbers of older workers.

1.5: The British Household Panel Survey

The British Household Panel Survey (BHPS) is used throughout this thesis in all the descriptive and multivariate analysis that follows. The BHPS is a nationally representative survey of randomly selected households.[21] The first wave of the BHPS was conducted from September 1991 to January 1992 and each future wave has been collected annually thereafter. More than 5000 households formed the representative sample, giving nearly 10000 individual survey responses in the first wave.

Sample members are re-interviewed year after year, and any changes to the household's surveyed change the sample. For example if any householder leaves their original household and moves into a new household, then this new household becomes part of the BHPS and any other individuals living in this household are also then interviewed. Children from sample households also join the BHPS once they reach 16 years of age.[22,23]

Additional sub-samples to the BHPS were included from waves 7 and 9 respectively. From wave 7 the BHPS included a sub-sample of the United Kingdom European

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[21] The BHPS is nationally representative of Great Britain excluding those living above the Caledonian canal in Scotland.
[22] See Taylor (2001) for more details, including the type of BHPS member that an individual can be.
[23] In addition, from wave 4 there is a survey of all children aged 11-15 in sample households.

Community Household Panel (UKECHP), which included all those households who were still responding in Northern Ireland. The UKECHP sub-sample was discontinued after wave 11, and so is excluded from all the analysis in this thesis. In wave 9 booster samples for Wales and Scotland were incorporated into the BHPS. Again these additional interviewees are excluded from all analysis to maintain the representative nature of the data.[24]

Surveys are completed either in person, by telephone (when all other attempts at face-to-face interviews have failed), and by proxy (mainly for those unable to be interviewed for themselves). The latter two survey methods are not adequate enough for the requirements of this study since they contain only a fraction of the information that the full interview has and are thus omitted throughout this thesis. Finally, also removed from the starting datasets in this thesis are any individuals that were under the age of 16 in the year of the interview. This gives a starting dataset of over 16,000 individuals and nearly 110,000 interviews for all the analyses in this thesis.

1.6: Thesis overview

To examine and discuss the aims of this thesis the next six chapters will present the issues of labour supply and retirement, with two theoretical chapters reviewing the existing economic literature on both retirement and labour supply, while four empirical chapters will look at the labour supply of older workers, the retirement process for older workers, the effects of retirement and the movement out of retirement and back into work respectively. The following chapters are now outlined in more detail.

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[24] Also excluded from all analysis are the Northern Ireland Household Panel Survey (NIHPS), and the relatively small number of respondents from Northern Ireland. Therefore the dataset used throughout this thesis is only representative of Great Britain.

- **Chapter 2: The Theory and Empirical Evidence of Labour Supply**

Chapter 2 reviews the literature of the labour supply of the older worker, again concentrating on evidence for Great Britain but still including some relevant findings from abroad. Firstly the basic life-cycle labour supply is outlined for the case of the older worker, which is then followed by the two key theoretical models of labour supply, the individual labour supply, here the model including endogenous wages developed by Shaw (1989) is outlined, followed by the joint utility or household model of retirement using the model originally formulated by Ashenfelter and Heckman (1974). An empirical overview follows examining the extent of literature on the labour supply of the older worker. The review goes on to outline how there has been little recent work on the labour force participation of older workers, nor on their wage and income elasticity of work hours. The chapter concludes with a motivation for estimating the labour supply of older workers and examining the movement back into employment from retirement, which follow in chapters 4 and 6 respectively.

- **Chapter 3: The Theory and Empirical Evidence of Retirement.**

This third chapter will concentrate on the theory of retirement, firstly developing three theoretical models of retirement, the life cycle model of retirement, the option value model of retirement and the theory of mandatory retirement respectively. The Key papers in this area that are addressed include Lazear (1979) and Stock and Wise (1990). For each model literature which has used these models in their work are discussed. The chapter brings the three separate models together and examines the conclusions that can be drawn from them before turning attention to some questions that the models pose.

The chapter then focuses on retirement literature for the UK discussing papers including Zabalza, Pissarides and Barton (1980), Meghir and Whitehouse (1997) and Bardasi,

Jenkins and Rigg (2002). The chapter highlights the drawbacks that the current literature has in terms of the questions posed and thus motivates the analysis of examining what occurs to both income and happiness in retirement. Before a conclusion the chapter also analyses other issues in retirement including spousal influence on retirement, the retirement process itself, partial or bridge retirement, the return to work after retirement, and the retirement consumption puzzle. By highlighting that there are some retirees who do return to work, the chapter motivates the empirical analysis of what affects an individual to leave retirement and return to work.

- **Chapter 4: The Labour Supply of Older Workers.**

This chapter analyses the determinants of both the labour force participation and the labour supply of workers aged 50 to 70 using data from the BHPS. The chapter also looks at their wage elasticity and other household income elasticity of job hours, and compares these to the respective elasticities of younger workers (aged 24-49). Whereas chapter 2 of this thesis provides a review of past empirical literature on labour supply as a whole, this chapter continues with an overview of empirical work that focuses on the labour supply of older workers. Random effects probit models of labour force participation are estimated for older men and older women separately. Results of this suggest that for older men and women health, having a spouse who is retired, wages, other household income and previous employment status all play an important role in determining their labour force participation.

The chapter goes on to estimate labour supply regressions for older and younger workers controlling for possible censoring of the observed hours of work of individuals that would occur at zero hours of work. A random effects tobit model is estimated and these results show that older male workers are significantly less responsive to wage changes on working hours than their younger counterparts, while the same is true for

older and younger women. The chapter also provides evidence that older workers are also significantly less responsive to changes in other household income.

- **Chapter 5: The movement into retirement of older workers**

Using the BHPS this chapter looks descriptively at the economic activity of the older worker and their movement into retirement. The chapter aims to look at whether the movement into retirement is a gradual process or whether it is a very sudden end to working life. First individuals are pooled into wave cohorts to examine whether there are any differences in the movement out of economic activity over time. The same cohorts are then split by gender to examine any differences between men and women in their movement out of economic activity over time and any differences within gender wave cohorts. The chapter then goes on to further analyse the movement out of the work force for individuals using different aged individuals within the same waves. Again the same age cohorts are then split by gender. Finally the chapter presents evidence of the number of working hours that are worked by older men and women respectively and also of the proportion individuals working part time in the years prior to retirement.

Overall the analysis suggests that for older workers as a whole the movement into retirement is a gradual process. However, the analysis does suggest that for the majority of individuals the retirement process will certainly be a sudden end to their working life, although for a large minority of individuals there is some indication that there is a reduction in working hours as they near their own retirement.

- **Chapter 6: The Effects of Retirement: A Descriptive and Multivariate Analysis.**

Using the BHPS this chapter of the thesis will analyse and discuss the effects retirement has on the income and happiness of older people. The chapter will look at the effects

through time, studying whether there is a trend in the impacts of retirement, and also look at the impact of retirement on different groups, including low and high income, and men and women. The panel nature of the BHPS allows for waves to be pooled into three groups, and then the impact of retirement analysed for both *within* pooled groups and *between* pooled groups.

Following this the chapter continues with a multivariate analysis of the impact of retirement on the happiness of retirees. The chapter estimates a regression of the change in wellbeing upon retirement using two different measures of happiness, a derived general happiness variable and a life satisfaction variable. The results for the life satisfaction variable show that late retirees are unhappier than those who retire at state pension age and the greater your pre-retirement wage the happier you are as you retire. These results are discussed, extensions to the work are examined and conclusions drawn as to the effects of retirement.

- **Chapter 7: An Empirical Analysis of What Makes Retirees Return to Work**

The final chapter of this thesis moves on to look at those who are already retired and to examine what the factors are that determine whether an individual who is retired will move back into work or not. Evidence is presented highlighting the lack of quantitative analysis on this area for the UK. Episode files of individual work life's from the BHPS, waves 1-8, are used to generate a sample of spells of retirement some of which end by moving back into employment. Descriptive statistics show that the vast majority of retirees who return to work go into part time employment. Instead of estimating a duration model with this data, the chapter uses logistic regressions of the spell month at risk of exit as described by Jenkins (1995). Results of this estimation suggest that health and income amongst other variables are important determinants of the return to work

from retirement. Further areas of research that could further this work are discussed in the conclusion to the chapter.

The Theory and Empirical Evidence of Labour Supply

2.1: Introduction

Before an older individual retires from the labour force they will have to be in the labour force and supplying their labour. Therefore any discussion on retirement must also focus at some stage on the labour supply of older workers, with focus on the labour supply of the older population in the UK. This chapter of the thesis intends to outline labour supply through economic theory and analytical models of how to measure labour supply. In 1994 over 13% of 60-74 year olds were in some form of employment, according to both the family expenditure survey and the British Retirement Survey. In the latter survey's 1994 wave, 23.6% of men and 25.8% of women considered themselves to be retired while they were still in employment. (Tanner, 1997) The issues of retirement and labour supply are interlinked, and to understand one we must be able to understand the other.

Therefore the first aim of this chapter is to highlight how the retirement decision can be analysed using models of labour supply, and in doing so focus on how the findings of the chapter that follows on the process of retirement can be formalised in economic models.

The second aim of the chapter is to discuss two different ways of measuring labour supply. Labour supply in economic models is usually seen as an individual decision. Individuals decide how much they should work given their preferences for leisure and the wage they will receive. However, labour supply could also be seen from the household level. Individuals who live in a household with their children and spouse will not make their labour supply decisions based on what is best for them, they will instead make their decision to supply labour based on their own preferences and also the needs of their family. If their spouse is also economically active, then their labour supply

decision may be a joint one, based on their circumstances. For example a couple with two grown up children still living at home may be able to supply more labour than a couple who have two young children, *ceteris paribus*. Also a couple who have a higher combined wage rate than another couple are more likely to supply more labour, *ceteris paribus*.[25] These two measures of labour supply could lead to completely different implications for modelling labour supply.

The third aim of this chapter is to discuss and motivate one of the main aims of this thesis, namely to estimate the labour supply of older workers. If policy makers are to know what affects the retirement decisions of older workers it must be possible for them to be able to know about the labour supply of older workers. With this there must also be some comparison between older and younger workers: do older workers respond in a different way to changes in wages or other income than their younger counterparts? Also are there any differences between the two genders? So not only is it necessary to examine the labour supply of older workers it is also necessary to estimate their wage elasticity of labour hours and their other income elasticity of labour hours so as to be able to quantify how changes in wages or their wealth will affect their supply of labour.

This chapter proceeds as follows. The following section provides a diagrammatical evaluation of the neo-classical economic theory of labour supply in the mould of the work first proposed by Jevons, highlighting the issues of supplying labour as you grow older, and the decision of whether to retire or not. The third section highlights two models of labour supply: firstly the model of individual labour supply developed by Shaw (1989) and secondly the model of household labour supply developed by Ashenfelter and Heckman (1974). This in itself brings into discussion the issue of how to measure the labour supply of the older worker, at the individual or household level? The main conclusion of this section is that when estimating the labour supply of older

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[25] There are income and substitution effects of a wage rise, and if the income effect is strong enough then labour supply may actually be reduced. This is the backward bending labour supply curve. See for example Sapsford and Tzannatos (1993).

workers, restrictions in the model should be available to test whether individual or household models of labour supply are more suited to older workers.

The fourth section then overviews empirical work of labour supply in two areas, work concentrating on the UK, and work concentrating on the labour supply of the elderly. The section highlights that the vast majority of empirical evidence in the UK is based on individual models of labour supply but is based largely on older data. Therefore the section continues by outlining and motivating the estimation of the labour supply of older workers in the UK using more current data. The section also outlines how examining an older workers wage elasticity and income elasticity of labour hours may also be of use to policy makers. Section 5 concludes.

2.2: Economic theory of labour supply

Most people in the modern world will work at one stage or another. The decision to work is simple for most since for many not working would mean living at a level that is below what they would prefer. This is how economic theory looks at the supply of labour. It does not look at a typical individual, but instead studies the rational, utility maximising economic agent. Each individual is assumed to want to maximise their utility, which is some level of happiness or satisfaction. To do this, an individual will most likely have to work to earn enough money in wages so that they can consume goods through expenditure of their wages.[26]

In some cases it will be the case that some individuals will maximise their utility on the consumption of preferred goods without having to work because their unearned income is large enough that they do not need to work. This is likely to be the case with the older worker, who at some stage in their life will decide that, through savings, they have

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[26] Labour supply as a utility maximising decision was first proposed by, and is still based on, the work of Jevons (1871). See also Young (1912).

enough unearned income to warrant retiring from the workforce, withdrawing their labour supply completely. However, for some it is also likely that retirement may need to be supported through working a part time or less strenuous job than before, since some workers may not have saved up enough of their previous earnings to achieve their utility maximising set of preferences. In the chapter that follows, evidence from empirical papers will highlight that the movement into retirement is an area of great debate, and the movement of workers from full-time jobs to part-time jobs before retirement is a very real phenomenon. To understand all this in more detail, let us begin with the basic utility maximising economic theory of labour supply as applied to the retirement decision of an individual. Most graduate labour textbooks will highlight the case of how unemployment benefit will affect the labour supply decision of the individual, and this can easily be transferred to the decision between retiring and working.[27]

An individual must choose what amount of their time they will use for paid work, and what amount of time to use on leisure activities, that is all other non-work activities all bundled together. The individual chooses the levels of work and leisure to maximise their utility subject to a budget constraint, that is the amount of income they have, be it earned or unearned income. It is assumed that work is associated with disutility that is offset by the wages that the individual receives, while the consumption of goods and services by the individual accrues some level of utility.[28]

The individual must decide how long to work for, and in so doing how much pay they will receive to spend on goods and services in their leisure time. The decision of how long to work and how much leisure time to have are determined jointly by the individual.

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[27] See for example Sapsford and Tzannatos (1993). For a model of the labour supply/retirement decision for the older worker also see Mitchell and Fields (1984).

[28] However, one must be careful at this stage. It is likely that some individuals will gain some utility from their work, since they may enjoy it, and some leisure time will probably be associated with activities that lead to the derivation of utility, but at the time the activities may derive some level of disutility. A good example would be the time spent on housework. Cleaning the house is seen as a chore, but the individual will probably derive utility from a clean house.

The opportunity cost of leisure time is simply the wages that the individual could have received if they had been working instead.

Now consider an older worker. They have been in the work force for many years and are now beginning to contemplate retirement. Their decision is based on their preferences between leisure and income. Given that their labour supply and retirement decision are interlinked, how can the labour supply decision be modelled to highlight the decision process that the older worker must make? Figures 2.1a-c highlight the case of three different individuals who all have the same level of non-wage and wage income, but have different preferences for work and leisure which are reflected in their different sloping indifference curves due to their differing marginal rates of substitution between work and leisure. All three also have the opportunity to retire and take a corner solution income of Z per day and do no work.

Figure 2.1a highlights the situation where an older individual decides to stay in work rather than retire. The individual's hours of leisure per day go left to right from the origin on the X-axis, and so conversely their hours of paid work per day go from $L2$ right to left. The individual must decide whether to retire now or to stay in work given their preferences for work and leisure, and given the level of wages and potential pension income they could earn. The individual in figure 2.1a is indifferent between working $L2$-$L1$ hours per day and earning a total income of $Y1$ (a wage income of $Y1 - Y0$) or retiring, doing no work and taking an income of $Z0$ per day. However, if the individual were in fact to have a total retirement income of $Z1$ per day then they would retire since they would gain a greater utility from retiring (because they move onto a higher indifference curve). Figure 2.2b highlights the individual who decides to retire. Here the individual will have a higher utility if they retire and earn $Z0$ per day rather than work for $L2$-$L3$ hours per day and earn a total income of $Y3$ per day.

Figure 2.1a: The labour supply decision of an older worker. Remaining in Full-time employment
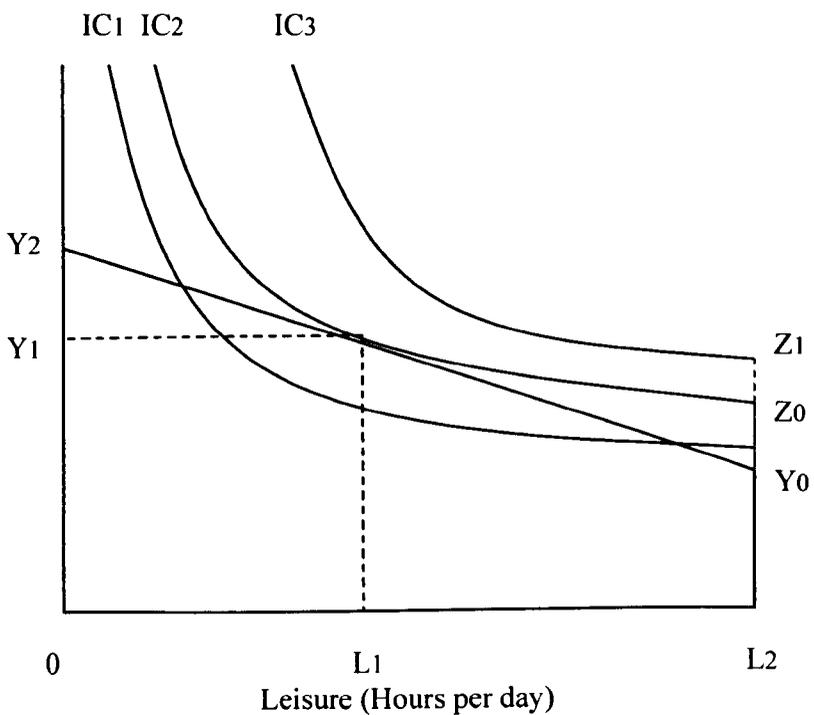
Figure 2.1b: The labour supply decision of an older worker. Retirement
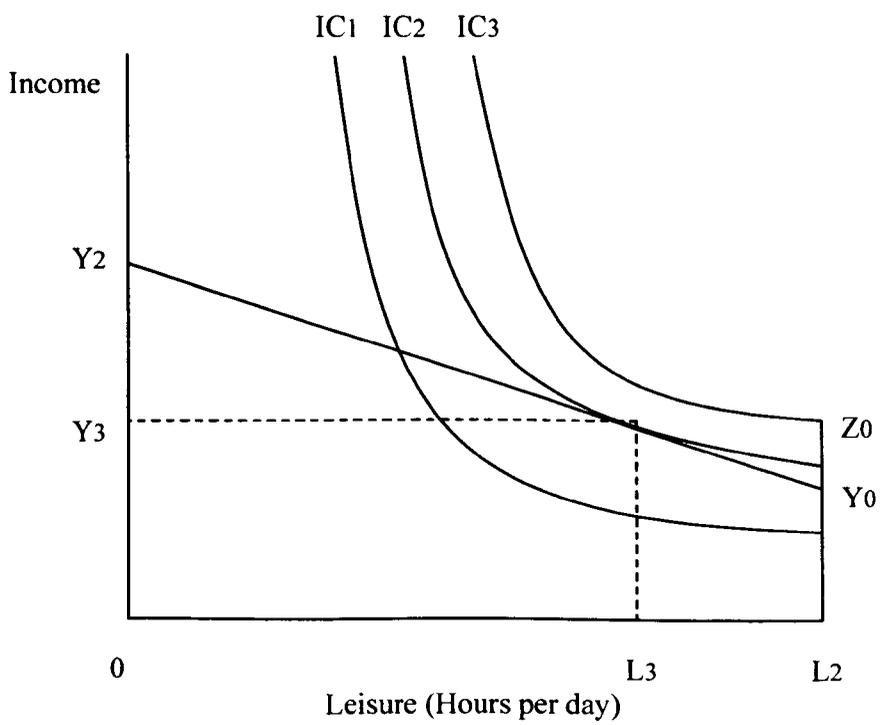
Figure 2.1c: The labour supply decision of an older worker. Part-time employment
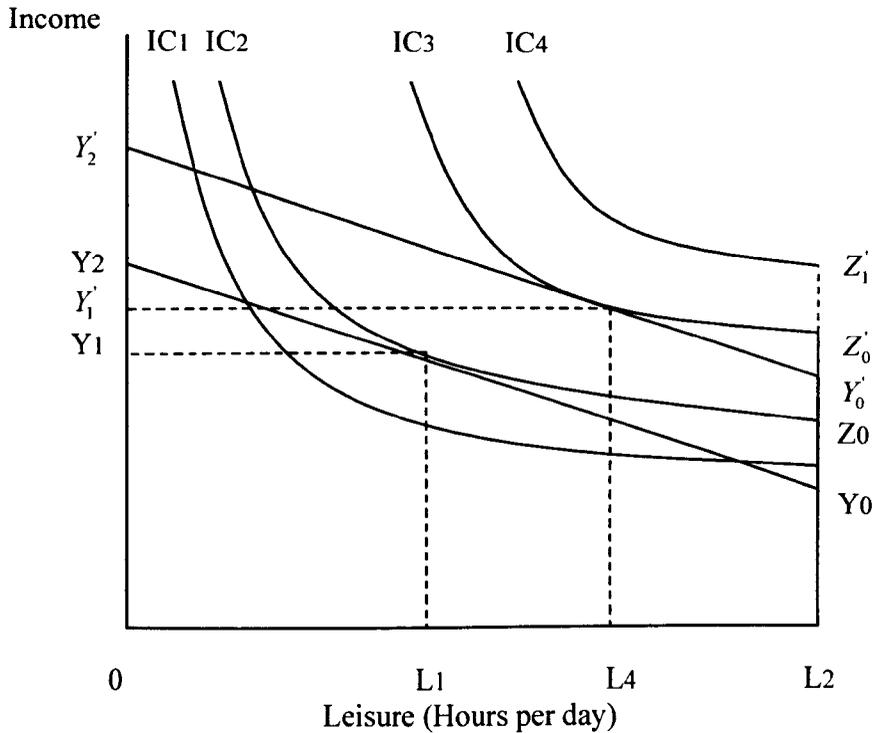
Source: All three figures adapted from Figure 2.10 in Sapsford and Tzannatos (1993) P40

In chapter 3 of this thesis evidence from empirical studies on retirement will highlight that many individuals will reduce their hours of work before they move into retirement, be it by reducing hours of work at their current employment, or moving into a new job. Such a situation is highlighted in figure 2.1c. Here at first the individual is indifferent to staying at work for L2-L1 hours per day and earning Y1 per day or earn Z0 per day in retirement. However, if the worker had a higher non-earned income per day of Y_0' per day and a higher potential retirement income of Z_0', then, given these new levels of potential and non-earned income, the individual would be indifferent to retiring or reducing their hours of work per day to L2-L4 hours per day. If however, their potential income from retiring were Z_1' per day then the individual would prefer to retire.

This section of the chapter has highlighted that the retirement decision of older workers can be modelled using models of labour supply. Labour supply modelling was used to

highlight the gradual and sudden approach to retirement, each of which has been highlighted in past empirical papers in the UK which will be discussed in chapter 3 of this thesis. The models highlighted that individual decisions on work and retirement are dependent on their preferences for work and leisure. The next section of the chapter turns its attention to econometric modelling of labour supply, focussing on both the individual and household labour supply decision.

2.3: Modelling labour supply

How can labour supply be modelled so that it can then be estimated using econometric techniques? There are two possible measures of labour supply. The first is individual labour supply. Section 2.2 highlighted a simple neo-classical view of the labour supply and retirement decision for an older individual. In this section the focus turns to analysing the model developed by Shaw (1989) which is a model of individual labour supply that allows for wages to be endogenous in that on-the-job training can cause wage rises.

The second model of the labour supply that is analysed is the joint utility model of labour supply outlined by Ashenfelter and Heckman (1974). This is a model of household labour supply, in that it is assumed that individuals within a household set their labour supply so as to maximise a household utility rather than their own personal utility.

Which model is correct? Should economists model labour supply at the individual or the household level? As will be seen in the following discussion of both models, there are pros and cons to both. On the one hand it is important to capture the individual aspects of labour supply, because it is after all an individual that will supply their own labour, but on the other hand it is important to know how the household decisions affect the labour supply of those that live within the household. An empirical paper by Lundberg (1988) is

then discussed in which the model used allows for simple significance testing of which type of labour supply modelling is correct for different types of workers.

2.3.1: Individual labour supply with endogenous wages

The model of labour supply outlined is that presented by Shaw (1989). There are many other models of labour supply that could be outlined, but in the model of Shaw endogenous wages are allowed to affect utility because the model allows for the possibility of an individual improving their future wage earnings profile by working today.[29] In the previous section we outlined a simple model of labour supply with no endogeneity in the wage of the individual, as this would alter their potential earnings in the future. Shaw begins with the following maximisation problem for each individual:

$$Maximise \qquad E_t \sum_{\tau=t}^{T} \beta^\tau U\left(C_\tau, L_\tau\right) \qquad\qquad (2.1)$$

That is the individual must maximise their utility in time t, given all the information available at time t, Ω. The individual's utility is dependent on both their consumption, C, and their leisure, L, which implies that utility is also dependent on work, since leisure is taken as the time in a day when an individual is not at work. β is a discount factor and is equal to:

$$\beta = \frac{1}{1+\rho} \qquad\qquad (2.2)$$

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[29] Other models of individual labour supply that have been developed are those of Hotz, Kydland and Sedlacek (1988), MaCurdy (1981), and Heckman and MaCurdy (1980). All these papers differ slightly in their approach, and the model developed in Shaw is presented because of the allowance for endogeneity in wages.

Where ρ is the rate of time preference for the individual. It is assumed that the function $U(\cdot)$ is concave and twice differentiable, and is increasing in both consumption and leisure. The individual maximises this function subject to a wealth constraint:

$$A_{t+1} = (1 + r_t)(A_t + W_t h_t - C_t) \qquad (2.3)$$

where A_{t+1} is wealth in period t+1, and this is dependent on the current market interest rate, r_t, current wealth, A_t, current earnings, which is the number of hours worked in the current period, h_t, multiplied by the current *real* wage rate, W_t, minus the current consumption, C_t. For simplicity current consumption is taken as the numeraire. It is also assumed that there are no bequests, that is:

$$A_{T+1} = 0 \qquad (2.4)$$

It is assumed in the model that wages are determined endogenously. Firstly a determination of wages is required:

$$W_t = R_t K_t \qquad (2.5)$$

Where K_t is the human capital stock of an individual in the current time period, and R_t is the rental rate for a unit of human capital. It is assumed that a worker can improve their future wage by working today. That is, by working, an individual improves their human

capital stock in a learning-by-doing process. This means that the human capital stock of an individual will look like:

$$K_{t+1} = (1 - \delta) K_t + g(h_t, K_t) \qquad (2.6)$$

The human capital stock of an individual in time t+1 is equal to the human capital stock in time t less depreciation, δ, plus the function g which is a human capital production function which is dependent on the number of hours an individual puts into market work and the current stock of capital of the individual.[30] The function g is assumed to be concave, twice differentiable and increasing in both h_t and K_t. One can now insert the human capital production function into the wage equation, 2.5:

$$W_{t+1} = R_{t+1} K_{t+1} \qquad (2.7)$$

The distinction here between depreciation and investment in human capital can only be seen here through a simple functional form. Instead Shaw assumes that the human capital production function takes a more general form:

$$K_{t+1} = f(h_t, K_t) \qquad (2.8)$$

Substituting this into equation 2.7 and also substituting in the value of K_t from equation 2.5 gives:

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[30] For this model the easiest way to model endogenous wages is to highlight that the more hours you work and the greater your initial human capital levels the greater the effect will be on their future human capital.

$$\frac{W_{t+1}}{R_{t+1}} = f\left(h_t, \frac{W_t}{R_t}\right)$$ (2.9)

To estimate labour supply, Shaw has to assume that there is no difference between the actual wage rate and the observed wage rate, which will arise since the development of human capital occurs as a by-product of the number of hours that an individual works. Shaw's model allows for the year to year variation in the Rental rate of capital, R_t. The importance of this is highlighted in equation 2.7 since if you were to simply regress wages or the logarithm of wages on a set of individual and work characteristics, your fixed parameter results would only reflect the rental price for a given year, and would not reflect any changes in the rental price from year to year.

The individual in time t must attempt to maximise the value function:

$$V^t(A_t, W_t, R_t) = \max_{h_t, c_t} \{ \ U(L - h_t, C_t) + \mathbb{Z}$$
$$\beta E_t V^{t+1}[(1 + r_t)(A_t + W_t h_t - C_t), R_{t+1} f(h_t, W_t / R_t), R_{t+1}] \ \}$$ (2.10)

Here L is replaced by $L - h_t$, with L in this case being the maximum potential hours of work. The decision variables in this maximisation problem are h_t and C_t. V^t is the maximum lifetime utility that the individual can get if they optimally allocate their choices of consumption and hours of work for the time periods t = 1,.....,T. V^t is a function of the stock of wealth, A_t, the current hourly wage rate, W_t, and the rental value of human capital, R_t. E_t is the expectation operator given the current information set, Ω_t, and r_t is the current interest rate. To maximise this function, we must solve the

first order conditions, which are dependent on the choice variables, consumption and leisure:

$$E_t\left[-U_{1,t} + \beta(1+r_t)W_tV_A^{t+1} + \beta R_{t+1}f_{1,t}V_W^{t+1}\right] = 0 \qquad (2.11)$$

and

$$E_t\left[-U_{2,t} + \beta(1+r_t)V_A^{t+1}\right] = 0 \qquad (2.12)$$

Equation 2.11 is the first order condition for maximising equation 2.10 with respect to hours worked, and equation 2.12 is the first order condition for maximising equation 2.10 with respect to consumption. Following Shaw (1989), the above equations have included the following abbreviations:

$$U_{1,t} \equiv \partial U(L - h_t, C_t)/\partial h_t$$
$$U_{2,t} \equiv \partial U(L - h_t, C_t)/\partial C_t$$
$$f_{1,t} \equiv \partial f(h_t, K_t)/\partial h_t$$
$$V_A^{t+1} \equiv \partial V^{t+1}/\partial A_{t+1}$$
$$V_W^{t+1} \equiv \partial V^{t+1}/\partial W_{t+1}$$

The $U_{i,t}$'s , for i = 1,2, in equations 2.11 and 2.12 are negative since they represent the loss in current utility from increasing the number of hours worked, for i = 1, and the loss in current utility that would result from increasing consumption today and thereby foregoing consumption in the future, for i = 2.

V_A^{t+1} is the individual's marginal utility of wealth at time t+1 and V_W^{t+1} is the change in the individual's utility caused by a change in their wages at time t+1. Given the information available to the individual at time t, Ω, optimally allocating their resource over time would imply that:

$$V_A^t = \beta(1+r_t)V_A^{t+1} \tag{2.13}$$

and

$$V_W^t = E_t\left[\beta(1+r_t)h_tV_A^{t+1} + \beta(R_{t+1}/R_t)f_{2,t}V_W^{t+1}\right] \tag{2.14}$$

where

$$f_{2,t} \equiv \partial f(h_t, K_t)/\partial K_t$$

Equation 2.13 highlights that the current marginal utility of wealth should equal the future marginal utility of wealth, taking into account the current interest rate and the rate of time preference. Equation 2.14 indicates that a wage change will have two effects, one on the marginal utility of wealth in the future, because a change in wage will increase future wealth, and one on the marginal utility of a wage change in the future.

It is now possible to rewrite the first order conditions. Firstly, substituting equation 2.12 into equation 2.11 and equation 2.14 gives respectively:

$$E_t\left[-U_{1,t} + W_tU_{2,t} + \beta R_{t+1}f_{1,t}V_W^{t+1}\right] = 0 \tag{2.15}$$

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and

$$V_W^t = \mathrm{E}_t \left[h_t U_{2,t} + \beta \left(R_{t+1} / R_t \right) f_{2,t} V_W^{t+1} \right]$$ (2.16)

This is the revised first order condition for leisure. In equation 2.15 the $-U_{1,t}$ represents

the loss in current utility because of an increase in work, $W_t U_{2,t}$ represents the utility

gain that will result from an increase in consumption due to increased wages, and

$\beta R_{t+1} f_{1,t} V_W^{t+1}$ represents the discounted increase in utility due to the higher level of

wages in every period.[31] If wages were not endogenous, then the final term in the

brackets of equation 2.15 would disappear, leaving the condition:

$$U_{1,t} = W_t U_{2,t}$$ (2.17)

This is the same as our analysis in the previous section, whereby the marginal rate of

substitution between consumption and leisure is equal to relative prices, and the

individual optimally allocates their resources given the information they have. This

highlights the problems of traditional estimations of labour supply that do not take into

account the possible endogeneity of wages. If the term $\beta R_{t+1} f_{1,t} V_W^{t+1}$ is large then

there will be a large bias in estimates using a traditional framework. On the job training

is likely to significantly affect this term and so its value should be different from zero.

In equation 2.16 $h_t U_{2,t}$ represents the increase in utility associated with an increase in

consumption from working more hours, and $\beta \left(R_{t+1} / R_t \right) f_{2,t} V_W^{t+1}$ represents the

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[31] Within this, $f_{1,t}$ represents the increase in capital stock and V_W^{t+1} represents the increase in utility that results from an extra unit of human capital.

discounted increase in utility due to working more in every period when the individual has extra unit of human capital.[32]

The estimation of equation 2.15 can be simplified to reduce the number of unobservables. To do this, substitute equation 2.16 into equation 2.15, using equation 2.11 to substitute in V_H^{t+2} plus equation 2.12 to substitute for V_A^{t+2}. This gives:

$$E_t\left\{ f_{2,t+1}\left[-U_{1,t+1} + W_{t+1}U_{2,t+1} \right] - \left[f_{1,t+1} / \beta f_{1,t} \right]\left[-U_{1,t} + W_t U_{2,t} \right] \right. \\ \left. - R_{t+1} f_{1,t+1} h_{t+1} U_{2,t+1} \right\} = 0 \tag{2.18}$$

Equation 2.18 can be made simpler by considering that the marginal rate of substitution in consumption over time must equal the rate of time preference plus one over the market interest rate plus one, or:

$$E_t\left[U_{2,t+1} / U_{2,t} \right] = 1 / \left[\beta(1 + r_t) \right] \tag{2.19}$$

Therefore, one can divide through equation 2.18 by $U_{2,t}$ and then substitute in equation 2.19 to get:

$$E_t\left\{ f_{2,t+1}\left(-U_{1,t+1} / U_{2,t} + W_{t+1} / \left[\beta(1 + r_t) \right] \right) \right. \\ \left. - \left[f_{1,t+1} / \beta f_{1,t} \right]\left[-U_{1,t} / U_{2,t} + W_t \right] - R_{t+1} f_{1,t+1} h_{t+1} / \left[\beta(1 + r_t) \right] \right\} = 0 \tag{2.20}$$

Equation 2.20 has expectation zero at time t, but the actual occurrences of the random variables imply that the actual value of equation 2.20 will take the value:

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[32] Here $f_{2,t}$ represents the increase in hours worked for a given level of capital stock.

$$E_t\left\{f_{2,t+1}\left(-U_{1,t+1}/U_{2,t}+W_{t+1}/[\beta(1+r_t)]\right)\right.$$
$$\left.-[f_{1,t+1}/\beta f_{1,t}][-U_{1,t}/U_{2,t}+W_t]-R_{t+1}f_{1,t+1}h_{t+1}/[\beta(1+r_t)]\right\}=u_{t+1} \qquad (2.21)$$

Here u_{t+1} is the forecast error associated with equation 2.20 at time t, which must occur because of the random nature of the variables. Given that the individual is rational, and will use all the information in time t to anticipate what will occur in future periods, it must therefore be the case that the expected value of the forecast error for any time t must be zero:

$$E_t\left\{u_{t+1}\right\}=0 \qquad (2.22)$$

The above model, equation 2.21, can then be estimated using empirical methods. This model of labour supply differs from the simple model outlined in section 2.2. The main differences are that this model is dynamic and allows for endogenous wages. In the basic labour supply model, the decision is one period, and future wages do not affect the decision. Also, as mentioned previously, any endogenous wage variation would alter the individuals potential wage income in our earlier analysis. If the individual had no time preference, and instead only wanted to maximise their current utility, then this model would simplify to the model of labour supply highlighted in section 3.2, since there would be no possible way for endogenous wages to affect the labour supply decision in one period.

Both of these models however, fail to account that the individual's labour supply decision may be affected by their families or those who they are living with. For instance this may simply be a case of having to work when your housemate works since you

cannot drive and cannot afford using any other form of transport. Or you may have to

work around the needs of your family, working around school runs and holidays. Or you

may reduce your number of hours of work because your spouse is in a job that has better

remuneration. Therefore a household model of labour supply may be of some use, and

the following sub-section moves on to highlighting a household model of labour supply.

2.3.2 The Joint Utility Model

Individual labour supply might not tell the whole story. Most individuals will live

within a household in which not just their feelings but also the feelings of their

cohabitors count when making their labour supply decision. The household labour supply

models begin with the work of two well known and important economists; Becker (1973,

1974) and Samuelson (1956). Becker's theory of marriage, parts I and II goes some way

to describing the decision making process of choosing a 'mate', and how those that care

for one another are more likely to maximise their joint utility by pairing off. In part I

Becker showed that the gain from marriage for any pair of persons was positively related

to their incomes, their relative difference in their wage rates, and to education and beauty.

In Part II Becker moves on to analyse whether those that care for one another are more

likely to marry. Since the two will care for one another, it will be the case that each

individual's utility will be affected by the well being of the other, which would be

measured through their commodity consumption. By assuming, quite realistically, that

one individual could only share their commodities with another individual if they were

married, Becker shows that individuals could become better off by marrying one another

and thus share their commodities to maximise their utilities.

Samuelson's 1956 paper on the existence of social indifference curves can easily be

transferred to a lower level, that is to the level of the household. Indeed Samuelson

himself discusses society by using the family as a clear example.[33] A family will want to maximise their joint utility subject to their budget constraint, which is affected by, amongst other things, their labour supply decision.[34,35]

The first common method of analysing household labour supply is the joint utility model (sometimes also called the neoclassical model). Joint utility models consider the maximisation of a single utility function for each household subject to the budget constraint that each household faces. Labour supply decisions of both spouses are made dependent on each other's labour supply. Ashenfelter and Heckman (1974) is a classic example of a joint utility model, and their model is now developed. The utility function that the household maximises is assumed to take the form:

$$U = U(L_m, L_f, X) \qquad (2.23)$$

Where the utility function is twice continuously differentiable. L_m and L_f are time spent in non-market activities by the male and female of the household respectively The assumption made by the authors with this is that non-market time may have many different varieties, varying from 'leisure' time to housework, but that the opportunity cost for any activity is the same, namely the wage rate, W_m or W_f, that the male or female

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[33] "What we have been calling a family is after all but a disguised version of society itself – i.e. a collection of more than one person." (Page 12) And in the context of our discussion, *vice versa*.

[34] Becker's findings also support Samuelson's work: "Since, therefore, caring does encourage…marriage, there is a justification for the economists usual assumption that even a multiperson household has a single well-ordered preference function." (Page S16)

[35] In the context of this chapter both these two works can be seen to support the joint utility models of labour supply. Samuelson's work can be seen to support the joint utility models of household labour supply, in that there is a utility function that depends only on the total amount of goods consumed by the household, so long as there can be an optimal reallocation of income within the household. Becker too, in highlighting that married couples can transfer commodities (which could be a monetary transfer) to one another within the household, also supports the joint utility model. However, while the collective labour supply models look more at the individual, they still allow for altruistic behaviour of individuals that care for one another, and are based on Becker's work of two individuals joining together to improve their own welfare.

receives respectively.[36] X is a Hicksian composite good since it is assumed that the relative prices of the goods do not change. The decision on maximising the utility function in 2.23 is made subject to the budget constraint:

$$W_m(T - L_m) + W_f(T - L_f) + Y = PX \qquad (2.24)$$

Where the new variables not already mentioned are T, which measures the fixed amount of time that each household member allocates, Y, which represents non-labour income, and P, which is the price of consumption goods. Maximisation of 2.23 subject to 2.24 is given using Lagrange, and gives the solutions:[37]

$$\frac{\partial U}{\partial L_i} = \lambda W_i \qquad (i = m, f) \qquad (2.25)$$

and

$$\frac{\partial U}{\partial X} = \lambda P \qquad (2.26)$$

λ is the Lagrange multiplier which is equal to the marginal utility of income. For given values of W_m, W_f, P and Y, there are four equations for four unknown variables, L_m, L_f, X and λ. Assuming second order conditions for a maximum are satisfied, the demand for leisure functions that result are:

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[36] As will be mentioned later in the chapter, many, for example Chiappori (1988) and Apps and Rees (1997), formulate models where non-market time is allocated between leisure and production of a home-good.
[37] For all further equations (i = m, f)

$$L_i = L_i(W_m, W_f, P, Y) \qquad (2.27)$$

The labour supply of a family member is equal to:

$$R_i \equiv T - L_i \qquad (2.28)$$

Therefore the labour supply functions which go with the demand for leisure functions are:

$$R_i = R_i(W_m, W_f, P, Y) \qquad (2.29)$$

The Slutsky decomposition gives:

$$\frac{\partial R_i}{\partial W_j} = S_{ij} + R_j \frac{\partial R_i}{\partial Y} \qquad where \quad i \neq j \qquad (2.30)$$

Here S_{ij} is the substitution effect, and the other term on the right hand side represents the income effect. Restrictions are made due to the Slutsky decomposition, the first being that own substitution effects must be positive:

$$S_{ii} > 0 \qquad (2.31)$$

So any income compensated change in any family member's wage rate results in an increase in the family member's work rate. Secondly cross-substitution effects must be equal:

$$S_{mf} = S_{fm} \qquad\qquad (2.32)$$

So an income compensated increase in the wife's wage rate has the same effect on the husband's work rate as an income compensated increase in the husband's wage rate has on the wife's work rate. The final restriction is that:

$$\begin{vmatrix} S_{mm} & S_{mf} \\ S_{fm} & S_{ff} \end{vmatrix} > 0 \qquad\qquad (2.33)$$

Presumptions are then made on the signs of the income derivatives in equation 2.30. The authors state that it would seem doubtful that non-market activity would be an inferior good and thus:

$$\frac{\partial R_i}{\partial Y} < 0 \qquad\qquad (2.34)$$

Therefore there is a negative effect on the work rate of family members due to any increases in non-labour income. Therefore because of this and equation 2.31 the uncompensated wage effect could be of either sign. The second implausibility is that consumption goods are not likely to be inferior. Therefore the sum of the wage rate

weighted income effects $\Sigma W_i \partial R_i / \partial Y$ should be greater than -1. Supposing that dP = 0 then the total differential of the labour supply function is given by:

$$dR_i = (\partial R_i / \partial W_m) dW_m + (\partial R_i / \partial W_f) dW_f + (\partial R_i / \partial Y) dY \quad (2.35)$$

Substituting equation 2.30 into equation 2.35 gives:

$$dR_i = S_{im} dW_m + S_{if} dW_f + B_i \left[R_m (dW_m) + R_f (dW_f) + dY \right] \quad (2.36)$$

Where $\partial R_i / \partial Y = B_i$ gives us an income effect on labour supply of changes in non-labour income.

To estimate this model empirically one needs to replace the infinitesimally small changes dR_i and dW_i with measurable finite changes. Using cross-section data allows one possible method where you can replace the differentials with differences from means, that is:

$$\Delta Z_k = Z_k - \overline{Z} \quad (2.37)$$

which measures the deviation of the kth observation of any variable Z from its mean. Ashenfelter and Heckman also use an approximation of the square brackets term on the right hand side of equation 2.36 taking:[38]

$$\Delta F \equiv \Delta (R_m W_m) + \Delta (R_f W_f) + \Delta Y \quad (2.38)$$

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[38] As the authors note (see their footnote 14, p77), this procedure causes a bias in parameter estimates. The authors argue that this bias would be small.

Therefore, using measurable discrete differences and using equation 2.36 above, equation (38) becomes:

$$\Delta R_{ik} = S_{im}\Delta W_{mk} + S_{if}\Delta W_{fk} + B_i\Delta F_k + \varepsilon_{ik} \qquad (2.39)$$

Where S_{ij} and B_i are the parameters for estimation. ε_{mk} and ε_{fk} will likely be correlated, and also there will be an upward bias caused by the correlation between ΔF_k and both ε_{mk} and ε_{fk}.[39] Ashenfelter and Heckman therefore use three stage least squares to estimate efficiently equation 2.39, with ΔF_k being treated as a right hand side endogenous variable.

The joint utility model of labour supply is useful in that it allows for the individual utility maximising model of labour supply to be correct. This would occur if there were no cross-effects between the male and female's wages on each others hours of work. If the female's wage was the only factor deciding their labour supply, and the same was true for the male's wage and labour supply, then the individual model of labour supply would be true.

More recently models have been proposed that move away from the joint utility modelling of household labour supply. This is because there are three main criticisms to the joint utility model of household labour supply. Firstly joint utility models are criticised for grouping individuals. This goes against basic microeconomic theory which is based on the individual.[40] Secondly joint utility models of household labour supply are criticised because they are a "black box". (Chiappori, 1992) When estimating joint utility functions, nothing is ever known about intra-household aspects of both the decision making process and reallocation of resources. Very little can also be said regarding the

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[39] See the authors footnote 16 (p77) for a more detailed explanation.
[40] Although note the discussion in footnotes 33, 34, and 35 from earlier in this chapter that show economic support for joint utility models.

decision process in getting married, or even in getting divorced. Finally, though, and probably most important of all, little can be said regarding policy issues at the individual level. In these instances, the joint utility model can be misleading since it only represents the preferences of the household and not the individual. (Chiappori, 1988, 1992)

Despite the problems raised with this form of household labour supply model, this model is sufficient enough for the purposes of this chapter to highlight how to model household labour supply.[41,42]

2.3.3: Testing for the correct model of labour supply

Which modelling of labour supply is the correct method of estimating labour supply, at the individual or at the household level? One empirical paper that gives set up which allows for testing which of the joint utility household model of labour supply and the individual labour supply models is the correct method is that of Lundberg (1988). In this paper the author estimates a simultaneous equations model of household labour supply using a sample of 381 husband and wives pairings from the Denver Income Maintenance Experiment. The author empirically estimates a model of the form:

$$H_m = \alpha_m + \delta_m w_m + \gamma_m H_f + \beta_m Y + \beta_m^* \left(w_f H_f \right) + \varepsilon_m$$

$$H_f = \alpha_f + \delta_f w_f + \gamma_f H_m + \beta_f Y + \beta_f^* \left(w_m H_m \right) + \varepsilon_f$$

(2.40)

Where the subscripts m and f represent male and female respectively. w_i and H_i represent wages and hours of work for the male or female of the household. Y is the total family non-labour income and the error terms represent a shock to tastes or errors in the

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[41] The interested reader could begin by examining the collective labour supply models of Apps and Rees (1997) and Chiappori (1988, 1992, and 1997).
[42] See Kawaguchi (1994) for a comparison of different household labour supply models.

optimisation. This formation of the model allows for each individuals labour supply to be dependent on the others within the household.

Both the joint utility and individual models of labour supply hold if certain restrictions of the above model are true. The joint utility household model of labour supply will be the correct model of labour supply for a worker if both $\beta_m^* = \beta_m$ and $\beta_f^* = \beta_f$ and if the cross-substitution effects on labour supply are equal. This is because in the joint utility model spouse's earnings only affect labour supply of the individual through adjustments in family income. The individual labour supply model will be the true model of labour supply of a worker if $\beta_m^* = \beta_f^* = \gamma_m = \gamma_f = 0$. Simple significance testing of these restrictions can be made to ascertain the true best model of labour supply of the older worker, whichever model it may be.

A major problem that Lundberg faces when addressing these equations is when using panel data in these types of models the hours worked by an individual will be autocorrelated. Lundberg removes one possible set of causes, the individual-specific effects, by first differencing the data. By looking at changes in hours worked any effects on labour supply that do not vary over time, such as individual's tastes for work and leisure, are removed. To remove any non-additive effects on hours worked, such as a lagged adjustment between actual work and desired work, the author includes lags of hours worked.

Lundberg estimates time-series estimates of quarterly data, both with and without allowing for truncation in the hours worked. The author splits her sample into three groups depending on the number of children under six in the family. Her results highlight that for those families with children under six years of age there are significant positive cross-hours effects and negative cross-earnings effects on labour supply. For those in the sample with no children under the age of six the restriction that husbands and wives make their decisions independently of one another, that is $\beta_m^* = \beta_f^* = \gamma_m = \gamma_f = 0$,

cannot be rejected. There is no effect on husband's working hours through either their wife's working hours or the increase in household income caused by the wife's increased work, and *vice versa*. The individual labour supply model cannot be rejected for those with no children under the age of six.

For those households with at least one child under six there are interactions in labour supply decisions. In numerical terms the basic dynamic results suggest that if the husband's monthly income rises by $100, the wife will reduce their labour supply by between 6 and 9 hours, depending on the number of children under six they have. Correcting for the truncation in female working hours at zero does not alter the results greatly.

This section of the chapter has highlighted the two different ways to model labour supply. The first is at the individual level, and the model of Shaw (1989) highlighted how to model individual labour supply allowing for wages to be affected by on-the-job training. The second is at the household level, and the model of Ashenfelter and Heckman (1974) was used to highlight the joint utility model of household labour supply, and how to estimate such a model empirically. The latter model allows for the former model if restrictions are made to the model, that is there are no cross-substitution effects between male and female's wages on the other's labour supply decision.

This section has also highlighted one empirical estimation of labour supply in which the author was able to apply restrictions to the model to discuss whether or not the individual or household models of labour supply are the correct model to highlight the labour supply of the workers. Lundberg (1988) highlighted that married couples labour supply decisions were affected by the presence of young children within the household, and while this thesis does not go on to examine this model future work using this model would be useful to examine older workers. The next section looks at the empirical side of labour supply, specifically concentrating on both UK papers and papers focussing on the labour supply of older workers.

2.4: Empirical overview

This section of the chapter focuses on the empirical estimation of labour supply with most attention paid to the labour supply of older workers. First studies of the labour force participation of older workers are examined, before attention is turned to UK labour supply, starting with the paper by Bingley and Walker (2001), which looks at the effects of cuts in unemployment benefits on married women's labour participation.[43] UK studies focusing on the labour supply of the older worker include Blundell and Johnson (1998), Disney and Smith (2002), and Zabalza, Pissarides and Barton (1980). Each of these three empirical papers results are discussed. Secondly this section turns to other empirical work on the labour supply of the older worker, examining empirical studies from abroad.

As will be seen once the papers have been reviewed the majority of empirical papers in the UK use model that estimate individual labour supply. Therefore the conclusion of this section of the chapter is that while estimation of a model of household labour supply with testable restrictions would be beneficial, the thesis will instead examine individual labour supply using more recent data than that which is used in the past empirical work.

2.4.1: Empirical findings on labour force participation

What do past empirical papers tell us are the important factors in labour force participation? Past empirical studies have looked both at the individual level and at the aggregate level as to how the labour force participation rates of the elderly are affected. Zabalza, Pissarides and Barton (1980) examine the labour force participation of older

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[43] While there are many other studies of UK labour supply, this overview focuses on the labour supply of the older worker. The analysis of the paper by Bingley and Walker (2001) gives a brief idea of the level of analysis into the UK labour supply. Other papers on UK labour supply include Blundell, Duncan and Meghir (1998), Disney and Webb (1991), who investigate the increase in the number of long term sick in the UK, and Blundell and Walker (1986).

men and women in Great Britain aged 55-73 and 50-73 respectively.[44] Their results highlighted that for both older men and women the probability of working was significantly increased by having a spouse that worked while was significantly reduced by poor health, being above the state pension age and from losing your main job involuntarily. The authors also found that for women being married significantly reduced the likelihood of being in the labour force.

Cai and Kalb (2005) concentrate on how an older individual's health status affects their labour force participation using data on Australian males aged 51-64. Their results indicate that health status is a key factor in determining the labour force participation of older men, with the healthier an individual is the more likely they are to be participating in the labour force. Having a degree and a spouse in the labour force also significantly increases the likelihood of a 51-64 year old male participating in the labour force, as does having a degree, while the higher their non-labour income the less likely they were to participate in the labour force.

Kapteyn and de Vos (1998) examine the labour force participation rates of the elderly in Holland and the incentives they face to retire. They highlight that the labour force participation of elderly Dutch men has been falling since 1960. For example 60-64 year old men had a participation rate of around 80% in 1960 but it was only 20% in 1994. The authors also highlight that while elderly Dutch women's participation rates have increased since 1960, they, like their male counterparts, still have low labour force participation rates. Kapteyn and de Vos estimate the social security wealth of all possible benefits that an elderly couple could receive minus the future payments they would have to make for them. The implicit tax rates that they estimate show that there is a large incentive to leave the labour force once you are entitled to early retirement or disability insurance.

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[44] Zabalza *et al.* (1980) is an important empirical paper in the context of the labour supply of older workers and their retirement decisions. There is a fuller outline of their paper in section 2.4.2, and section 3.3.2 examines the paper from a retirement stand point.

Studies that have examined older individuals labour force participation at an aggregate level include Campolieti (2001) and Clark, York and Anker (1999). Campolieti (2001) examines the effect of disability insurance on the labour force participation of elderly men by Canadian province. Her results highlight that the higher the unemployment rate in a Canadian province has a significant negative impact on the labour force participation rates of men aged 45-64.

Clark, York and Anker (1999) analyse the labour force participation rates of the elderly from an international perspective. They use labour force participation rates of older persons for 134 countries using 1990 labour force participation rates and examine how the labour force participation rates of the elderly are affected by socio and economic factors. Their results indicate that as the ratio of older (65 and above) to younger people (those aged 15 to 64) increases so the labour force participation rates of all men above the age of 59 is significantly reduced. For women the same effect is only significantly found in women aged 55-59. For elder men and women of all ages the higher the percentage of the labour force participating in agriculture the higher are their labour force participation rates.

2.4.2: UK studies

Before focussing attention on the findings on older workers labour supply in the UK attention is first turned to looking at the paper of Bingley and Walker (2001) which is used as an example of the labour supply literature as a whole for the UK.

Bingley and Walker (2001) estimate the effect of reducing the length of time of eligibility for unemployment benefits had on the labour supply of married women using data from the Family Expenditure Survey for the years 1978-1992. The authors estimate a unordered probit random utility model allowing for three possible states, full-time work, part time work and not participating, controlling for the endogeneity created by the fact that some of those who are not participating would like to be. Their results highlight

that women are deterred from both part-time and full-time work by long term unemployment for their husband. Children under the age of five significantly deters wives from entering work of any form, as does rises in the local unemployment rate, and if the family lives in rented accommodation implies that the wife is significantly more likely to prefer non-participation to full-time work.

Looking at the unemployment benefit reforms, Bingley and Walker find that wives whose husbands are medium term unemployed who then continue to be unemployed and the family income is based on income support will have an increase in non-participation of 3.5%, with a reduction in part-time work of 4.5%, compared to just being medium term unemployed. Wives with a medium term unemployed husband who finds work have a 12.5% fall in non-participation and a 9.0, 2.3 and 1.2% increase in full-time work, part-time work and involuntary unemployment respectively. Their conclusions are that the effects of the reform on married women depends on the effect that the policy has on their husbands periods of unemployment, with shorter periods of unemployment promoting married women into the labour force.

Blundell and Johnson (1998) examine the impact of disability benefits on retirement incentives for UK males. They highlight that for a 65 year old male in 1995 the net present discounted value of social security wealth of retiring at 65 is about £2,000 less than the wealth conditional on retiring at the age of 55. This small negative effect is almost offset by the increases in the individual's state second pension. If the disability benefit becomes available at age 60 however, the social security wealth falls by nearly £8,000 per year. There is a large disincentive to work. The authors also highlight that the incentives to retire early is much greater if the individual does not have an occupational pension.[45,46]

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[45] See also the discussion of Meghir and Whitehouse (1997) in Chapter 3.3.2.

[46] Also note that if we were to insert disability benefits into the analysis of section 2.2 then an individual's decisions on labour supply may be affected. If an individual could qualify for disability benefits, then this may alter their decision from continuing to work full time to retiring from work altogether (Consider figure 2.1a and the disability benefit being equal to Z_1-Z_0).

Disney and Smith (2002) examine the labour supply of older workers and how this was affected by the abolition of the earnings rule on the amount of pension an individual can receive if they continue to work. Using the Family Expenditure Survey for 1984-1994, the authors compare the change in working hours of men aged 65-69 and women aged 60-64 before and after the abolition of the earnings rule to a group of men and women who were before state pension age and so were ineligible state pensions throughout and a group of older men and women who could receive their pension without being affected by the earnings rule. Using Tobit regression Disney and Smith find that for men the abolition of the earnings rule increased labour supply significantly by 3.6 or 4.1 hours per week relative to the control groups, depending on whether just the old age or both old age and younger age control groups were used as the control respectively. For women the respective increase in labour supply was 6.3 and 5.2 hours per week, and there was also an effect on the younger workers labour supply of the removal of the earnings rule, results indicating that male younger workers increased their labour supply by 22.2 hours per week and women by just over half that amount, both relative to the older control group.

Zabalza, Pissarides and Barton (1980) examine the determinants of the retirement decision in the UK and the labour supply of older workers. They use maximum likelihood functions to maximise every individual's utility over three possible states of work, full-time work, classed as 30 hours or more work a week, part-time work, classed as less than 30 hours of work per week, and retirement, zero hours of work per week. Using a weighted sample of 1483 men and 1207 women aged 55-73 and 50-73 respectively, all of whom had a job at the age of 45, collected in early 1977 by the Office of Population Censuses and Surveys in Great Britain.

Their results suggested that for the typical male, the respective wage and income elasticities were -0.020 and -0.023, while for the typical female the same figures were

0.37 and -0.38.[47] Women were much more responsive in their labour supply and retirement decisions to wage changes and income increases than men.

When splitting men and women into sub-samples according to whether their age was before or after the statutory retirement age the authors found that men over the age of 65 were more responsive to wage changes than men under 65, while for women the reverse was true, women over the age of 60 were less responsive to wage changes than women under the age of 60. For both sexes the older group's probability of retirement was also affected to a larger extent by whether their spouse was working, indeed for women under the age of 60 if their spouse was working did not affect their probability of supplying labour significantly.

Like Disney and Smith (2002), Zabalza *et al.* examined what would happen to labour supply if the earnings rule was abolished according to their results. Their results implied that for the typical man annual hours of labour supply would increase by just over 12 hours and fall slightly each year thereafter until they would supply almost 9.5 extra hours annually at age 69.[48] The same decline in extra hours of work occurs in the typical woman's labour supply, but for them annual hours of work would increase by over 10 hours at age 60 to 6 hours at 64 years of age.

2.4.3: Non-UK studies of older workers labour supply

As well as the UK studies of older workers there are studies that examine data from different countries. Two papers are discussed below, one focussing on a developing country and the other on the employment of older workers in Russia.

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[47] The authors' typical male was a married man, aged 63, who was a homeowner, who had good or fair health, who did not have an occupational pension, had savings income of £2.50 per week, a gross income of £1.30, had a spouse who was not working, and who did not leave their main job involuntarily. The typical female was a married woman, aged 60, a homeowner with good or fair health, who did not have an occupational pension, who had no savings income per week and a gross wage of £1, who was not a waiting wife, had a spouse who did not work, and who did not leave their main job involuntarily.

[48] The typical man and woman in this part of their analysis have the same traits as in footnote 49 except that the age varies.

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Cameron and Cobb-Clark (2002) analyse the labour supply of older workers in Indonesia using the 1993 Indonesian Family Life Survey. Using a sample of 1429 individuals over the age of 60 the authors estimate labour supply functions for men and women depending on whether or not they live with their children. Their results show that increases in financial transfers from their children only reduces the hours worked significantly of elderly women who do not live with their children, and this effect is relatively small. There is no effect on labour supply of increases in other income or assets, except for women who live with their children, whose labour supply increase with an increase in other income. Age reduces labour supply, as does disability, while being previously self employed or working for a private firm 20 years earlier increases labour supply compared to those who were not in work 20 years earlier.

Kolev and Pascal (2002) examine the determinants of pensioner employment in Russia, looking at both the number of hours worked and the probability of holding a job.[49] The paper uses data for 1994-1999 from the Russian Longitudinal Monitoring Survey and estimates the probability of being employed and the number of hours worked using a random effects probit model and random effects Tobit regression respectively, with the latter used to control for the censoring of the hours worked at zero.

The authors find that university or a tertiary education outside of university significantly increases the probability of employment for both men and women relative to those with less than a secondary level education, while age of pensioners and health problems reduce the probability of employment for pensioners of either sex. For women there is a significant negative effect of working in self-subsistence farming on the probability of being employed. Income, pension and local unemployment rates have no significant impact on the probability of employment for the elderly in Russia. The results for the hours of work estimation are broadly similar, with the only notable differences being a negative impact of family income for the working hours of women, which is significant

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[49] Women aged 55 and over and men aged 60 and over are entitled to a pension in Russia.

at the 10% level, and the local unemployment rate negatively affects the working hours of men, but this effect is not quite significant at the 10% level. The results also highlight significant regional effects for women, highlighting that living in St. Petersburg or Moscow increases the likelihood of employment and the hours of work.

This section has highlighted the extent of the literature so far on labour supply in the UK and the labour supply of the older worker. As can clearly be seen, there is a strong interrelation between the labour supply of older workers and retirement, and these are one option between two choices that an older individual must make, to retire or carry on working. Therefore all the empirical literature reviewed in this current chapter and in chapter 3 that follows could easily be used in the other chapter as evidence of the retirement decision or the decision to supply labour.

This thesis will further the literature to date for the UK by examining the labour supply of individuals using more recent data. For the UK there is no evidence of empirical models of labour supply at the household level, at least to this author's knowledge. However, there is a lack of households in the BHPS with the full information required for a study of this nature. Also missing from the current literature are the effects of spouses on the labour supply of individuals. Therefore this thesis will go on to examine both the labour force participation and labour supply of older workers in the UK using data from the BHPS. Included in the estimations are the effects of having a spouse who is retired.

2.5: Aims and objectives

Given the preceding sections of this chapter what has become evident is that for the UK: there exists a lack of up to date studies on the labour supply of older workers; there is little evidence on the differences between older workers and younger workers in their labour supply; there is no evidence of spousal effects on the labour supply and retirement decision of older workers; and there is no evidence on the labour force participation of

older workers. Given these statements this thesis will go on to look at the following areas:

- Examine the labour force participation of older workers in Great Britain.

- Estimate the labour supply of older workers in Great Britain.

- Analyse the impact of spousal effects on the labour supply (and hence retirement decisions) of older workers.

- Compare the labour supply of older workers and younger workers to look for any differences between the two.

- In particular the above will be achieved by comparing the wage elasticity and other household income elasticity of working hours of men and women in different age groups.

- All of the above will be analysed using data from the 1990s and 2000s thus using more recent data and making the economic evidence on the labour supply of older workers in Great Britain more contemporary.

All the work outlined above follows in chapter 4 of this thesis. A lot of this work will on the one hand be important for bringing the economic evidence up to date for Great Britain. What will also be important is that there are likely to be policy implications that arise from the evidence found. For instance if older workers have different reactions in their labour supply to wage or other household income changes then it is possible that policy makers can change the labour supply of a certain age of workers through tax or welfare changes.

2.6: Conclusion

This chapter began with an explanation of how pensions and savings would affect labour supply and the decision of whether or not to retire using neo-classical diagrammatical analysis. Three different outcomes were outlined where, depending on an individual's preferences for leisure and income from work, an individual would continue working, retire, or reduce the level of hours that they worked. This modelling of the labour supply decision also models the retirement decision formally: once an individual is in a situation where they can gain more utility from not working than working then they will retire. This will depend on the level of income they will receive in retirement.

More formal models of labour supply were then explained, one a model of individual labour supply and one a model of household labour supply. The individual labour supply model that was analysed takes the diagrammatical analysis of a static model of labour supply a step further by allowing for the wage of an individual to increase in the future by working today. This dynamic model however also fails to take into account the likelihood that an individual's family will affect their level of labour supply. The household model of labour supply presented in this chapter allows for a household utility function to be maximised with respect to the labour supply of those in the family rather than an individual's utility function deciding their own labour supply. The joint utility household model of labour supply does allow for the individual labour supply model to be correct so long as there the wage of an individual's spouse did not affect their own hours of work. There followed a discussion of an empirical model by Lundberg (1988) which would allow for the testing of certain restrictions within the model to ascertain which of the household or individual labour supply models fitted the data better.

The chapter then moved to highlight the extent of empirical work on the labour supply of workers both in the UK and abroad. There is quite a large literature on the labour supply of the older worker for the UK. Many have focussed on the impact of changes in

the labour supply caused by changes in pensions or taxation or income. However, all these papers to this author's knowledge have looked at labour supply at the individual level, and most of the evidence is based on data from at least ten to twenty years ago. Therefore this thesis can extend the scope of the literature by examining labour supply of older workers at an individual level using more recent data, in particular examining any differences in the wage and income elasticity of labour supply between older and younger workers.

The work of this chapter has highlighted the theory of labour supply of older workers and the extent of the literature so far in this area. However, this chapter has raised issues that have not been formally investigated or have not been attempted for some time. Therefore there are certain research questions that are raised from the work of this chapter and that are then to be formally investigated in later chapters of this thesis. First, what are the determinants of the labour force participation for older workers? Second, what are the wage and income elasticities of labour supply for older workers? Third, are there any differences between older and younger workers respective wage and income elasticities of labour supply?

As has been already discussed in this conclusion much of the work in the UK is based on older data and so an investigation of more recent data will be of great benefit. Also there is very little work on the labour force participation of older workers using UK data, and it is important for policy to know the reasons behind the decision to work. In comparing younger and older workers in terms of their respective wage and income elasticities of labour supply we can examine whether there are any differences and if they are these may also be very important for policy makers. Chapter 4 of this thesis will go on to examine these research questions. Now attention in the following chapter will turn to examining the theory of retirement.

The Theory and Empirical Evidence of Retirement

3.1: Introduction

Only in the last fifty or sixty years has retirement become the norm in civilised societies. As a result retirement is an area of economics that has only been concentrated on to a fuller extent in the last twenty years or so. Many people now will spend a large proportion of their life in retirement. It is an issue that is gaining more and more attention around the world as leaders of nations discuss how to deal with ageing societies and dwindling workforces. Yet if anyone were to pick up almost any undergraduate level book and the look in the index for the word 'retirement' it is unlikely that they would find it. If textbooks do have retirement in their index then it will generally be to do with public economics and the provision of state pensions. Retirement in economics has until recently been seen as just an event that happens, and very few models to explain retirement exist.

With the advent of large longitudinal datasets, more and more empirical papers are now able to examine the retirement process. However, lots of areas are still to be explored. This chapter overviews the theory of retirement and discusses the findings of previous empirical papers, concentrating on findings of studies using UK data.

A major question that is asked in the introduction of many empirical papers is: what is retirement? In the models of retirement that are outlined in the following section, retirement is assumed to be a one-time movement from employment to leaving the labour force for good. Yet, as evidence later in this chapter highlights, more and more individuals will continue working in their retirement or will move back into employment and class themselves as not retired. The two methods of working after retiring in the

previous sentence are completely different and highlight the problems that any empirical work must face in deciding how to measure retirement.[50]

The assumption of 'complete' retirement can be dropped in each of the three models discussed in this chapter. In the life-cycle based model of retirement, individuals will maximise their utility, and so any decision on their future is valid, be it retiring for two years then returning to work, or working part time during their retirement, or carrying on working for two more years before retiring completely. The option value model of retirement assumes that individuals decide whether to retire now or to continue working to their optimal future retirement date. Again the assumption that 'retire' means complete withdrawal from the labour market could easily be relaxed in this model. Lazear's (1979) mandatory retirement model explains a way in which firms enter into a contract with employees that pays a wage over their marginal product in later life. Once the mandatory retirement age is reached the individual can either retire, negotiate a new contract with their existing employer, or move on to another job.

For this chapter the term 'retirement' is given a loose meaning, and can be interpreted as is seen fit. In proceeding chapters it is necessary to tighten the term retirement, but in terms of theoretical issues, as outlined in the last paragraph, modelling retirement is not severely affected by how the term 'retirement' is defined.

The rest of the chapter proceeds as follows. Following the introduction, the second section turns its attention to examining models of retirement. In this section three models of retirement are examined: The first model discussed is a model of retirement based on maximising utility given certain budget constraints; the second model discussed the option-value model outlined by Stock and Wise (1990); thirdly a model of mandatory retirement outlined by Lazear (1979) is explained. Following each model, empirical results from using each model are analysed and discussion will turn to whether or not retirement is a final decision in each of these models.

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[50] The issue of measuring retirement is discussed in more detail in chapter 1.2 of this thesis.

In the third section empirical findings to date for the UK are examined, focussing on two papers that are of great interest for this thesis and will provide good points for comparison. Before a brief conclusion is drawn, the fourth section of the chapter overviews other factors that have been examined in the retirement process, including spouses' involvement in the retirement decision, the issue of whether the retirement process is a gradual process or a sudden decision, whether retirement is a final decision and the retirement consumption puzzle.

3.2: Economic models of retirement

When will an individual retire? Common sense tells us that an individual will retire only when it is in their benefit to do so.[51] They will not retire if it is going to leave them worse off. Therefore an individual will retire when the benefits that they will accrue from retiring, such as financial gains from pensions and savings and the increased amount of leisure time to use to do what ever they like, outweigh the costs of retiring, such as the fall in income that the individual will face upon retirement and the possible psychological impact retiring could have on the individual. But how can the retirement decision be modelled.

The following section outlines three economic models of retirement. Firstly an economic utility maximisation model similar to the arguments of the preceding paragraph is outlined, including a discussion of the results of an empirical paper that has used this model in their work. Second the option value model of Stock and Wise (1990) is explained and empirical findings discussed, before attention is turned to a theory to explain mandatory retirement as proposed by Lazear (1979).

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[51] This is assuming that the individual is rational in their behaviour.

3.2.1: Life cycle retirement model

The simple common sense approach to retirement outlined in the previous paragraph can easily be transferred into economic theory. The chapter now turns to outlining this economic theory by outlining the arguments presented in the paper by Mitchell and Fields (1984). All monetary values are looked at in terms of present discounted values, with ϕ being the discount factor that allows for time preferences and our mortality. The present discounted value of labour income once an individual starts to contemplate retirement is:

$$I = \int_{X}^{R} e_t \phi_t dt \qquad (3.1)$$

where I is the present discounted value of income for the period from time X, the time at which an individual begins to plan their retirement, to time R, the point at which the individual retires.[52] So long as after-tax labour income, e_t, is greater than zero the present discounted value of labour income will be increasing over time up to time R. The present discounted value of pensions and savings, P, that the individual will receive is equal to:

$$P = \int_{R}^{T} (PP_t + SP_t + S_t) \phi_t dt \qquad (3.2)$$

where PP is private pension, SP is state pension, and S are income from other savings. The individual will receive their pension benefits from the year they retire until the year

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[52] The point at which an individual begins to plan for retirement will vary from person to person and is very likely to vary widely. Mitchell and Fields consider the age of 60, but today governments are attempting to try to make individuals begin planning for their retirement as soon as they are in employment. A better representation of this 'planning period' is the time at which an individual starts to consider whether to retire this year or work for another year.

that they die, year T. By retiring later, the individual will increase the benefits that they will receive each year in retirement, but they will receive them for a shorter period of time.[53] Therefore the total income, Y, that the individual will receive once they consider retirement is equal to the sum of equations 3.1 and 3.2:

$$Y = \int_{X}^{R} e_t \phi_t dt + \int_{R}^{T} \left(PP_t + SP_t + S_t \right) \phi_t dt \qquad (3.3)$$

Once the individual has decided to consider retirement there is a present discounted value of income for each year that the individual stays in employment (length of retirement reduces). This is represented by the downward sloping line in figure 3.1. The level of income they receive each year in retirement is at it's highest as the length of their retirement reduces, and the present discounted value of income acts as an intertemporal budget constraint for the individual, as they try to maximise their wellbeing.

The wellbeing of the individual is represented by an intertemporal utility function, which will be dependent on both income and the number of years of retirement:

$$U = U\left(Y, L \right) \qquad (3.4)$$

where L is the number of years of leisure where the individual is retired and is equal to T-R. The marginal utilities relationships for income and leisure are:

$$U_Y, U_L > 0, U_{YY}, U_{LL} < 0$$

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[53] This does assume that retirement age and age of death are not related.

The various indifference curves that the individual faces are also highlighted in figure 3.1. The further to the top and right, the greater is the utility of the individual. The individual will want to attain the highest possible level of utility given their intertemporal budget constraint. Figure 3.1 highlights the retirement decision by the individual given both the intertemporal budget constraint and the intertemporal utility will be at an optimum length R1 years of retirement. At the tangent the marginal utility of income from an additional year of work is equal to the marginal utility of leisure for one more year of retirement.

Figure 3.1: The retirement decision
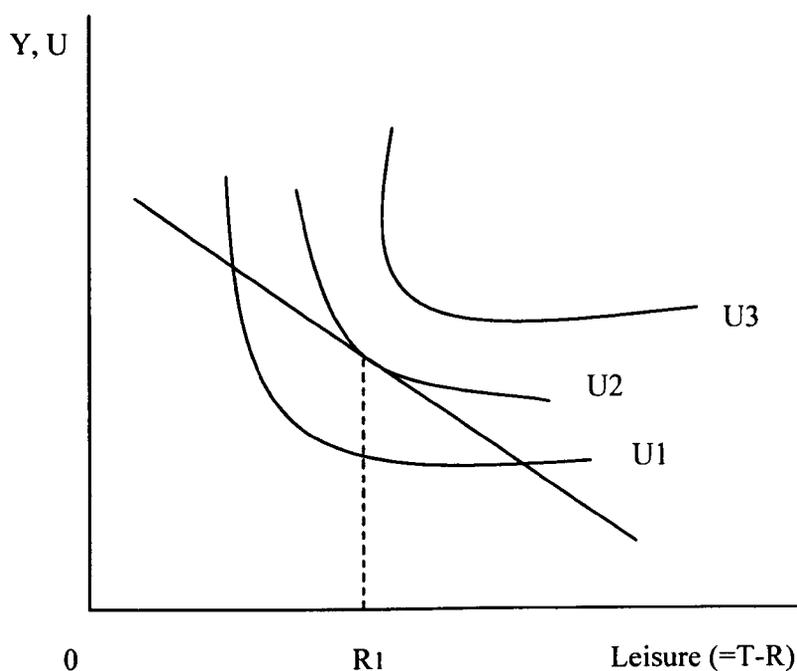
Burtless (1986) estimates retirement age using a model that is very similar to the basic life-cycle hypothesis based retirement decision model outlined above. In the paper the author is looking at the effect on retirement age of an unexpected increase in social security in the USA, and so as such his budget constraint is kinked to portray the changing income an individual could receive as they age (See the author's figures 1 and

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3, pp783 and 791). Burtless uses the Retirement History Survey of the USA, with 58-63 year old head of household males being interviewed bi-annually from 1969 to 1979. Ordinary Least squares results suggested that men who reported having worse health than average retired 1.15 years earlier than those who did not, *ceteris paribus*. The results also suggested that some wealth (up to $25,000) significantly increased retirement age by 0.6 years compared to those with no wealth, but those that had wealth greater than $25,000 retired 1.1 years earlier than those with no wealth, other things equal. These results point to a non-linear relationship between wealth and retirement age. Being married and household size also significantly affected retirement age, *ceteris paribus*, with the former increasing retirement age by 0.55 years and the latter reducing retirement age by 0.18 years.

Burtless also found that, at close to the mean wage, a doubling of the cost of retirement, that is the wage foregone, would lead to an increase in average retirement age of just over 0.9 years, while the effect on retirement of increases or decreases in lifetime wealth were not as strong, with a doubling of lifetime wealth decreasing average retirement age by around 0.6 years, *ceteris paribus*. When examining the effects of the unexpected increases in social security on retirement probabilities, Burtless found small increases in the probabilities, with a 1.5 percentage point increase in the probability that the men would be retired by the age of 65.

3.2.2: The option value model of retirement

There are many more possible models of retirement that could be outlined, many varying only very slightly from each other.[54] The next model outlined in this chapter is the option value model of retirement used by Stock and Wise (1990). This model

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[54] Berkovec and Stern is another paper that looks at US data and formalises a model of job exit behaviour, including retirement. Blau (1994) examines transitions out of employment using US data. Not many papers have examined retirement behaviour outside of the USA, although LeGrand (1995), who examines the determinants of retirement in Brazil and Kolev and Pascal (2002), who examine why pensioners in Russia keep working, are two exceptions.

assesses the option value of continued work, which is the value of retaining the option to retire at a later date. The author's starting point of argument is that many firms have pension plans that give large incentives to retire from a very early age, often as young as 55 (See their figure 1, p1152). In fact, the authors highlighted a fortune 500 firm, where, if an employee left before age 55, they would start receiving benefits at age 55, and the present value of these benefits would be exactly the same as the present value of retirement benefits if they retired at 65. However, for this large firm, retiring at age 55 is better than retiring at age 65 since the expected present value of benefits is greater at the younger age.

The option value model differs from the neo-classical model explained above in that when making their choice on retirement an individual compares retiring this year against the year in the future that maximises their utility, when comparing all possible future years. So whereas the model outlined in the previous section only allows the individual to compare retiring this year against retiring in the following year, the option value model allows an individual to compare retiring this year against retiring in the **optimal** future year for them in terms of their utility.

The model is constructed as follows. An individual i will retire if the expected present value of retiring now is greater than the maximum expected present value he would receive in *any* future year. For individual i who retires at age r, the discounted value that i will receive over the rest of her life is:

$$V_i(r) = \sum_{s=t}^{r-1} \beta^{s-t} U_w(Y_s) + \sum_{s=r}^{S} \beta^{s-t} U_r(B_s(r)) \qquad (3.5)$$

where $U_w(Y_s)$ is the *indirect* utility derived from real earned income, $U_r(B_s(r))$ is the indirect utility gained from pension benefits received from time r, S is the time of death, s

is some year, and β is the discount factor. This value function depends on earned income and retirement benefits, both of these depending on r, the age of retirement for individual i. Individual i must choose whether to work in year t or to retire, so that r = t. Stock and Wise assume that an individual decides whether to retire or not by comparing the expected present value the individual would receive were they to retire now, against the *greatest* expected present value of retiring at some future retirement date, r > t. Therefore, for individual i, the expected gain from postponing her retirement to a later date is:

$$G_t(r) = E_t V_t(r) - E_t V_t(t) \qquad (3.6)$$

where $E_t(\cdot)$ is individual i's expectations of the future given the information available at t. For now, consider the state pension age for women in the UK, currently set at 60.[55] i will, at some time t, consider her retirement options for every year up to her sixtieth birthday, t_{60}. Let r* be the future retirement date (r* > t) which maximises i's expected value for postponing retirement:

$$r^* solves \qquad \max_{r \in \{t+1, t+2, \dots, t_{60}\}} E_t V_t(r) \qquad (3.7)$$

i will retire if and only if there is no expected gain from continued work, that is if $G_t(r) \le 0$. If $G_t(r) > 0$ then i postpones her retirement. Individual i will therefore continue to work at time t if:

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[55] Women do not have to retire at the age of 60. However, it is a useful age to consider for this exercise as it is the age at which their state pension entitlements begin and their work rights are reduced at this age. However, note that the state pension age for women is to increase from 60 to 65 between the years 2010 and 2020 and that it is now possible to defer your state pension, which has also coincided with increased workers rights for older workers. See chapter 1.4 for a more detailed discussion of these facts.

$$G_t(r^*) = E_t V_t(r^*) - E_t V_t(t) > 0 \qquad (3.8)$$

In their analysis of a Fortune 500 firm, Stock and Wise use their option value model to consider the probability that a person will retire during the first year of their sample data, against the alternative of retiring at their optimal future year of retirement. The firm they consider had a mandatory retirement age of 70 and their model was estimated for 1500 salesmen who were aged 50 or older at the beginning of 1980, and initially they consider if the individual worker would retire in 1980 so that 1981 was their first full year of retirement. Their estimates suggest that the individuals in the sample were risk neutral, and that when making their retirement decision the dollar value of income when retired was worth 80 cents of income when working. Their model fit was very reasonable and their predicted values of annual and cumulative retirement rates were always within the 95% confidence interval.

Blundell, Meghir and Smith (2002) use an option value model of early retirement as part of their empirical work on early retirement in the UK. The authors use a balanced panel sample of individuals taken from the Retirement Survey of 1989 and 1994. To calculate the option value for an individual the authors require full information on an individual's past earnings and on their pension entitlements which are not available in the Retirement Survey. Instead the authors match earnings profiles from two other surveys, the Family Expenditure Survey and the General Household Survey, to an individual based on their age, education and industry of work. They also estimate an individual's occupational pension entitlements by using the rules of the most common pension scheme in the sector in which the individual works.

Their results highlighted that the median option value of remaining in work was positive even up to age 71, indicating that for the UK there are large incentives to remain

in work in old age. Blundell *et al.* then compare the option value model with a simple single period accrual model using a sample of 1276 males from the UK Retirement Survey. Using probit estimation, the authors find that the option value has a stronger negative effect on retirement than the single period accruals in income. The effect is stronger by just over one and a quarter percentage points. In the option value model an increase in option values of £10,000, leaving pension wealth unchanged, reduces the probability of retiring by 8.25 percentage points.[56,57] Increases in total wealth in both models reduce the probability of retirement, although neither effect is significant. Their results suggest that when making the decision to retire the most important factor taken into account in the UK are the earnings foregone.

3.2.3: A theory of mandatory retirement

Both of the previous two models discussed focus on the retirement decision being an individual decision as to when to retire. However, neither model can explain why it is that some firms affect the retirement process by having mandatory retirement ages that employees must adhere to. Given a mandatory retirement age, both models can then solve the retirement decision for an individual. But the models are unable to explain why mandatory retirement exists. The 1979 paper by Lazear proposed a formal economic solution as to why mandatory retirement exists.

In this paper Lazear gives an explanation as to why employees and employers alike both agree to have a mandatory retirement clause in a contract between the two parties. He argues that at the beginning of their working career the employee is paid less than their marginal product of labour, but their pay increases as they age, and so after a certain age their pay is great than their marginal product of labour. As a result there will be some

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[56] The increase in the option value of £10,000 is basically saying that equation 3.8 increases by £10,000.
[57] This paper is a little puzzling, especially their results, which seem to be back to front. Their results in Table 4 (Page C168) actually have an option value increase of £10,000 **increasing** retirement by 8.25 percentage points, while increases in total wealth **reduce** the probability of retiring. Since their table does not fit with their discussion as the signs are the wrong way round, this analysis has sided with their discussion as the correct results to discuss.

time T where the amount that the employee was underpaid during their early years with the firm is exactly equal to the amount the individual has been overpaid in their later years with the firm. It is exactly at this point that employers would wish the contract either to be terminated or renegotiated, or else they will lose out.

More formally, the above can be modelled in the following manner. Mandatory retirement is seen as a set date where either implicitly or explicitly, employees contracts ends, and at this date some of the employees would wish to retain their position at the firm but the firm will not employ them at the wage they are receiving at the given date.

Consider then an individual i who has a marginal product at time t of V*(t), with her reservation wage being W'(t) and her wage path is W*(t) and satisfies the condition:

$$\int_0^T W*(t)e^{-rt}dt = \int_0^T V*(t)e^{-rt}dt \qquad (3.9)$$

Where it is assumed that the worker can borrow and lend at the rate r. One possible W*(t) path is presented in figure 3.2, along with the reservation wage and the value of the workers marginal product.[58] Individual i receives an amount less than her value of their marginal product for the period t < t* and an amount that is greater than the value of her marginal product for the period t > t*. T is the date of worker-firm separation. Any W*(t) path that satisfies equation 3.9 will be an equilibrium path for the worker, since total wages paid over their lifetime will equal the total value of their marginal product over their lifetime. The main crux of Lazear's arguments is that each equilibrium path will yield a different *present value*.

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[58] Worker i's marginal product is implicitly assumed by Lazear in his arguments to be constant over time. The paper does not take into account any increases in productivity caused by training or an increase or promotion. It could be argued however, that the wage path W*(t) in figure 1 represents the increases in wage due to training and promotions, and as such V*(t) represents the marginal product that worker i could receive at any other firm. This would, of course, imply that training and promotion are only firm specific, and that when worker i leaves the firm, their marginal product falls back to V*(t).

Cheating by worker i can be spotted immediately and will result in her dismissal from the firm. Worker i will only cheat if the present value of cheating exceeds the cost of cheating. The cost to the worker of cheating is losing their job, and with it their wage which exceeds the value of their marginal product. So long as wage paths, and as a result reservation wage, of the worker are steeper than the value of the worker's marginal product, as in figure 3.2 below, cheating will be discouraged. So a firm which withholds payment to workers until the end of their work life will face less cheating than a firm that pays more at the beginning of a workers life and less at the end. Workers discouraged from cheating will thus have a higher present value of their lifetime earnings for the contract that pays more at the end of their lifetime, so as to reduce cheating, than a contract that either pays more at the beginning of their working life or pays exactly their marginal product throughout their working life.

Figure 3.2: Worker i's marginal product and one possible wage path.
Source (Fig. 1, p1265, Lazear, 1979)
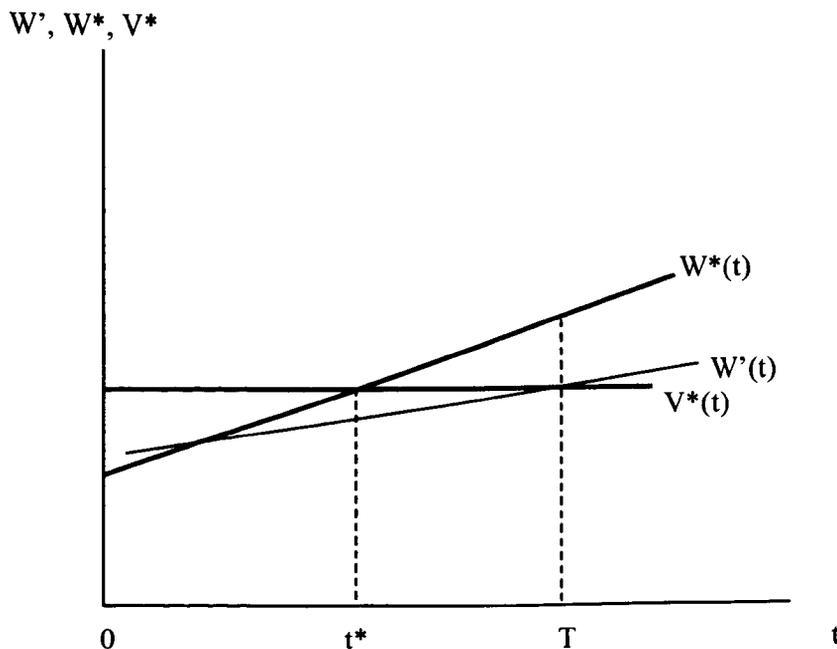
Given that i's reservation wage is equal to her value of marginal product at time T it is optimal for her to leave the firm, and so both i and the firm will agree on a contract at t = 0 whereby there is a mandatory retirement date of T. However, once at T, the worker would not want to retire since $W^*(T) > W'(T)$. However at this point i's marginal product is less than her wage $W^*(T)$ and she has been paid exactly the full present value of her marginal product of her working life. As a result the date of time T retirement is voluntary *ex ante* but mandatory *ex post*.

Lazear's model also allows for early retirement to be efficient, so long as the worker receives some severance pay, for example in increased pension benefits. He also argues that the value of T will likely take a single value, and may largely be determined by government policy. If workers start receiving state social security benefits at age 65, then at t = 65, each worker's reservation wage will increase, and as a result voluntary retirement at 65 would increase as well.

One implication of Lazear's theory is that those workers with steeper profiles will more likely face mandatory retirement, even after controlling for other factors such as ability and education. This implies that those workers that earn more than expected over their lifetime should be more likely to face mandatory retirement. Lazear tests for this implication empirically by performing a logit regression of mandatory retirement, where the dependent variable takes a value of 1 if the worker has a mandatory retirement provision in his current job and zero if not. Using the Longitudinal Retirement History Survey for 1969-1971 Lazear obtains a sample of 4,123 individuals who were aged 58-63 in 1969 and who answered the follow-up survey in 1971. Wage growth is measured as the difference between average wage growth and predicted level of average wage growth as found by a wage growth regression. Lazear's baseline results implied a positive relationship between both job tenure and unanticipated wage growth and mandatory retirement. Those workers working for a firm for a long time and who have an

unanticipated average wage growth are more likely to face mandatory retirement than those that do not.

Another empirical study of Lazear's model is that by Hutchens (1987). Hutchens argues that since Lazear's model implies that firms and workers enter implicit contracts that reduce shirking and cheating by delaying payment, then those jobs that are relatively easier to monitor, and hence know if workers are shirking or cheating, should be jobs that have less mandatory retirement, an absence of pension schemes, low tenure, and higher wages for older workers.[59] This argument derives from that if it is easier to monitor workers for shirking and cheating the firm, the firm no longer needs to enter into an implicit contract with the worker. The author uses data on older males from 1971, using the National Longitudinal Survey. Performing separate regressions on whether the job had a pension; whether the job imposes mandatory retirement (both estimated by probit regression); on the length of tenure; and on the hourly wage (both estimated by Ordinary Least squares using the natural logarithm of the variable as the dependent variable) on a sample of 2,852 older males showed that there was a significant negative effect of the repetitiveness of a job, as defined by the Dictionary of Occupational Titles, on all four dependent variables.

Hutchen's results suggest that those workers who have occupations involving repetitive tasks are less likely to face mandatory retirement or have a pension, and have a lower job tenure and lower wage. These results agree with Lazear's theory of mandatory retirement, however, as the author notes, the results also support other theories of the labour market such as the dual labour market theory.

This section of the chapter has focussed on three separate models of retirement. The first two models, the life-cycle utility maximisation model of retirement and the option

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[59] Hutchens (1987) also argues that Lazear's theory, if correct, goes against all the empirical work on on-the-job training (and in essence most research on labour that uses wages) since this relies on wage being equal to a worker's marginal product. The only way that Lazear's theory does advocate on-the-job training is if the training is *firm specific*.

value model, are closely related with the latter differing from the former in allowing an individual to compare retiring now against all other possible future retirement dates rather than just next year. Lazear's model of mandatory retirement explains why mandatory retirement could exist. The first two models have the retirement decision as a voluntary choice, while in the mandatory retirement model the decision is voluntary *ex ante* but not *ex post*.

The first two models allow individuals to choose when they retire, and they will choose when it is optimal to do so given all the information available at the time. Therefore any changes in situations after retirement may see changes in their decision, be it a complete reversal or a movement into a part-time job. The mandatory retirement model also allows some choice in the retirement decision, but this decision is censored at the mandatory retirement age. The model is looser in terms of the decision process involved in retirement. Indeed the model in itself only states a point in time where a contract of employment at the individual's current firm will end. There is no reason why they cannot continue working in different employment if necessary or if they wish to.

In terms of the effects of retirement, some tentative conclusions can be drawn from these models. Individuals will retire when their utility is maximised, and so income in retirement will be relatively high, if not at the highest it can be for the individual. They will retire when it benefits them the most, and in general this will be when they have enough money to survive at a certain level of living. In terms of happiness, an individual will be happy with their decision to retire in the first two models since it is their choice and they are maximising their utility at the time they retire. However, the theory of mandatory retirement suggests that individuals will not be at their happiest because the decision to end their employment is not the decision they would *necessarily* take.

As a result of these models some questions can be posed in terms of retirement in the UK. Firstly when do individuals retire? Do they all retire at some given point or do they retire when they wish to? Secondly what happens during the retirement process in terms

of both income and happiness? This is in itself linked to the first since leaving your job is going to affect your income and how you exit the labour market should affect your happiness in some way. Thirdly can what happens during the movement out of the labour force and into retirement be explained? Fourthly what happens once an individual is retired? Do they remain retired or is it possible that they return to work? If this is the case, what effects their decision to go back to work? To answer the questions posed, attention is now turned to the current empirical findings on retirement in the UK.

3.3: Retirement in the UK – empirical findings

The previous section of this chapter has outlined models of the retirement process, and examined empirical papers based on these models. Because of these models, four questions have been posed: 1) When does an individual retire and what is the process of retirement like? 2) What happens during the process of retirement, especially in terms of income and happiness? 3) Can the causes of what happens during the retirement process be explained? 4) Will an individual return to employment after retirement and why?

This section focuses attention to the experience of retirement in the UK, focussing on the empirical papers that are closely related to the aims of this thesis. The first sub-section presents a brief overview of two papers that outline the type of work that has been attempted on retirement in the UK but that is not focussed on the areas of interest for this thesis, that is they do not give any answers to the four questions posed at the end of the last section.

Attention is then concentrated on empirical papers that are of great interest for the purpose of this thesis. Firstly two papers that look at the transition into retirement and the labour supply of older workers are discussed, before the next sub-section analyses two papers whose techniques are employed in proceeding chapters that examine the effect of retirement, but, crucially, there are areas that this thesis can improve upon that the two

papers did not attempt. The section ends with a discussion of how empirical findings to date answer the research questions posed in this thesis.

3.3.1: Unrelated UK retirement work

In a recent paper, Blake (2004) examines how wealth affects both consumption and retirement in the UK. Using aggregated time-series data from 1948-1994, Blake finds that housing and basic state pension wealth have a significant positive impact on consumption, while personal and occupational pension wealth have significant negative effects on consumption. Blake uses the labour participation rate of the elderly, that is those working beyond the 'normal' retirement age, to examine the effects on retirement of wealth. At the sample means, the author finds that a 10% increase in overall wealth leads to a 4.4% fall in the labour participation rate of the elderly, and when disaggregating wealth he finds that a 10% increase in personal pension wealth and occupation pension wealth lead to a 0.6% increase and a 4.8% fall respectively in the labour participation rate of the elderly, *ceteris paribus*.

Parker and Rougier (2004) examine the retirement behaviour of the self employed using data from the British Retirement Survey. The sample size of their study is 197 self-employed individuals who were interviewed in both the two waves that took place in 1988/89 and 1994. In their analysis the author's use two measures of retirement, a broad measure which is if the individual considers themselves to be retired, and a narrow measure, which is based on objectively verified work status. Static analysis highlights that being long-term self employed significantly reduces the probability of retiring, using either retirement measure.

3.3.2: Important UK empirical work - retirement and work

Zabalza, Pissarides and Barton (1980) examine the determinants of the retirement decision in the UK and the labour supply of older workers. They use maximum

likelihood functions to maximise every individual's utility over three possible states of work, full-time work, classed as 30 hours or more work a week, part-time work, classed as less than 30 hours of work per week, and retirement, zero hours of work per week. Using a weighted sample of 1483 men and 1207 women aged 55-73 and 50-73 respectively, all of whom had a job at the age of 45, collected in early 1977 by the Office of Population Censuses and Surveys in Great Britain.

For the sample as a whole, Zabalza *et al.* found that for men age, statutory pension age, poor health and involuntary loss of their main job all had a significant positive impact on the probability of retirement. For women the all the same variables significantly affected the probability of retirement in the same direction with the addition of married women were significantly more likely to retire than single women. For both men and women there was a sudden jump in the marginal rate of substitution between leisure and income at the statutory retirement age.

Using their results the authors were able to find the probabilities of retirement at different ages for the typical man and woman and how this probability of retirement would be affected with changes to wages, pensions, or the traits of the typical person.[60] Their results highlight that poor health increases the probability of retirement substantially. The effect is greater for women than men, as seven years before the statutory pension age the typical woman with poor health has a probability of retirement that is 39 percentage points higher than the typical male with poor health.

The results also highlight that women are much more responsive to wage and income changes than men. For men there is no effect on the probability of retirement caused by either a pension increase or a wage increase until the age of 65. At age 65, the typical male is 1 percentage point less likely to retire if their gross wage was 50% higher, while

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[60] The authors' typical male was a married man, who was a homeowner, who had good or fair health, who did not have an occupational pension, had savings income of £2.50 per week, a gross income of £1.30, had a spouse who was not working, and who did not leave their main job involuntarily. The typical female was a married woman, a homeowner with good or fair health, who did not have an occupational pension, who had no savings income per week and a gross wage of £1, who was not a waiting wife, had a spouse who did not work, and who did not leave their main job involuntarily.

he would be more likely to retire by nearly 3.5 percentage points with a pension increase of £5 per week. For women the effects of pension and income changes are much stronger. Even before the statutory pension age an increase in gross wages will decrease the probability of retirement by 5 and 6 percentage points at the ages of 56 and 59 respectively. A pension increase means the typical woman would have an increase in the probability of retirement of almost 10 percentage points at the age of 60.

The results of Zabalza *et al.* found that the typical woman had much stronger wage and income elasticities than the typical man, and so were much more responsive to wage and income changes.[61] For the typical man the wage elasticity was slightly negative indicating a backward bending labour supply curve.

Meghir and Whitehouse (1997) focus on the transition into and out of work in the UK, and by combining the results offer results as to the causes of early retirement in this country. In the paper the authors use the 1988-89 UK retirement survey and split the sample into two based on whether or not the sample had an occupational pension scheme. Observations take place after 1968 and all job status changes are observed for individuals over the age of 40 up to the age of 65. They have a sample of 641 individuals, of which 453 have an occupational pension and 188 do not.

By combining the duration of employment and the duration of unemployment, the author's are able to estimate the probability of staying active in the labour market, or in other words the probability of retiring. Their results indicate that no individuals with an occupational pension scheme retire before the age of 45. Those without an occupational pension scheme have a steady increase in probability of being retired as their age increases, while for those with an occupational pension scheme the probability of becoming retired is very slight up to the age of 55, after which there is a dramatic rise in the probability of becoming retired as each year progresses. At age 63 both occupational

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[61] The typical man and woman in this context had all the traits in footnote 62 but was aged 63 and 60 respectively.

pension scheme members and non-members have the same probability of retiring. Most occupational pension schemes reward for the longer you work, but after a certain age there are incentives to retire. The authors argue that their results are in line with this argument, whereby occupational pension scheme members become increasingly likely to retire after the age of 55.

Meghir and Whitehouse then examine the transitions out of work and into work for men with no active occupational pension plan, a sample of 188 individuals, with 746 spells either in or out of employment after 40 years of age and after 1968. Exits from employment are positively affected by both minor and major bad health as well as the unemployment rate. Professional and managerial workers have the lowest exit rate relative to manual workers, and the number of years of education also negatively affects exits from employment. Exits from unemployment are positively affected by education, and is negatively affected by bad health, unemployment and age. So, when combining these results the authors conclude that retirement is affected by conditions in the labour market, age, and health. The older you are and the unhealthier you are the more likely you are to retire early, even more so in times when there is high unemployment. When including earnings and benefits in their estimations, Meghir and Whitehouse find that benefits have a negative effect and earnings a positive effect on the exit to work, while earnings have a negative effect on the exit from employment. The author's argue that these results imply that there are incentive effects at work for individuals and that they have an influence on the decision to retire.

Both these papers provide useful evidence for the UK on areas that are important for this thesis. The former provides evidence of the labour supply of older workers in the late 1970's. This thesis can extend this work by looking at more recent data and can use the findings of Zabalza et al. (1980) as a good reference point. The latter paper is not as important in terms of this thesis but does provide good evidence of the transition into retirement for older workers. Given that these findings are using fairly recent data and

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provide ample evidence of the movement into retirement this provides another motive for analysing the movement out of retirement and back into work. It will be useful to use Meghir and Whitehouse (1997) as a reference point however since it is likely that the factors that affect the movement into retirement will play some role in the potential to return to work from retirement.

Disney, Emmerson and Wakefield (2002) use the British Household Panel Survey to examine the impact of ill health on retirement decisions. In their estimation of economic activity, the authors find that the healthier you are the more likely that it is that you will be economically active, suggesting that in old age individuals who are unhealthy are more likely to retire than a healthier individual, *ceteris paribus*.

Johnson, Stears, and Webb (1998) use the British Retirement Survey to examine the change in income over time for individuals who were retired before 1988/89 and who remained retired, and also extend the analysis to focus on changes in occupational pensions after retirement.[62] For individuals who were retired before 1988/89 and who remained retired there was a slight increase in weekly income if you were married, and a slight fall if you were unmarried for both men and women. However, their results also highlight that for a good proportion of married men and women there are falls in income between the two surveys. Nearly one in eight married men and women have a fall in income of over 20% between the two waves, whereas for single men and women only one in ten have such a large fall in income between waves.

When looking at occupational pensions, Johnson *et al.* highlight that the large majority of men receive or will receive an occupational pension. 72% of married men and 61% of single men will or have received an occupational pension. For women the figures are smaller, only one quarter of married women and widows have or will get an occupational pension, while 45% of divorced women and 80% of never married women have an occupational pension. The mean pension receipt for men with an occupational pension

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[62] The paper focuses on women aged 60-69 and men aged 65-69 in 1988/89.

was nearly £100 in both waves, and for women the mean pension receipt was £44 in 1988/89 and £48 in 1994. Occupational income for some individuals changed dramatically between the two waves. Over 12% of those who were retired throughout the two waves and who only had one pension had their occupational pension income fall by more than 20%, while more than 8% had a rise in their pension income of more than 20%, and more than 40% of the sample had little or no change.

3.3.3: Important UK empirical work – the effects of retirement

This next sub-section focuses on the two papers that are important in terms of their empirical work to the objectives of this thesis. The first paper is that of Bardasi, Jenkins and Rigg (2002), and the second paper discussed is Webb (1997).

Bardasi *et al.* (2002) firstly examine the cross sectional evidence of the incomes of the retired then turn to examine longitudinal evidence including an investigation into the changes in the low income incidence amongst retirees. They then conclude their empirical work by performing a multivariate analysis on the probability of becoming poor. The datasets used for analysis in this paper are the Retirement Survey of Britain and the first nine waves of the British Household Panel Survey. In the descriptive section of their paper, the authors found that men have a large fall in income at the year of retirement compared to the year before retirement, while for women the fall in income is not as pronounced. Their analysis also pointed towards the idea of a gradual move in retirement, something which is discussed in more detail in section 3.4.2.

The authors then turn the main focus of the paper to estimating the probability of becoming poor when a person retires. Using probit analysis the authors examine the probability of being in the poorest third of the income distribution in the year of retirement given that they were not in the poorest third in the year before retirement, *ceteris paribus*. The estimations were estimated separately for both men and women. For women, having an occupational pension significantly reduces the probability of moving

into the poorest third of the income distribution. The marginal effect, other things equal, is 19 percentage points less likely to move into the lower income bracket. For men, full time work or being self employed significantly increases the likelihood of moving into the poorest third of the income distribution, while for women part time work and full time employment have the same effect, with the marginal effects for each being 34 and 30 percentage points for men, and 11 and 9 percentage points for women. There are also significant geographical and qualification effects for both men and women.[63]

However, despite the results that the authors find, there are three problems with Bardasi *et al*'s paper that could be improved and each is now discussed in turn:

1) The first major drawback is that the paper examines the differences between male and female incomes during the movement into retirement, yet its measure of income is real current net *household* income.

This in itself may not be a problem if addressed properly, if for example the paper was aimed at examining household low income incidence amongst the elderly. The problem comes in that the paper is targeting individual low incomes. The use of equivalised household income does mean that the number of individuals living in the house is taken into account. However, when considering the income of two people living in the same house, the use of this income measure would indicate that both individuals have the same income when this may not be the case.

When looking at the incidence of poverty the use of household income as an individual measure is adequate but when looking at the changes in individual income as an individual moves into retirement it is less likely to be a useful measure. Another important point to be made is that it may be that the decision to retire is made jointly by

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[63] For men having A-levels or above is associated with a significant decrease in the likelihood of moving into the poorest third of the income distribution of 19 percentage points, while for women there is a significant decrease in the likelihood for those who have O-levels of 16 percentage points.

married couples and so household income will be an important factor, but it does not strictly measure the income of the individual and so as such if household income was used as a measure of individual income in this type of analysis then it would confuse two possible retirement indicators.[64] Therefore in any study of income changes around retirement it is completely necessary to separate out two different channels through which a retirement decision could be based.[65]

2) The second drawback of this paper is that there is no examination of changes in male and female incomes across time.

In their analysis, Bardasi *et al.* do provide cross sectional evidence of the proportion of elderly who have low incomes across the nine waves of the BHPS.[66] They highlight that there is a higher proportion of elderly who have a low income compared to the population as a whole. However, an interesting point would be to examine whether the incomes of either females or males, or both, are changing over time. In their discussion of income through the retirement process, Bardasi *et al.* set all individuals' retirement year as Year 0, irrespective of what year their retirement year was. They then move backwards and forward from this year. The descriptive statistics in chapter 6 provide this discussion, as well as examining whether there are differences over time in income and happiness levels that occur as retirement takes place.

3) The sample that the authors examine changes across the years of study.

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[64] Section 3.4.1 of this chapter looks at the impact of marriage on retirement.
[65] Both individual income and household income may play some part in any retirement decision. In chapter 6 of this thesis when studying the change in income and happiness as an individual moves into retirement both individual income AND household income are included in the descriptive analysis.
[66] The author's use three different measures of poverty: the poorest fifth; the poorest third; and those below 2/3 of 1991 median.

For example in their analysis of the change in incomes over time, Bardasi *et al.* include individuals who have missing observations. Doing this prevents analysis of changes amongst the same people, and may misrepresent the results.[67] For chapter 6 of this thesis only those with full information on incomes and other variables specified in the analysis are included.

Another problem is that by Year +6 of their analysis, only people who retired in waves 1 and 2 could possibly be included in their data for incomes, since those who retired from waves 3 onwards would not have been in the panel long enough to have been retired for this length of time. This is a problem that cannot be rectified and in all essence is one that will also affect this thesis. However, any reductions in sample sizes are pointed out throughout chapter 6 of this thesis. At the same time changes in income are examined for only 1 year before retirement to up to 3 years after retirement, improving the number of individuals who are observed to retire.

The closest work so far in the literature to the nature of this thesis is the paper of Webb (1997), who examines incomes at both the individual and household level.[68] In the paper Webb examines how incomes of particular retirees have changed over time, and compares them to pre-retirement income. The data is taken from the interviews of 2114 individuals aged 55-69 in 1988/89 who gave full information in both interviews. For the whole sample, mean incomes fell about 8% between 1988/89 and 1994, from £154.72 to £142.51, while median non-zero incomes actually rose slightly, by about 3% of 1988/89 median income, from £97.93 to £101.37.

However, when only looking at those who moved from employment to considering themselves as retired in between the two interviews, of which there were 599 individuals, over 65% of individuals had a 1994 income that was worth at most 100% of their

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[67] Looking at a simple example, a person who was low income in one year may have missing information the next year, while a person with high income may be missing in the year that the low income individual is present in the survey but is in the survey when the low income individual is not.
[68] Webb examines individual incomes and the incomes of 'benefit units', which in most cases will be the same as the household, but in some cases adults live as a couple or on their own with other adults, and as such examining at the benefit unit level increases the preciseness of the analysis.

1988/89 pre-retirement income, indeed 1 in 5 of individuals had income in 1994 that was less than 50% the value of their 1988/89 incomes. However the survey also showed that 17% of individuals had income in 1994 of over 150% the value of their 1988/89 income.

Average earnings amongst this group of individuals fell from £215.93 to £138.83 as they moved from working life to retirement. Non-zero median incomes fell from £172.93 to £105.45. When looking at those who were in full-time employment in 1988/89 whom then classed themselves as retired in 1994, a sample of 299 of the 599 individuals, nearly 80% of individuals had incomes worth less than what they did before they retired.

Looking at the household level, Webb finds that, for those households that had one or more of the individuals in the household move into retirement between 1988/89 and 1994, average income fell from 406.71 to 269.85, while non-zero median incomes fell from £364.14 to £217.91.

Again, there are areas of this paper that can be improved upon. Firstly the dataset, the British Retirement Survey was only carried out for two sets of interviews. This means that we cannot see if the change in income carries on. Also the gap of five or six years between interviews does not allow us to view income changing yearly. Both of these points are solved by use of the BHPS, as seen in the Bardasi *et al.* (2002) paper discussed above. Another area where this thesis can improve and extend this work is to provide a multivariate analysis to explain the change in income as individuals moved into retirement. However, this paper, as well as the paper by Bardasi *et al.*, does give this thesis some descriptive analysis with which to compare with when discussing the descriptive results.

One of the aims of this thesis is to examine the changes in both happiness and life satisfaction that occurs as the retirement process takes place, and to try and explain these changes using multivariate analysis. In that the paper by Bardasi, Jenkins and Rigg (2002) only concentrates on income, and is only concerned with the increased likelihood of becoming poorer as individuals move into retirement, this thesis can extend the

analysis further by examining an individual's wellbeing in terms of both income and satisfaction, as well as addressing the issues raised in the preceding paragraphs. This thesis can also extend the work of Webb (1997) since the use of the BHPS allows us to examine income changing in a yearly process, and multivariate analysis to explain the changes in income can be performed.

3.4: Other issues in the Retirement process

There are other issues that have been discussed in the literature regarding the retirement process, a few of which are briefly turned to in the proceeding paragraphs. Three main discussion points have been how spouses influence their partner's retirement decision, whether the movement into retirement is a definitive choice or whether individuals return to work at some point, and whether retirement is a gradual process or a sudden departure from the labour market. This section now briefly discusses each issue in turn.

3.4.1: Marriage and its effects on retirement decisions

Tanner (1997) provides evidence for the UK from the Retirement survey that around 1/3 of married couples retired within 1 year of each other, although of the 532 couples who were married at the time of both interviews, which took place in 1988/89 and 1994, over 10% retired 10 years apart. The author also points out that 5% of late and 6% of early retiring women whom were interviewed in the survey cited retiring at the same time as her partner as their main reason for retiring.[69] Bardasi *et al.* (2002) also provide evidence for the UK that spouses influence the decision to retire. They find that in the two years before a woman's retirement, over 20% of husbands would retire. The reverse figure for wives is around 10%. The authors do point out however that their descriptive

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[69] For the USA, Smith and Moen (1998) provide evidence of spousal influence on the retirement decision.

analysis of the retirement decision cannot distinguish between an age effect and true coordination between spouses.[70]

3.4.2: The retirement process - a gradual or sudden movement?

Another important area that will be examined in the proceeding chapters in this thesis is whether or not the movement into retirement is a gradual process or more of a sudden choice. Those in favour of the gradual process argue that individuals will choose to work less as they move towards retirement and may move from full time to part time jobs. For the UK Meghir and Whitehouse (1997) and Webb (1997), whose papers are based on the British Retirement Survey, both suggest that the retirement decision is more of a sudden choice. The former paper points out that there was "....no evidence of individuals moving to part time work before they retire" (p336). However, their dataset does not contain any information on hours of work and so it may be that individuals reduce their working hours in the same job. Webb (1997) points to the fact that generally men employed in full time jobs at the time of the first survey were also employed in full time jobs at the time of the second survey. He also points to no evidence of falling income before retirement and concludes that retirement is not a gradual easing out of the labour market but is more of an "abrupt transition" (p132). Overall the British Retirement Survey concludes that the large majority of men moved from full-time employment to retirement. (Disney, Grundy and Johnson, 1997)

Bardasi *et al.* (2002) support the gradual process of retirement in their paper. Their results highlighted that there is a movement for both males and females away from full time employment in the years preceding retirement. Three years before retirement 50% of men in the sample of retirees are in full time employment, but in the year before retirement 38% of them are in full time employment. Their analysis also highlighted that

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[70] The age effect is that husbands tend to be older than their wives and so any similarities in retirement date may be purely coincidental.

although there was a sharp fall in labour earnings at the year of retirement, which was more pronounced for men than women, there was a gradual fall in labour earnings for both men and women as they neared retirement. This fall in labour earnings was compensated by gradual increases in benefits at first, and then also by pensions and investments as the individuals moved closer to retirement. The authors argue of a voluntary movement towards retirement by way of a reduction in working hours.[71] All these results point to a gradual process of retirement, which is a point they argue throughout the descriptive analysis of the retirement process.

This thesis can add to this debate by examining the retirement process in terms of by personal trait, by age and across waves, to examine whether there are any differences in the retirement process of individuals.

3.4.3: Partial retirement and returning to work

A discussion that is linked to the process of retirement is whether or not individuals will return to work after retiring. For example Ruhm (1990), using the Retirement History Longitudinal Survey for the USA, found that 24.9% of all workers who retired or partially retired in 1971 went back to work after classing themselves as retired. 11.6% of the sample re-entered the labour force more than four years after classing themselves as retired or 'partially retired'.

For the UK, Tanner (1997) highlights that some 2.2% of the sample of the British Retirement Survey returned to work after classing themselves as retired, although unfortunately there is no indication as to the split in this by gender.[72]

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[71] Of course a related argument here is that this may not be a voluntary move towards retirement. It may be that the reduction in working hours by older workers may be demand related. This could either be through redundancy or through reasons of discrimination towards the older worker for example. So in making these statements Bardasi *et al.* are assuming that the issue here are all directly supply side and do not come from the demand side.

[72] This figure may well be higher in reality as surveys of this nature suffer from the fact that people will alter their opinions of what happened in retrospect. For instance it is possible that some of the individuals who reported moving from work to unemployment to work again may in fact at the time have considered themselves as retired where they now consider themselves to have been unemployed. So the percentage of

The movement back and forth from retirement to employment does suggest that retirement is not a final decision, and that individuals are able to transfer between one state and the other with relative ease. However, this evidence could be used to support either process into retirement, since those individuals who go back to work may have found that they did not have enough income after suddenly having to stop work, or they may have decided to go back to work to increase their happiness. Given that there is evidence of individuals returning to work from retirement it gives rise to wanting to know why that is. Therefore the final chapter of this thesis will examine the probability of returning to work from retirement.

3.4.4: The retirement consumption puzzle

The life-cycle theory of consumption predicts that individuals will smooth their consumption paths over time, and that if there are any non-continuous areas of consumption then individuals will reallocate their consumption which will increase their utility without increasing their use of their resources. So if individuals are to smooth their consumption over their retirement then they will need to save enough for their retirement so as to maintain their consumption at pre-retirement levels. However, there is much evidence that highlights a drop in consumption at or around the time of retirement of individuals which cannot be explained by the life cycle model of consumption. This is the retirement consumption puzzle.

Evidence from countries around the world has found that once individuals have retired, their consumption takes a one time drop to a new level. Many authors have argued that this has shown that there is a retirement consumption puzzle, and have gone on to highlight that the life cycle model of consumption is inadequate at explaining this one time fall. However, there is recent empirical work that has responded to this, with some

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individuals who went back to work after retirement could well be higher, and if all individuals who were surveyed made this change in their perceptions, then the return to work percentage would be as high as almost 8%. (Meghir and Whitehouse, 1997)

works highlighting that the fall in consumption comes from areas of expenditure associated with employment, such as transport costs and clothing expenditure, and the substitution of home produced goods and services rather than market purchased ones, while other papers have highlighted that there is no fall in income once individuals have retired for some countries. Therefore the evidence from some of the recent empirical literature is that the retirement consumption puzzle can be solved within the life cycle model or may not exist at all.

So what is the evidence of a retirement consumption puzzle and can the life cycle model still explain the consumption decisions of individuals? Hammermesh (1984) provides early empirical work that shows that an individual's consumption early in their retirement outweighs their income, so they cannot afford to sustain this level of consumption without changing their lifestyle. This throws up two possibilities, first retirees could re-enter the labour force, and secondly they could reduce consumption. Looking at the 1973 and 1975 Retirement History Survey for the US the author highlights that households reduce their real consumption as they go further into their retirement. Hammermesh notes that the yearly fall in consumption from the 1975 RHS evidence is consistent with a sustainable consumption profile given the survival probabilities facing the households at the time. He concludes that the reason for an individual's reduction in consumption is because of tastes, either because of a bequest motive or the uncertainty of the length of the individual's lifetime coupled with a rate of time preference that is much greater than the real rate of interest.

The early evidence for the US suggests that there is a fall in consumption as individuals move into retirement but that quite possibly the fall can be explained by the life cycle model. Bernheim, Skinner and Weinberg (2001) go on to examine US panel data from 1978 to 1990 to analyse whether explanations within the life cycle hypothesis can identify why there is a retirement consumption puzzle. Their results indicate that those individuals with low income replacement rates do not reduce their consumption prior to

retirement, and their change in consumption is no different than those with higher income replacement rates. The results also highlight that irrespective of which income replacement or wealth ratio quartile you are in there is no significant difference between the quartiles in the change in consumption growth of food away from home. Also there is a fall in consumption growth of food at home at the time of retirement, which is significantly different across both wealth and replacement rate quartiles. Specifically those with greater wealth going into retirement have a significantly greater fall in consumption growth of food at home, and these findings cannot be explained by the life cycle model which would suggest that those with the higher wealth have the higher consumption growth. One possible explanation for the negative correlation between wealth and consumption growth would be if there was heterogeneity in the retirement decision, with some individuals having to retire early because of unforeseen events. The authors go on to highlight that the negative correlation still exists even when the unpredictable events that can cause an early than expected retirement are controlled for.

So Bernheim *et al.* conclude that the life cycle model cannot explain the consumption patterns for the US and that it is more feasible to explain it in terms of following rules of thumb and then adapting if necessary at retirement or where you mentally account your consumption but everybody has different levels of ability to withhold their feelings to spend more of their current income than they should.

Hurd and Rohwedder (2006) also look at US data and offer an interesting way of attempting to find out why there is a retirement consumption puzzle. The authors look at whether individuals, as suggested by Bernheim *et al.* (2001), have a shock at retirement where they are surprised as to how little money they have to take them through their retirement. They look at the anticipated change in consumption that individuals believe they will have when they retire and then look at the recollected consumption change once they have retired. Their findings highlight that there is little difference between anticipated and recollected changes in consumption around retirement, and therefore the

retirement consumption puzzle cannot be explained by a 'surprise' effect in consumption around retirement, at least for the US.

Banks, Blundell and Tanner (1998) provide evidence for the UK that there is a retirement consumption puzzle, but then go on to put forward possible explanations that would satisfy this puzzle within the life cycle model. Banks *et al.* (1998) look at data from the Family Expenditure Survey for Great Britain from 1968-1992. They use the data to create a pseudo-panel according to age and education cohorts.[73]

Banks *et al.* estimate consumption growth equations and look at actual and predicted consumption growth, with predicted consumption growth estimated as the consumption in period t given the information available in period t-1. Their figure 3 (p.777) highlights that at age 63 actual consumption growth falls by 3% while predicted consumption growth only falls by 1.5%. So there is a fall in consumption around the ages of retirement and at times half of this fall is unanticipated. To remove the possibility that it is their modelling of the life cycle that is failing to adequately capture individual's savings and consumption decisions the authors go on to allow for mortality risk and labour market related costs in their models. When including a survival probability term in their estimation of actual and predicted consumption growth their results indicate that there is still a retirement consumption puzzle since there is very little change in the difference between actual and unanticipated consumption growth between the ages of 60 and 65.

Banks *et al.* then add to this consumption growth equation a variable indicating whether or not the head of the household was in the labour market. This is done to remove the direct, in other words anticipated, effect of retirement and unemployment from the change in consumption as one would expect to see a fall in consumption if you were to leave the labour market. The results of this estimation of consumption growth show that predicted consumption growth falls by 2% between the ages of 60 and 65 while the

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[73] The education cohorts could only be used for data from 1978-1992 because of the lack of educational information in the survey before 1978.

actual consumption growth falls by between 2% and as high as 3% between the same ages. However, when they split the two states of retirement and unemployment the gap between the actual fall in consumption growth and the predicted fall in consumption growth around the ages of retirement is again reduced. However, there is still a gap indicating a retirement consumption puzzle, and Banks *et al.* also look at the fall in consumption expenditure by goods which highlights that while work related expenditure falls as retirement occurs so does expenditure on basic necessities. So while much of the fall in consumption can be explained within the life cycle model there remains a large proportion of the fall in consumption that cannot be explained. The authors conclude that it is likely that there are unanticipated shocks around retirement, one of which may be that individuals do not estimate their future pension entitlements correctly.

Smith (2006) goes on from the conclusion of Banks *et al.* (1998) and offers evidence using British data that the fall in consumption around retirement can be completely explained within the confines of the life cycle model since it is mainly due to a negative wealth shock around the time of their retirement, usually caused because they have to retire involuntarily early through ill health or redundancy. Smith uses BHPS data to analyse the spending of both voluntary and involuntary retirees, where an involuntary retiree is someone who retired from a non-work state of employment and do not return to work once they have reported themselves as retired, while a voluntary retiree is someone who moved into retirement from work who do not re-enter work after retirement.

Descriptive analysis of the data shows that voluntary retirees have the larger fall in income around retirement but their food spending remains fairly stable around retirement, with a £3 fall per week, while involuntary retirees have a £7 per week fall in food spending. These descriptive statistics point to the possibility that involuntary retirees face a negative wealth shock as they cut their food consumption to a greater degree around retirement. The author goes on to use regression analysis of consumption and highlights that when controlling for demographic and health variables there is no

effect on consumption of retirement for those who retire voluntarily, but there is a significant negative impact on consumption of retirement for those who retired involuntarily of just over 10%. This significant fall in spending on consumption comes despite the fact that those who retire involuntary have a significantly less dramatic fall in their income upon retirement than those who retire voluntarily. The same significant negative impact upon consumption of retiring involuntarily is still found when different measures of voluntary and involuntary retirement are used and when additional interaction terms are included in the regression to control for age of retirement, whether they had an employer pension or not and education level.[74]

Battistin, Brugiavini, Rettore and Weber (2006) also provide evidence that the fall in consumption around retirement can be explained within the life cycle model. Battistin *et al.* (2006) look at the retirement consumption puzzle using Italian data on retirees from a household survey using data from 1991-2002. They find that while consumption drops by 9.2% around retirement, over two thirds of the fall can be attributed to falls in expenditure on work related items such as clothing, transport and meals out. So it may be that while there is a consumption drop around retirement, the fall in consumption may be a move away from market produced goods to home produced goods, and so the fall can be explained removing any puzzle there may be.

But is there really a retirement consumption puzzle at all? There is some empirical evidence that suggests that for some countries there may not even be a retirement consumption puzzle. Christensen (2004) highlights using Spanish data that there is no retirement consumption puzzle in Spain. She agues that in Spain there is no significant income fall at retirement and so what can be examined with any fall in consumption is the pure retirement effect of having more leisure time. Using pseudo panels of age

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[74] The other measure of voluntary retirement is when an individual has two consecutive periods out of work once aged over 50 and who class themselves as retired and involuntary retirement is when an individual has two consecutive periods out of employment but class themselves as long term sick or unemployed.

cohorts of husbands the author shows that the mean replacement ratio of households is almost 1.3, and the median is 1.09, indicating that for Spain households actually have more income once they have retired than when they were working.[75] Christensen then examines whether there is any effect of retirement on incomes, total non-durable expenditures and budget shares. Her results highlight that there is no significant impact of retirement on total household income or total non-durable expenditure once demographics have been controlled for. Christensen then estimates a demand system to examine budget shares and the effect retirement has. These results highlight that the only commodity that has a significant change in budget share due to retirement is non-durable medicines, and it falls most likely because they are subsidised for retirees in Spain. When looking at the budget share of a combined set of goods which are classed as work related, that is clothing, transportation, petrol and food out, there is again no significant impact of retirement.

So what can be concluded from all the empirical evidence? What can certainly be demonstrated is that for the USA there would seem to be a retirement consumption puzzle with a large fall in consumption around retirement that cannot be explained by the life cycle model, while for the UK there is a significant drop in consumption around retirement but evidence would seem to explain why it occurs and it is acceptable within the life cycle model. Of the other European studies considered evidence suggests that in Italy the retirement consumption puzzle can be explained while in Spain there is not actually any puzzle to be solved. What is certain is that for the UK a lot of evidence exists on the retirement consumption puzzle and one paper has even used the dataset that is being used for this thesis, namely the BHPS. Therefore this thesis will not go on to look at the possible retirement consumption puzzle for the UK, instead it will look at

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[75] This finding as the author points out will be to some extent because the replacement ratio only examines the few years before and after retirement and so is not a complete replacement rate. So it is possible that this finding is simply because many individuals move into retirement from unemployment for example. However, Christensen's regression results in the following section of her paper show that there is no significant impact of retirement upon household income.

other issues in retirement and the labour supply of older workers but at the same time one must remember that there this is a key discussion area on the topic of retirement.

3.5: Aims and objectives

What do the findings from the empirical literature on other areas of retirement mean for this thesis? Well this chapter has highlighted that: Firstly there some evidence as to the reasons why an individual will move into retirement; secondly there is a great debate as to whether the movement into retirement is a gradual movement or more of a sudden one; secondly there is little evidence in the UK on the spousal effects on retirement income and happiness; thirdly there is some evidence on the impact of retirement on income of individuals but none on the impact retirement has on the happiness of an individual; fourthly there is already a large literature on the retirement consumption puzzle; and finally there is some evidence for the UK as to the reasons why an individual will stay on in work beyond the state pension age but no work has looked at the reasons why an individual will return to work after they have already retired.

Given the above findings this thesis will extend the literature to date by:

- Examining the movement out of the labour force to analyse whether the retirement process is a gradual or sudden move from one state (working) to another (retirement).

- Analyse the impact retirement has on the incomes and happiness of individuals in Great Britain.

- Examine how spousal influence affects retirement happiness and income, labour supply and thus the retirement decision, and the movement back into work.

- Providing a descriptive and multivariate analysis of why an individual will leave retirement and move back into employment.

Chapter's 5-7 will look at each of these areas in turn. Specifically, chapter 5 will look at the retirement process, analysing the movement into retirement for age cohorts by wave and gender and wave cohorts by age and gender. It will also look at the change in labour hours that occur as an individual nears their retirement. Chapter 6 of this thesis will go on to provide a descriptive analysis of the change in income and happiness as an individual moves into retirement. It will also provide a multivariate analysis of the change in happiness around retirement and discuss the impact a spouse has on their partner's income and happiness. As already outlined in the previous section of this chapter the thesis can extend and improve the current analysis of income changes upon retirement as well as provide the first evidence of the change in happiness that occurs around retirement. Chapter 7 of this thesis will look at the reasons why an individual will return to work after they have decided to retire by examining both descriptive and multivariate analysis. There is currently no empirical analysis of this area in the UK to date.

The preceding paragraph has highlighted how this thesis will extend the current literature in the area of retirement. Chapter's 6 and 7 will provide some new evidence that has not been looked at to a great extent in the UK while chapter 5 will provide further evidence as to an area of the topic of retirement that has already sparked large discussions. What is also true is that all three chapters will have important policy implications. In particular if the movement into retirement is a sudden movement for example then it would be important for the government to improve the options into retirement that could be taken by individuals. Also if there are large falls in happiness around retirement for instance then it would be important for the government to provide individuals with potential help as they leave the labour force and possibly provide more services for older individuals to improve their happiness. Finally the policy implications of the reasons why individuals leave retirement and return to work could be linked to either the labour supply policies or happiness improving policies. If individuals return to

work because of financial reasons then it is important that the government prepare individuals for retirement in advance. Also it will be important that many avenues are potentially open to individuals as they plan their retirement so that they can decide what is best for them both emotionally and financially. If an individual's happiness falls once they are in retirement then they make seek a return to work to improve the social aspects of their lives. If this is the case then it would be important for governments to provide a positive labour market which encouraged the employment of older workers.

3.6: Conclusion

This chapter has outlined the theory and empirics of retirement. For this chapter the issue of what 'retirement' means is not important, but the issue is returned to in future chapters when discussing how to measure retirement empirically. Three models of retirement were outlined: In the first, individuals maximise their utility in making their retirement decision. In the second model individuals decide which has the greater benefit to them, working for one more year or retiring at some optimal time in the future, and in the third model firms negotiate a fixed term contract with workers that have a mandatory retirement age.

From these three models four research questions were proposed: when do people retire and what type of process is the retirement decision; what happens to income and happiness as individuals move from work to retirement; can the changes in happiness be explained; and is there any movement out of retirement and can we explain these?

Empirical papers' findings were then reviewed for UK data, concentrating within this to papers that are similar in their nature to the aims of this thesis. Zabalza *et al.* (1980) estimate the labour supply of older men and women in the UK and provide estimates as to their wage and income elasticities. Meghir and Whitehouse (1997) examine the transition into retirement of older workers. The former paper provides some useful areas

in which to examine the labour supply of older workers, while the latter paper is useful when considering the fourth research question, namely is there any movement out of retirement?

Bardasi *et al.* (2002) examine the incidence of low income amongst the elderly, while Webb (1997) examines the income dynamics of the elderly at a descriptive level. For both papers, the issues and areas for improvement were addressed. These two papers attempt in one form or another to answer the second research question proposed, but it was argued that their analysis had problems and that this thesis could progress the research into this area. No work has yet been attempted on the third research question proposed in this chapter.

Finally attention was turned to other issues in retirement that this thesis will examine, such as whether or not retirement is a gradual process or a sudden exit from the labour force, and the issue of whether or not individuals return to work after retiring. For the UK, evidence is mixed towards the former and so this chapters' first research question will prove to be a good addition to the debate in this area. There is virtually no empirical evidence on the reasons for moving back to work from retirement in the UK and so it is possible to extend the literature in this area by analysing the fourth research question that motivates this chapter.

Therefore chapter 5 of this thesis will examine the first research question in this chapter by examining the movement into retirement, while chapter 6 will look at the next two research questions by examining the effects of retirement on income and happiness, and then examining the determinants of the changes in happiness that occur around retirement. Chapter 7 of this thesis will go on to examine the movement out of retirement and back into work and in so doing examine the fourth research question raised from this chapter. The chapter uses an empirical analysis of the movement out of retirement to examine the reasons why a retiree decides to move back into the labour force.

The Labour Supply of Older Workers

The determinants of labour force participation, wage elasticity and other income elasticity of work hours.

4.1: Introduction

A major area of interest in many countries currently and in the last few years is older people. Life expectancy is increasing in most industrial countries, and the ratio of older to younger people is rising, given that there are an increasing number of older people combined with lower birth rates. So how can nations support their older individuals? This has given rise to many policy issues, two of the most prominent being pensions and employment. If older individuals are not going to live in poverty in the future then they need to have a good pension in hand when they retire. Therefore governments across the world are pondering ways to increase private savings for retirement while trying to work out how to pay the state pension to the rising numbers of pensioners. One way in which governments can help retirement issues is by increasing the labour supply of older workers, and indeed many countries are increasing their state pension age so as to keep people in work longer to save more for retirement. This chapter focuses on this potential area for policy discussion, employment, or the labour supply, of older workers.

In particular what is of interest is what affects an older individual's labour force participation decision? Also, once an older individual has decided to participate what will affect their supply of labour in the labour market? Finally, do older workers respond in a different way to wage or other income changes than their younger working counterparts? All of these aims are important for government policy in the area of labour and in particular the employment of older individuals, and these areas of policy have become very important in recent years.

The aims of this chapter are achieved by first estimating a labour force participation equation for older individuals to find those determinants which affect their decision on whether to work or not. Second, a labour supply equation is estimated for older workers to analyse the factors that affect older workers supply of labour. Finally, the responsiveness of older workers' labour supply to wage and other income changes are found from the labour supply equation, and a comparison is made to the responsiveness of younger workers' labour supply which is found using the same methods.

The importance of older worker's labour supply

Labour supply is a key area in which governments can increase the savings and potential prosperity of older individuals in their retirement. As previously mentioned, many governments are increasing the age at which individuals become eligible for a state pension. In the UK the age that women will receive their state pension is being phased gradually from 60 to 65 from 2010. From 6th April 2020 the state pension age of men and women will be 65 years of age. The Pensions Commission's two reports for the government also recommended further increases in the state pension age in the future.[76] (Pensions Commission, 2004 & 2005) Indeed the government currently is passing through Parliament a bill which will see the state pension age rise from 65 to 68 by 2046.[77] The government has also introduced increased weekly pension payments if you put off receiving your pension and continue working, which was available from 6th April 2005.[78] (The Pension Service, 2006)

Getting older individuals to work for longer and to increase the number of older workers would benefit the government and the individual. As well as state pension

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[76] See www.pensionscommission.org.uk/publications/2004/annrep/fullreport.pdf and www.pensionscommission.org.uk/publications/2005/annrep/main-report.pdf for the full reports. (Pensions Commission, 2004 & 2005)
[77] See chapter 1.4.1 of this thesis for more details.
[78] See http://www.thepensionservice.gov.uk/pdf/spd/spd1jan06.pdf for a complete explanation of state pension deferral. (The Pension Service, 2006) Also see chapter 1.4.2 of this thesis for a more thorough discussion on the topic.

deferral there are two other major policies that affect the UK in this area. One major policy that has been introduced to help increase the labour supply of older workers by New Labour is New Deal 50 plus. The New Deal 50 plus is aimed at individuals over 50 and is intended to help them into work by allocating them a personal adviser to help an older individual find employment. The New Deal 50 plus also allows individuals who join the programme to gain extra tax credits depending on an individual's income and be able to claim an in-work training grant of up to £1500.[79]

The second major policy that will increase labour supply of older workers is based on an EU directive. EU directive 2000/78/EC removes all forms of discrimination from the workplace, including ageism.[80] New employment equality laws, including laws on equality of age in employment, have brought the UK into line with this directive and came into force on 1st October 2006.[81]

Given all this policy and discussion on older individuals and how best to solve the ageing society issue there is, as would be expected, a large literature on the pensions and their effect on retirement, employment and savings, but, maybe surprisingly, there is a relatively small literature by economists that focuses on the labour supply of older workers, and only some work using British data.[82]

This study therefore will examine the labour supply of older workers using longitudinal data from Great Britain. The analysis focuses on the determinants of labour force participation for older workers before moving on to estimate their wage and income elasticity of job hours. Each of these measures how responsive older workers percentage of work hours will be to changes in both their wage and their income respectively. It is

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[79] See http://www.jobcentreplus.gov.uk/JCP/Customers/New_Deal/New_Deal_50_plus/ and http://www.agepositive.gov.uk/newdeal/index.asp for details of the New Deal 50 plus. Also see http://www.hmrc.gov.uk/manuals/eimanual/EIM01660.htm for details of the working tax credits available to individuals who join the New Deal 50 plus.

[80] See http://europa.eu.int/comm/employment_social/news/2001/jul/directive78ec_en.pdf for the full directive. (The European Union, 2000)

[81] See http://www.opsi.gov.uk/si/si2006/20061031.htm for an online version of the regulations that have been accepted by Parliament. Also see chapter 1.4.3 of this thesis for another discussion of this.

[82] A good starting point for the interested reader on the economic literature on the role of pensions in the labour market is Gustman, Mitchell and Steinmeier (1994). Disney, Emmerson and Wakefield (2001) examine pension reform and its effects on saving in Britain.

important for policy decisions that we know what affects an older person's labour force participation decision and it is also of interest for policy makers to know how older workers wage and income elasticities of labour supply compare to their younger counterparts. If older workers are less responsive to wage changes than younger workers for example, then tax reductions to increase their take-home pay may not be the way to go about increasing the labour supply of older workers.

Potential older workers will have a two stage process if they are to work. First they must choose whether to participate in the labour force or not, and then secondly they must decide just how many hours a week to work. So what factors would one expect to determine whether an older individual will enter the labour force or not? Health, level of education and previous employment status are all likely to be important factors in determining whether an older individual participates in the labour force. The inclusion of previous employment status is important as it will show us how likely individuals are to move back into the labour force compared with those already in the labour force. The argument that arises in this respect is that it may be that once you are out of employment you are less likely to go back, and if this was the case then it would be important for policy to keep people employed rather than tempt them back into work. Another important factor for older individuals is whether their spouse has retired or not. In the estimation that follows in section 4.4 of this chapter a simple dummy variable indicating whether the individuals spouse is retired or not is included in the random effects probit regression of labour force participation.[83]

Would we expect any differences in the wage elasticity and income elasticity of labour supply of older and younger workers? The wage elasticity of labour supply will depend on the relative strengths of the income and substitution effects that a wage rise would

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[83] Gustman and Steinmeier (2000) present and estimate an actual model of spousal retirement and how this affects the labour supply decision of the older individual. While this is certainly a model that would be of use to estimate using British data in the future, only a simple 0/1 binary variable is used here to indicate retirement of a spouse as this topic is not the sole focus of this chapter. However caution must be taken in the significance of the binary variable as the estimate is likely to be biased upwards.

cause. One the one hand an older worker may respond more to a wage rise by working more hours as they can reach their target income for retirement quicker by taking extra work on in the short term. Therefore we might expect a stronger substitution effect for an older worker. On the other hand however, given a finite lifetime two individuals who differ only in age are likely to have different tastes. The older individual will value their leisure time more as they have less time left in their lifetime relative to the younger individual. Therefore a rise in wages means that the older worker can enjoy more of their leisure while earning the same amount working fewer hours. Given this their income effect reaction to a wage rise is also likely to be stronger than a younger worker. (Begg, Fischer and Dornbusch, 1997; Cahuc and Zylberberg, 2004) The overall picture then is still unclear, since older workers should have both stronger income and substitution effects to a wage rise than their younger counterpart. Therefore estimating the wage elasticity of labour supply for both older and younger workers is useful in observing which effect, if any, is stronger for older workers than younger workers.

Other household income elasticity of labour supply should be negative for both the older and younger worker, since a rise in non-wage income will lead to a total income effect, which should cause a reduction in work hours as individuals will reach their target income by working less given their higher non-wage income.[84] (Ehrenberg and Smith, 1997) However, whether there is any difference between older and younger workers is a useful discussion point. We might expect older workers to have a stronger reaction to an increase in non-wage income than younger workers, *ceteris paribus*, since they will value their leisure time more. But is this actually the case? This chapter will estimate the non-wage income elasticity of labour supply for both older and younger workers to discern what difference, if any, there is in their respective elasticities.

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[84] The variable other household income is in effect the best measure available from the dataset used to capture an individual's wealth in terms of their returns on savings and investments. Of course it must be kept in mind that this measure will not perfectly capture wealth.

The results of this chapter highlight that previous work status, spouse retirement status and other household income are important determinants of labour force participation of older individuals. The wage and income elasticities of work hours are found by estimating a model of labour supply that controls for the censoring of observed work hours at zero. The results highlight that there are significant differences in the wage elasticity of working hours for older men and women in comparison with their younger counterparts. Older men have no response to wage changes while their younger counterparts have a significant negative impact of wage increases on their work hours. Both older and younger working women have a negative wage elasticity of work hours, but the response of younger women is much greater. The results for the younger men and women are in line with some of the wage elasticity of labour supply found in the previous literature.

The income elasticity of labour supply is not significant for older men, and only is significantly negative in one of the specifications for both younger men and older women. Younger working women have significant decreases in labour supply in response to other income increases, and are also significantly more reactive to income changes than their older counterparts.

The remainder of this chapter begins with section 4.2 which focuses on the empirical literature that has investigated labour supply and the labour supply of older workers in particular. The third section follows with an introduction to the dataset used for the whole of this thesis, the British Household Panel Survey, there then follows a discussion of the dataset for this chapter and descriptive statistics, before the econometric specification of the models to be estimated is analysed. Section 4.4 presents and discusses the results and considers the relevant policy implications. Section 4.5 concludes.

4.2: Previous literature

Attention is now turned to the past empirical work that has studied the areas that this chapter focuses on. Firstly findings on wage and income elasticities of labour supply in the UK are discussed, before continuing with a brief overview of past work on older workers labour supply in the UK and abroad.[85] This section then finishes by discussing two papers that estimate labour supply functions using a very similar methodology to that used in this chapter.

4.2.1: Wage and income elasticity

What do previous estimates of wage elasticities and income elasticities suggest we will find in this study? In the vast majority of studies the wage elasticity of men has been found to be slightly negative or not significantly different from zero, indicative of males working on the backward part of their labour supply curve. For women the wage elasticity has usually been found to be positive and significantly different from zero. Hence, the wage elasticity of the two genders differs considerably. By contrast, the income elasticity for men has usually been found to take a negative value in previous studies, and the same is true for women, whose income elasticity of labour supply is generally negative but not significantly different from zero in the vast majority of these studies.[86]

However, work on labour supply is not widespread in the economics literature of late and so most of these estimates come from older studies using data from the 1970's and 1980's. Even so they are a useful benchmark on which to start our analysis. As such this

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[85] Chapter 2.4 provides a more comprehensive review of the past literature on both the labour force participation and the labour supply of older workers from both the UK and abroad.
[86] For more detailed analysis of previous empirical studies see Pencavel (1986), Killingsworth and Heckman (1986) and Blundell and MaCurdy (1999).

sub-section now turns its attention to previous UK findings of wage and income elasticities of labour supply.

Zabalza, Pissarides and Barton (1980) estimated wage elasticities to be -0.02 and 0.37 for **older** men and women respectively. They also estimated income elasticity of labour supply for both men and women and found this to be -0.023 and -0.38 respectively. Another paper that indicates wage elasticity of labour supply for older men and women is Disney and Smith (2002) who examine the abolition of the earnings rule in the UK which meant that those in work could not receive their full pension. They point out that relative to the unaffected control groups, men and women who were affected by abolition (that is those already above the state pension age) increased their labour supply. This finding suggests that older men and women both have positive wage elasticities of labour supply since the abolition of the earnings rule effectively increased an individual's wage, as before the earnings rule was acting as a tax on their earnings.

Other UK studies have estimated the wage elasticity of labour supply for males and females overall. Blundell and Walker (1982), using data on two worker families in 1974, estimate male wage elasticity to be -0.29, and for women 0.43. However, their results also highlight that with young children the female's wage elasticity becomes more inelastic, and becomes negative with two children aged between 3 and 6. Brown, Levin and Ulph (1976) find a wage elasticity of -0.107 and -0.140 for their two main specifications with a sample of 434 working married men under the age of 65. For the same group of men they find an income elasticity of labour supply of -0.016.

4.2.2: Previous work on older individuals

The study of older workers, their labour supply and pensions in the UK is beginning to get more attention as it becomes a major area of policy. Those UK studies that concentrate on older workers include Blundell and Johnson (1998), who examine disability benefits and their impact on retirement, and Disney and Smith (2002), who

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examine how the labour supply of older workers was affected by the abolition of the earnings rule on the amount of pension you could receive if you continued to work. Parker and Rougier (2004) examine the retirement behaviour of self-employed workers in Britain and Meghir and Whitehouse (1997) examine the transition into retirement of men in the UK. However, the closest work in regards to what this chapter is studying that has used data from the UK is the work of Zabalza, Pissarides and Barton (1980).[87]

In their paper Zabalza *et al.* examine the determinants of the retirement decision and the labour supply of older workers in the UK. They examine 55-73 year old men and 50-73 year old women, all of whom were employed at the age of 45, using data from 1977. Not only did they discuss the findings in terms of what determines retirement and what would happen to labour supply if the earnings rule was abolished, but they also examined the wage and income elasticities of work hours for the sample. They also split their sample into pre-state pension age and post-state pension age and highlight that at the means, the wage elasticity of post-state pension age individuals is greater than their younger counterparts. Indeed whereas a 59 year old man had a wage elasticity of work hours of -0.0078, a 68 year old man had a wage elasticity of work hours of 0.012. For a 55 year old woman the wage elasticity was 0.26 and for a 66 year old woman the wage elasticity was 0.47. These results highlight that older individuals have a greater wage elasticity of work hours than younger ones, indicating a greater response to wage changes.

Empirical papers that use non-UK data and examine the issue of the labour supply of older workers include Kolev and Pascal (2002), and Cameron and Cobb-Clark (2002). Cameron and Cobb-Clark (2002) estimate labour supply functions for men and women depending on whether or not the men or women live with their children. Kolev and Pascal (2002) examine Russian data to find the determinants of pensioner employment

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[87] A review of many of these papers from a retirement point of view can be found in chapter 3.3 of this thesis.

and then proceed using a random-effects tobit model to estimate the number of hours worked.

A major deficiency in the two papers just described is that there is no attempt in the papers to control for possible specification bias. Specification bias arises in labour supply estimation in that data on wages and hours of work will only be available for those who are in work. This is caused by self-selection in that each individual chooses freely whether to work or not, and hence whether a wage is observed or not. (Heckman, 1979; Berndt, 1991; Connolly, 1997) Two papers that do correct for selection bias in their estimation of labour supply models are those of Connolly (1997) and Smith (1995), the former examining UK data and the latter using data from Denmark. The papers of Connolly (1997) and Smith (1995) both correct for any potential specification bias using the method developed by Heckman (1979).[88]

Connolly (1997) examines female labour supply in the UK where their supply of labour is affected by the chances of finding employment. The data used is those women who left school at the age of 16 who took part in the National Child Development Survey (NCDS). In the paper Connolly estimates both the probability of participation and the probability of being employed, with the two being distinct and the former is labelled the unconstrained model and the latter the constrained model. The estimation of the constrained model of the probability of employment is to allow for the fact that labour supply is not only dependent on an individual's decision to participate but also the local job market and the probability of finding a job.

Connolly's results highlight that if the second stage of being employed, that is the likelihood of finding a job, is ignored then the individual's own wage elasticity is

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[88] Correcting for selection bias is widespread throughout economic literature. For example Heckman's procedure to correct for selection bias is used by economists in examining wages, such as the work by Reilly (1991); the procedure is also used by economists examining demand elasticities for foodstuffs, such as the work by Saha *et al.* (1997) and Lazaridis (2004); it has also been used in health economics by Dusheiko *et al.* (2004) and in business economics by Calvo (2006).

overstated. Her results also indicate that there was a large financial disincentive for women to work if their partners were unemployed.[89]

Smith (1995) estimates labour supply functions using Danish data and controlling for any possible specification bias using the method developed by Heckman. Smith (1995) examines the labour supply of 3000 Danish married couples who were watched over the period 1980-86. Like Connolly (1997) the author estimates two different models of labour supply depending on whether or not unemployment is included as labour supply.[90]

The results suggest that own wage and spouses' hours of work are significant in affecting both male and female labour supply in Denmark. Males have a significantly negative income effect on work hours while income has an effect on working hours for women that is not significantly different from zero. All of these results are irrespective of the model used in estimation. Her results are also in contrast with those of Connolly which used British data as they highlight that for both men and women having a spouse who is unemployed significantly increases their labour supply.

Smith also presents the elasticities for work hours that her results estimate. For men there is an income elasticity of between -0.025 and -0.032 depending on which model is used, while for women the income elasticity of work hours is zero. Men's wage elasticity of work hours is estimated to be about 0.1, while for women the wage elasticity is estimated to be 0.06 and 0.09 depending on which model is used.[91]

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[89] Connolly also states that her results highlight that women who have partners whom are unemployed are more likely to be unable to find employment themselves. This is based on the larger coefficient for the dummy variable indicating whether the partner is unemployed or not in the unconstrained compared to the constrained model. However, the figures are not significantly different from one another and so this conclusion is in doubt.

[90] This is the same argument as applied by Connolly (1997) but using a different methodology. Therefore the results that are of primary interest are the results that allow for the probability of employment to affect labour supply, that is the results which include unemployment as labour supply as well as hours worked.

[91] Interestingly these results for the wage elasticity of work hours in Denmark go against the majority of findings of empirical work using data in other countries, as outlined earlier in the chapter.

4.3: Data and methodology

The aim of this chapter is to focus on the determinants of labour force participation of older workers, and to examine any differences in the wage and other income elasticities of work hours between older and younger workers. Estimating the labour supply of individuals can be extremely difficult since we will only have wage and hours of work data on individuals who are in employment at the time of their interview. Therefore we can only estimate labour supply for those that are in employment, and this in itself creates issues as it creates the possibility of sample selection bias, as was discussed in section 4.2.3. Therefore we first estimate the determinants of labour force participation, before estimating the labour supply of older individuals using a tobit regression to allow for the censoring of hours worked that occurs at zero. This employment estimation will also need to include labour demand factors as it is possible that the labour supply of workers has been affected by local labour market factors. As is discussed later in this section the use of tobit regression does not remove the selection bias that arises.

This section continues by examining what factors are likely to affect labour force participation and labour supply, before describing the dataset used and presenting descriptive statistics. The section concludes with an examination of the econometric specification used in the estimation process.

4.3.1: Factors affecting labour force participation

What will be the determinants of labour force participation? Firstly we would expect age, health and education to be important factors in the participation rates of individuals. Ageing individuals may be less likely to participate in the labour market, *ceteris paribus*, while those with poor health should be less likely to participate than those with good health. The greater your educational qualification, the more likely you will be to be participating in the labour market, all other things equal. This should be the case because

those with more qualifications will be in more demand by employers than those with no qualifications.

Participation may also depend on your possible wage if you were to work and the size of your other income sources. The higher the predicted wage the greater will be the likelihood of an individual participating in the labour force, while the greater the size of other income sources available to the individual, the less likely they are to participate in the labour force, as this increases their reservation wage.[92]

Other factors that may be important in determining your labour force participation may be the number of children you have, whether or not your spouse is retired, your non-labour income, and your job status in previous years. The greater the number of children you have, especially younger children, the more likely it is that you will not participate in the labour force. This may be offset to some extent by the availability of childcare, but the effect should still occur. If your spouse is retired, it may increase the value of your leisure and so increase the likelihood of you not participating in the labour force. The higher your non-labour income, that is your income from savings and investments for example, the lower will be the likelihood that you participate in the labour force. It would also be expected that those who were employed in the previous year are more likely to be still in employment in the next year, and therefore your previous labour force status in the is likely to be important in determining your labour force status in the current year.

All these variables are included in an estimation of both labour force participation and labour supply. Table 4.1 outlines the variables used in the estimation process of labour force participation and the labour supply of older workers. However, as mentioned above, the labour supply of workers alone is to be estimated as we do not have full information on non-workers. Therefore we are estimating an employment equation, and as such this may be affected by local labour market conditions. Therefore the regional

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[92] See chapter 2 of this thesis for a full discussion of the theory of labour supply and for a diagrammatical explanation of how a higher reservation wage reduces the likelihood of labour supply.

Table 4.1: Variables used in chapter 4

Variable Name	Description	Notes
Independent Variables	.	
Labour Force Participation	Binary variable indicating if the respondent is active in the labour market.	0 – No 1 – Yes
Log Wage	The natural logarithm of the usual real hourly wage received by the respondent.	
Hours of Work	The respondent's usual hours of work per week.	Hours of work not including overtime
Personal characteristics		
Age	Age of respondent on 1st December of wave year.	
Age squared	The square of Age	
Highest Qualification	The self reported highest qualification obtained by the respondent	0-4 (None – Degree)
Spouse Retired	Binary variable indicating if the respondent's spouse as retired or not	0 – No 1 – Yes
Number of Children	The number of children under 18 living in the household	
Household equivalised income	Other income per Head	(HH Income per month minus respondent's monthly labour income)/household size
Regional Unemployment rate	The unemployment rate in the respondent's region of residence	
Housing status	Variable indicating the respondent's level of ownership of their residency	0-2(Rented, Mortgage, owned)
Marital Status	The respondent's marital status	1-4 (Married, Widowed, Divorced, Single)
Region variable	Indicates the respondent's standard region of residence	1-11
Health Status	Indicates the respondent's self-reported health	1-5 (very poor – very good)
Wave variable	Indicates the wave in which the respondent was interviewed	1-12
Job characteristics		
Experience	The number of years the respondent has worked for their current employer	
Experience Squared	The square of Experience	
Previous Employment Status	Indicates the respondent's previous employment status in the year prior.	1-5 (Self-employed, employed, unemployed, retired, long term sick/other)
Industry variable	Variable indicating the respondent's 1-digit Standard Industrial Classification	0-9
Occupation variable	Variable indicating the respondent's 1-digit Standard Occupational Classification	1-9

unemployment rate will also be included in the labour supply estimations to allow for possible labour demand factors affecting the labour supply of workers. (Smith, 1995)

4.3.2: Data

This chapter uses the first twelve waves of the British Household Panel Survey (BHPS) for the years 1991-2003 as the starting point for creating the dataset. The BHPS is a nationally representative survey of randomly selected households. Only the original sample of BHPS households are included as the starting dataset to maintain the national representation of the sample.[93] Older workers are any individuals aged 50-70 at the time of their response to the survey, while younger workers are any individuals who are aged 24-49 at the time of their interview. As a result individuals can move from the younger workers sample to the older workers sample. Therefore this analysis should be seen as examining the behaviour of specific age groups in their responses to labour supply decisions.

Full information is required on their job status, their education, age, marriage status, health, and income. Only those respondents who have full information in all the required areas are included in the samples of younger men and women and older men and women. The final samples of older men aged 50-70 is 1904 with 9690 observations and for older women aged 50-70 the same figures are 2255 and 11215.[94]

Table 4.2 presents descriptive statistics for the four groups being examined. The figures for spouse retired make for interesting reading. In the case of 24-49 year olds there are a small percentage of men and women who consider and report themselves as retired. For the older workers there are a lot more retired men than women according to the table. Why might this be the case? Firstly it may be that women state their job status to be

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[93] See chapter 1.5 and Taylor (2001) for more details on the BHPS.
[94] In the analysis of the wage elasticity and income elasticity of work hours that follows, a sample of men aged 24-49 and women aged 24-49 is used. These samples were collected in the same manner as their older counterparts and the sample sizes are for 4119 men with 21968 observations and 4301 women with 25207 observations.

family carers or long-term sick rather than retired. Secondly it is easier to pick up male retirees in the data since they begin to receive pensions from their work in the main. However, this is less likely to be the case for women and hence why it seems that less wives are retired than husbands.

The difference in the level of qualifications highlights the changes in society rather than a large difference in those being observed. As time passes it may be more difficult to remember what qualifications you have, but on the whole these figures just highlight that qualifications have become more and more important in society as time has passed.

Looking briefly at the reported health statuses of the respective age groups, it seems that older individuals do not feel as healthy compared to someone else of their age as younger people.[95] As would be expected, women have higher other income in the household than men, when ignoring their own wage income. Interestingly the sample highlights that older and younger working counterparts of the same sex earn a similar real hourly wage on average. Men earn around £9 per hour while women earn around £6 an hour.

Nearly 60% of older male observations report being active in the labour force, most of whom are either employed or self-employed. Of those who are active in the labour market, 7.5% of older men are unemployed, while 3.9% of older women report being unemployed. For younger men and women the corresponding unemployment figures are 7.2% and 4%. The figures also highlight a much lower labour force participation rate of older workers than younger workers. Therefore a study of this kind will be of benefit to examine what factors are important in determining their labour force participation. This will be of help for any policy decisions that have to be made in the future to increase the participation rates of older people and will enable us to analyse whether current policies will be of any effect or not.

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[95] Chapter 6 of this thesis examines how retirement affects not only the income of individuals, but also their happiness.

Table 4.2: Descriptive statistics of the four groups sorted by age and gender

Group:	Male 24-49	Female 24-49	Male 50-70	Female 50-70
Age	36.82	36.81	59.00	58.97
	(7.89)	(7.98)	(6.53)	(6.58)
Health very poor	1.38%	1.90%	2.36%	2.59%
Health poor	5.23%	7.06%	8.93%	9.41%
Health average	17.16%	19.80%	23.80%	24.31%
Health good	46.84%	47.42%	42.52%	45.93%
Health excellent	29.38%	23.82%	22.39%	17.77%
Spouse retired	0.49%	1.22%	9.78%	22.58%
Married	78.77%	77.90%	84.70%	73.64%
Other Income	1032.3	1686.6	1061.37	1411.78
	(999.12)	(1144.1)	(873.21)	(1204.54)
No qualifications	14.03%	16.55%	35.63%	46.33%
Other	7.85%	11.18%	9.55%	10.04%
GCSE	18.66%	24.68%	13.32%	16.35%
A-level	13.63%	10.46%	7.15%	4.28%
Degree	45.83%	37.12%	34.34%	23.00%
Number of children	0.92	1.05	0.13	0.07
	(1.11)	(1.12)	(0.47)	(0.32)
LFP	93.98%	73.84%	59.69%	44.44%
Employed	87.20%	70.92%	55.22%	42.71%
Wage (if employed)	9.21	6.63	8.73	5.87
	(5.33)	(4.26)	(5.37)	(3.72)
Number of individuals	4119	4301	1904	2255
Number of observations	21968	25207	9690	11215

Notes: Standard deviations between the individuals are reported in parentheses for those variables measured in units rather than percentage.

4.3.3 Econometric specification

As described earlier in this section, the two aims of this chapter, to focus on the determinants of labour force participation of older workers and examine any differences in the wage and income elasticities of work hours between older and younger workers, require two different estimation processes. The first is the estimation of labour force participation. This is achieved using a random effects probit model using a simple 0-1 binary variable to indicate whether the individual was participating in the labour force or not. In this study labour force participation is any individuals who reported their job status to be employed, self-employed or unemployed. Random effects probit models are

estimated so as to capture the unobservable individual effects that will be present in the data and does so by allowing the intercept to vary across individuals. (Greene, 2005)

The second stage is more difficult as an estimation of the labour supply of workers will be censored at zero hours as many individuals will not work any hours. Therefore the chapter goes on to estimate labour supply using a random effects tobit model so as to allow for the censoring of the observed hours of work at zero. The chapter follows the process outlined in Berndt (1991).[96]

The econometric specification for the above models is now briefly described. The determinants of labour force participation of older individuals are estimated using a random effects probit model:

$$LFP_{it} = \beta X_{it} + V_{it} \qquad (4.1)$$

where

$$V_{it} = u_i + e_{it}\beta \qquad (4.2)$$

LFP is Labour force participation, X_{it} is a set of explanatory variables and V_{it} is a random error that includes an individual error component and a component that is uncorrelated between and within individuals.

To estimate labour supplied by older workers, we first need to examine wages. Wages are of the form:

$$w_{it} = \alpha Z_{it} + \varepsilon_{it} \qquad (4.3)$$

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[96] The procedure used from the discussion in Berndt (1991) is procedure III. This procedure will yield inconsistent estimates of the coefficients. This problem is discussed further in this section and in the results section.

Where w is real hourly wage, Z_{it} is a vector of individual characteristics that will determine wages and ε_{it} is again a random error term that is composed of an individual error effect and a time invariant error effect. However, wages will not be observed for those who are not in work and so equation 4.3 is regressed using OLS estimation of hourly wages using working individuals' hourly wage. The predicted wages from this regression are then included in the estimations that follow for all workers and non-workers alike.

To estimate the labour supply of older workers we must first allow for the fact that for many individuals the hours of work will be equal to zero as they are not employed. So what in effect is happening is that we are observing a variable that does not actually reflect the true underlying variable to the full extent. So for older workers we observe hours worked, HRS, but the true underlying variable HRS^* is only actually observed for those in work. Therefore we must estimate a random effects tobit model rather than a simple OLS estimation which will be both inconsistent and biased.[97] More formally it is assumed that there is a latent unobserved hours of work variable which takes the form:

$$\mathrm{HRS}_{it}^* = \mathrm{X}_{it}^{*'}\beta + \nu_i \qquad (4.4)$$

Where

$$\nu_i \sim \mathrm{N}\left[0, \sigma^2\right] \qquad (4.5)$$

where X^* is a vector of individual characteristics and ν_i is a random error. Actual hours of work are then observed when:

$$HRS = \begin{cases} HRS^* \text{ if } & HRS^* > 0 \\ 0 & \text{ if } HRS^* \leq 0 \end{cases} \qquad (4.6)$$

The tobit model then explicitly allows for the occurrence of censoring in the data. A labour supply equation of the form below is then estimated:

$$LS_{it} = Y_{it} + \varphi_{it} \qquad (4.7)$$

where LS_{it} is the labour supply of individual i at wave t and is equal to the number of usual working hours per week, Y_{it} is a vector of individual characteristics and φ_{it} is a random error that is composed in the same way as V_{it} which is shown in equation 4.2.

This estimation procedure is problematic however and so the results must be interpreted with caution. The estimated coefficients for the individual characteristics are highly likely to be inconsistent. This is because the wage, even when using the OLS estimates of wage, will be endogenous within the labour supply equation. This is because ε_{it}, which will capture the unobserved factors that affect wage rates, will likely be correlated with φ_{it}, which captures the unobserved factors that affect labour supply. (Berndt, 1991) So for example it is likely that any effect of productivity that is not captured by the individual characteristics in the wage equation is linked with an individual's tastes for

work which will be reflected to some extent in the individual characteristics and the error component in the labour supply equation.[98]

The paper proceeds using the tobit procedure to correct for the censoring of working hours at zero, but the problems raised in this section must be remembered when discussing the results, which must be analysed with a degree of caution.

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[98] One way to remove the potentially serious issue of selection bias is to use the technique proposed by Heckman (1979). What Heckman showed was that when a wage equation using only the observed wages of those in work is estimated what you are actually estimating is:

$$E(w_{it}|Wrk_{it} > 0) = \alpha Z_{it} + E(\varepsilon_{it}|\phi_{it} > -\sigma C_{it}) \qquad (f4.1)$$

This is the equation that would be estimated rather than the wage equation outlined by equation (4.3). Heckman showed that by estimating a probit model of the probability of being *employed* (as opposed to the probability of participating in the labour force which includes those who are unemployed) you could estimate the second term on the right hand side of equation (f4.1). You could then include the correction term, the Inverse Mills Ratio (IMR), on the right hand side of the wage equation:

$$w_{it} = \alpha Z_{it} + \varphi \lambda_{it} + \eta_{it} \qquad (f4.2)$$

One could then simply estimate hours of work in a similar vein including the correction for the selection bias and also including an instrument for wages in the independent variables:

$$Hrs_{it} = \pi_1 X_{it}^h + \pi_2 \lambda_{it} + \tau_{it} \qquad (f4.3)$$

Here equation (f4.3) is equivalent to equation (4.7) with the exception of correcting for the selection bias with the inclusion of the IMR. This process will yield consistent estimates for the coefficients. See Berndt (1991) for further information on the use of the Heckman correction for selection bias.

4.4: Results

This section of the chapter begins by presenting the results of labour force participation regressions for older men and women respectively. Attention then turns to examining their labour supply, before presenting the respective wage elasticity and income elasticity of job hours for older and younger working men and women. The section ends with an analysis of these results in terms of policy implications.

4.4.1: Labour force participation of older men and women

Tables 4.3 and 4.4 present the regressions of labour force participation both with and without the hourly wage of individuals included in the random effects probit regression of a 0-1 binary variable indicating whether or not the individual is participating in the labour market. The former table presents the results for men and the latter for women.

Table 4.3 highlights that labour force participation is reduced for older males the greater is their level of education. 50-70 year old males who report having A-levels or degrees (or equivalent) as their highest level of education are less likely to be participating in the labour market than those with no qualifications. These results hold with the inclusion of the predicted wage. This finding goes against ordinary labour supply theory where the more human capital an individual has the more they should be participating in the labour force. However, as these results are focussing on the older male it may be that the older male with greater human capital has thus earned a greater income over their lifetime and so are able to leave the labour force sooner, *ceteris paribus*.

Table 4.4 indicates that older females' labour force participation in a different way from their male counterparts, and is more in line with traditional theory of labour supply. The results highlight that the greater the educational attainment of the female the more likely they are to be participating in the labour force. When predicted wages are excluded from the regression both those with A-levels or equivalent or a degree as their highest

qualification are significantly more likely to be participating in the labour force than those older women reporting having no qualifications. However, when predicted wage is included as a regressor only those with degrees or equivalent are significantly more likely to be participating in the labour force than those with no qualifications.

As expected health is a very important factor in the labour force participation for both older men and women. Those 50-70 year olds who rated their health as being very poor are significantly less likely to participate in the labour force than any other individual who states that their health is better than very poor. Again the inclusion of the predicted wage in the regression does not change this result. These results are in line with previous work on the effect of health status on labour force participation, for example the work of Cai and Kalb (2005).[99]

An older man's marital status does not significantly affect their labour force participation, irrespective of whether or not their predicted wage is included in the probit regression. The marital status of the older female is important in determining their labour force participation. Widowed and single 50-70 year old females are significantly less likely to participate in the labour market than married older women. This latter finding is not significant when the predicted wage is included in the probit regression. For widows this may link to their entitlement to at least part of their former partner's pension.

Housing status is important for both older men and women. For older men having a house that is owned outright significantly reduces the likelihood that they will participate in the labour force compared to older men who rent their property. For women the same is true when the predicted wage is left out of the estimation but not when it is included.

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[99] Health is measured here using subjective data so it may be that there is a causation issue here, so for example those who do not wish to work will report their health as poor so as to have a reason for not working rather than poor health actually leading to an increased probability of not working. This unobserved heterogeneity could be a major problem but the discussion of these results assumes that the use of the subjective measure of health is valid.

Table 4.3: The determinants of labour force participation of 50-70 year olds.

Labour force participation	Men A		Men B	
	Coefficient	Standard error	Coefficient	Standard error
Highest educational qualification				
Other	-0.070	0.088	-0.074	0.088
GCSE	0.003	0.082	-0.0003	0.082
A-level	-0.263	0.101***	-0.246	0.099**
Degree	-0.197	0.081**	-0.149	0.062**
Health status				
Poor	0.515	0.203**	0.517	0.203**
Average	0.987	0.194***	0.988	0.194***
Good	1.243	0.193***	1.244	0.193***
Very Good	1.279	0.197***	1.279	0.197***
Marital status				
Widowed	0.017	0.142	-0.022	0.142
Divorced/separated	-0.043	0.099	-0.046	0.099
Single	-0.113	0.102	-0.115	0.101
Previous employment status				
Employed	-0.291	0.074***	-0.289	0.074***
Unemployed	-1.295	0.101***	-1.293	0.101***
Retired	-2.834	0.084***	-2.830	0.084***
Long term sick/Other	-3.172	0.112***	-3.172	0.112***
Housing status				
Mortgage	0.113	0.076	0.116	0.076
Owned	-0.160	0.071**	-0.156	0.071**
Personal regressors				
Age	-0.230	0.110**	-0.223	0.109**
Age-squared	0.001	0.0009	0.001	0.0009
Number of children	-0.052	0.064	-0.052	0.064
Spouse retired	-0.336	0.080***	-0.336	0.080***
Other income	-0.0002	0.0001**	-0.0002	0.0001**
Log wage	0.040	0.043		
Wave dummy variables included	YES		YES	
Region dummy variables included	YES		YES	
Number of individuals	1531		1531	
Number of observations	7786		7786	
Wald	3371.67		3370.12	

Notes: Column A presents the results when the log of predicted Wage is included in the regression, while column B omits log predicted Wage. The omitted variables are: no qualifications, health very poor, married, rented accommodation and previous employment status self-employed. *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

Table 4.4: The determinants of labour force participation of 50-70 year olds: With predicted wages

Labour force participation	Women A		Women B	
	Coefficient	Standard error	Coefficient	Standard error
Highest educational qualification				
Other	-0.048	0.077	-0.059	0.078
GCSE	0.046	0.065	0.085	0.064
A-level	-0.072	0.124	0.251	0.114**
Degree	1.232	0.145***	0.121	0.058**
Health status				
Poor	0.398	0.177**	0.384	0.174**
Average	0.718	0.168***	0.705	0.165***
Good	0.947	0.166***	0.938	0.163***
Very Good	1.075	0.172***	1.056	0.169***
Marital status				
Widowed	-0.181	0.078**	-0.148	0.077**
Divorced/separated	0.064	0.080	0.087	0.079
Single	-0.241	0.123**	-0.198	0.121
Previous employment status				
Employed	0.139	0.091	0.130	0.090
Unemployed	-1.172	0.137***	-1.202	0.136***
Retired	-2.577	0.103***	-2.579	0.102***
Long term sick/other	-2.482	0.100***	-2.498	0.099***
Housing status				
Mortgage	0.083	0.069	0.067	0.068
Owned	-0.085	0.064	-0.118	0.063*
Personal regressors				
Age	-0.115	0.099	-0.234	0.098**
Age-squared	0.0006	0.0008	0.001	0.0008*
Number of children	-0.103	0.082	-0.080	0.081
Spouse retired	-0.318	0.061***	-0.304	0.060***
Other income	-0.0001	0.00003**	-0.0001	0.0000***
Log wage	-0.528	0.063***		
Wave dummies included	YES		YES	
Region dummies included	YES		YES	
Number of individuals	1820		1820	
Number of observations	8959		8959	
Wald	4098.31		4192.17	

Notes: See Table 4.3

Of the main areas of interest, other income affects the labour force participation of older men, and having a spouse who is retired also significantly reduces the likelihood that a 50-70 year old male will participate in the labour force. For an older woman both other income and having a retired spouse significantly reduces the likelihood that they will participate in the labour force.

An older male's predicted wage does not significantly contribute to their labour force participation decision according to the results in table 4.3. For women the results suggest

that the greater your predicted wage the less likely you are to be participating in the labour force. Those who were self-employed in the previous year are significantly more likely to be participating in the labour force than those who reported being unemployed, retired or long-term sick. For men those who were self-employed in the previous year are also significantly more likely to be working than those who were employed. This may be because those who are self employed will be more likely to be working in an occupation that they enjoy.

These results highlight the importance of health in the labour force decision of older workers. The unhealthier you are the less likely you are to be participating in the labour force. For women increased educational attainment increases the probability of being in the labour force, while the opposite is true for older men. Having a spouse who is retired also significantly reduces the likelihood of you participating in the labour force. This suggests that any policy that attempts to increase the labour force participation of one particular gender may not be successful as the decisions of spouses' affect the decisions of individuals. Of course the opposite could also be true as if one spouse were to stay on longer in the labour force than they otherwise would have done then this would increase the labour force participation of the other spouse who would base their labour force participation decision on the retirement status of their spouse. The greater is other household income the significantly less likely an older individual is to participate in the labour force. This would be as expected, *a priori*, as the greater the unearned income the less likely an individual should be to participate in the labour force.

4.4.2: The labour supply of older workers

The results of estimating a labour supply equation using random effects tobit regression are presented in table 4.5. Table 4.5 present the results of the hours of work equation for both 50-70 year old men and women respectively, with male results in the first column

and female results in the second column. The results of the same random effects tobit estimation procedure for younger workers are included in the appendix to this chapter.[100]

The results for 50-70 year old men suggest that while labour force participation is not dependent on age, the number of hours a week that they work is significantly affected by age, with hours of work increasing as a man grows older but at a decreasing rate. Interestingly education levels have no effect on older males hours of work, and so these results coupled with the results in table 4.3 suggest that older males with greater levels of education are significantly less likely to participate in the labour market, but any hours of work decision is not affected by education. In other words once the decision to work has been made the level of qualification an older male has does not affect the number of hours they will work.

The results also highlight that the number of children under 18 in the household and if your spouse is retired are not significant factors in determining an older male's work hours. These and the results in table 4.3 suggest that older men are not influenced at all in their work decision by either their children in their labour supply decisions, but having a retired spouse affects their labour force participation decision, but not their hours of work. Once a male whose wife is retired has decided to participate in the labour force, their choice on the number of hours they work is not affected by their retired spouse.

Older men who are divorced or single are significantly more likely to work fewer hours than those who are married. So divorced and married older men are not affected differently in their labour force participation decision but divorced men will work fewer hours once they have decided to participate. Single older men are significantly less likely to participate in the labour force and even if they do will work fewer hours than married older men.

An older man's previous employment status is significant in affecting their work hours decision. Men who were self employed in the previous year are significantly more likely

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[100] The appendix to this chapter can be found at Page 144 of this thesis.

to work longer hours than those who reported their job status as long term sick or other. Also those who were employed or unemployed in the previous year are significantly more likely to work more hours than those who were self employed in the previous year.

An older male who lives in a house that still has a mortgage is significantly likely to work more hours compared to an older male who is renting while those who own their house outright will work similar hours to older men who rent their accommodation. So these results when combined with the results in table 4.3 suggest that older men who own their house outright will be less likely to participate in the labour force than older male renters but once they do participate they will work similar hours to those who rent.

The results also show that higher hourly wages positively affect hours of work but this affect is not significant. This and the results on the labour force participation of older men suggests that wage changes for older men do not affect either their participation in the labour force or their hours of work once they have decided to work.

Equivalised other household income significantly decreases the number of hours worked by older men. The greater the household income of an older man the less hours they will work. Therefore household income is an important determinant both in the labour force participation decision and decision on how many hours to work once an older male has decided to supply their labour.

Reported health status does not seem to be a large factor in the number of hours an older male will work. Having reported your health as poor you are significantly likely to work fewer hours than those who reported their health as very poor, while those with good health are significantly more likely to work more hours than those with very poor health. However, these are not strong results and are only significant at the 10% level. Again for older men health status affects the participation decision greatly but has less effect on the number of hours an individual will work.

Table 4.5: The determinants of weekly hours of work for older individuals

Weekly Hours of Work	Men Random effects tobit Coefficient	Standard error	Women Random effects tobit Coefficient	Standard error
Highest educational qualification				
Other	0.051	0.132	0.198	0.088**
GCSE	-0.119	0.114	0.217	0.067***
A-level	-0.187	0.143	0.423	0.118***
Degree	-0.125	0.109	1.639	0.147***
Health Status				
Poor	-0.498	0.290*	0.312	0.217
Average	0.402	0.270	0.620	0.205***
Good	0.445	0.269*	0.844	0.203***
Very Good	0.355	0.273	0.966	0.207***
Marital status				
Widowed	0.124	0.231	0.040	0.090
Divorced	-0.426	0.157***	0.010	0.083
Single	-0.395	0.166**	0.033	0.141
Previous Employment status				
Employed	4.849	0.126***	4.160	0.134***
Unemployed	1.601	0.163***	1.300	0.203***
Retired	-0.059	0.154	-0.547	0.159***
Long term sick/other	-1.009	0.230***	-0.395	0.151***
Housing status				
Mortgage	0.236	0.108**	0.201	0.072***
Owned	-0.031	0.108	-0.075	0.070
Personal regressors				
Age	0.262	0.139*	0.095	0.111
Age-squared	-0.003	0.001***	-0.001	0.0009
Number of children	-0.086	0.070	-0.115	0.087
Spouse retired	-0.127	0.119	-0.302	0.072***
Other income	-0.035	0.009***	-0.025	0.009***
Log Wage	0.072	0.052	-0.807	0.068***
Wave dummies included	YES		YES	
Region dummies included	YES		YES	
Constant	-6.491	4.072	0.149	3.252
Number of individuals	1526		1817	
Number of observations	7698		8879	
Wald	3687.73***		5919.70***	

Notes: The omitted variables are the same as omitted from the analysis of section 4.4.1 (see notes of table 4.3). *, **, and *** indicate significance at the 10%, 5% and 1% levels respectively.

The results for older women show that education levels significantly affect the hours of work decision, with those who have qualifications significantly more likely to work more hours than older women with no qualifications. So education levels play an important role in determining the number of hours worked by older women rather than in the labour force participation decision which suggests only those with higher levels of qualifications will be significantly more likely to participate in the labour force than those with no qualifications.

Age does not affect the number of hours worked decision of older women, nor does the number of children aged under 18 living the house or the marital status of an older woman. These findings and the results of table 4.4 suggest that the number of children living in the house plays no part in an older woman's labour decisions, while an older woman who is widowed or single is significantly less likely to participate in the labour force than a married older woman but once they participate their marital status has no bearing on their hours of work.

Older women who were employed or unemployed in the previous year are more likely to work more hours than women who were self-employed in the previous year. Those who were retired or were long-term sick or other are more likely to work fewer hours than those who were self-employed. These results combined with those in table 4.4 suggest that there is a negative effect on the labour force participation of those older women who were unemployed, retired or long term sick in the previous year when compared to those who were self employed, however once the decision to participate has been made those who were unemployed are likely to work more hours than those who were self employed while the retired and long term sick will work fewer hours.

Unlike their male counterparts, older women's work hours choices are affected by their spouse being retired and their health status. If their spouse is retired, an older woman is less likely to participate in the labour force and will work fewer hours if they do supply their labour. Health also plays a crucial role for women in their work hours decision. Having a reported health status as average or above increases the number of hours an older woman will work compared to an older woman who reports their health as very poor, *ceteris paribus*.

Like their male counterparts, older women are significantly affected by other household income and their housing status. Older women will work significantly fewer hours the greater is their equivalised other household income. Living in a property that still has a mortgage will lead to an older woman working significantly more hours than an older

woman who is living in a rented property while those living in a house they own outright have no difference in work hours compared to renters. The results also suggest that the greater the predicted wage of older women the fewer hours of labour they will supply. A wage increase for older women will decrease labour force participation and the number of hours they will work.

4.4.3: Wage elasticity and income elasticity of work hours

The respective wage and other household income elasticities of weekly working hours for those who are in work are presented in table 4.6. The wage elasticity of work hours for older working men 0.022 but is not significantly different from zero. The wage elasticity for younger working men is -0.156 and suggests that a 10% rise in wages will lead to a fall of around 1.6% in hours worked. So at the mean hours worked for younger men who have positive hours of work, 39.65 hours, this suggests that a 10% rise in wages will lead to a decrease in working hours of 0.62 hours per week, or around 32 hours per year.

To examine whether or not older and younger men or women have different responses to wage and other household income changes it is necessary to pool together the analysis again using a random effects tobit model including interactions of a binary variable indicating if the individual was over 50 years of age or not. From the results of this it is then necessary to test the restriction that the difference between the coefficients on the variables of interest of younger and older workers is equal to zero. Table 4.7 presents the test statistics from estimating the restriction on the pooled samples of men and women. What is shown is that *younger male workers are significantly more responsive in their work hours' decision to wage changes than their older counterparts*. However, it must be noted from table 4.6 that the overall effect is very small.

Table 4.6: Wage elasticity and other income elasticity of work hours for workers

Group	Wage		Other income	
	Coefficient	Z-stat	Coefficient	Z-stat
Men 24-49	-0.156	-6.98***	-0.019	-9.24***
Men 50-70	0.022	1.40	-0.011	-3.79***
Women 24-49	-1.377	-42.65***	-0.011	-4.62***
Women 50-70	-0.228	-11.81***	-0.007	-2.89***

Notes: *, **, and *** indicate significance at the 10%, 5% and 1% levels respectively. The respective elasticities are calculated at the sample means.

Table 4.7: Test statistics of equality of responses by older and younger workers

Group	Wage		Other income	
	Coefficient	Prob > χ^2	Coefficient	Prob > χ^2
Men	57.57	0.0000***	3.45	0.0631*
Women	1566.66	0.0000***	4.03	0.0447**

Notes: The table shows the test statistics of the test that the difference between the two coefficients on wage or other income for younger and older men or women is equal to zero, and is compared against the χ^2 distribution with 1 degree of freedom. *, **, and *** indicate significance at the 10, 5 and 1% levels respectively.

Older women are less responsive to wage changes than their younger counterparts. *Again the difference between younger and older female workers wage elasticity of work hours is significant.* The results suggest that a 10% rise in wages would lead to a 2.3% decrease in work hours for older females. At the mean levels for older females a 10% wage rise would lead to a decrease in work hours of around 0.61 hours a week, nearly 32 hours per year. Younger women have a wage elasticity of -1.377 and this suggests that the same increase in wage for younger women of 10% would lead to fall in working hours of over 4 hours per week, or 210 hours per year.

Looking at the other household income elasticity of work hours for men, it can again be seen that older working men are less responsive to changes in other household income elasticity, although this finding is only significant at the 10% level. Older working women are also significantly less responsive to other household income changes than

their younger counterparts. For younger men a 10% increase in other household income, which at the mean would be a rise of just over £13 per person per month, would lead to a fall in working hours of almost 4 hours per year, while the same figures for older men would be a £18.63 increase in equivalised household income per month which would decrease working hours by 2 hours per year. For younger women a 10% increase in other household income of £31 per person per month would lead to a fall in working hours of nearly 1.7 hours per year. The same figures for older women would be a £35.56 increase in equivalised other household income per month and this would lead to a decrease in working hours of 1 hour per year. In all cases the other income elasticity of work hours is very small and the difference made by increases in income on work hours is minute. Therefore only very large changes in other household income are likely to make marked changes in hours of work.

Of course all of these findings must be taken with a degree of caution. The estimation procedure for examining the labour supply of older and younger workers assumes that there is no correlation between the error term in the estimated wage equation and the error term in the labour supply equation. However, what is more than likely to be true is that these two error terms will be correlated because of selection bias and so the predicted wage included in the labour supply equation is likely to be endogenous which will mean the estimated coefficients are inconsistent.

4.4.4: Policy discussion of labour force participation and labour supply results

What are the implications of these results for policy decisions regarding the labour force participation decision of older individuals in the UK? The results suggest that health, previous employment status and the retirement status of spouses are important factors in the labour force participation decisions of both older men and women.

The current policies that are aimed at older workers in the UK include removing any age barriers to work, helping older workers getting back into work and increasing the

state retirement age. Certainly the results back these policies. The current policy of helping older individuals get back into work is vindicated by the results, which indicate that previous employment status is a significant factor in the labour force participation decision. Also increasing the state retirement age is likely to increase the labour force participation of older workers as the results highlight that having a spouse who is retired significantly reduces the likelihood of participating in the labour force.

With regards to the wage elasticity and other income elasticity of work hours, older workers do have significantly different responses to changes in wage and to changes in other household income. Both older working men and women are less responsive to wage changes than their younger counterparts and therefore policy could be formulated to take advantage of this. For example tax cuts to increase the effective wage of workers would decrease the labour supply of younger male workers and all female workers, but not older male workers, who are unresponsive to wage changes. Also the fall in labour supply of older women will be less strong than the fall in labour supply of younger women. So a decrease in the non-taxable level of income for example would increase the labour supply of older workers. Older working men and women are also less responsive to other household income changes than their younger counterparts but all working individuals have a fall in labour supply as other income increases. This finding indicates that if the government wants to keep older workers in employment then they should delay payments of unearned income. Therefore the government policy to increase the state pension age will therefore have an added effect of not increasing other household income for an individual approaching the previous retirement age and they will therefore should maintain their labour supply rather than cut it back. Also the recent government policy of pension deferrals could lead to a similar effect.

4.5: Conclusion

With an ever ageing population in the UK it is important that policy and empirical discussion be focussed on the issues that this generates. Pensions and the well being of older individuals in the economy is one important area that should be highlighted, but these are left to later chapters of this thesis. Another important area is the labour supply of older individuals, and this current chapter has investigated the determinants of labour force participation of older individuals in the UK. The results have indicated the great importance in health in the labour force participation decision. The results also give initial evidence that having a retired spouse significantly reduces the likelihood of an older individual participating in the labour force. Further investigation within a more formal framework for the UK is needed to further cement this finding, possibly following the example of Gustman and Steinmeier (2000). Education attainment and other household income also affect the labour force participation decision of older workers, with the former reducing the likelihood of older males participating in the labour force but increasing the likelihood of participation of older females, while the latter significantly reduces the likelihood of labour force participation of all older individuals.

The chapter then continued with an estimation of the wage elasticity and income elasticity of work hours for older and younger men and women. To do this a model of labour supply was needed that allowed for the censoring of the observed hours of work of individuals at zero. A random effects tobit model was developed and estimated to allow for the censoring of the observed hours of work. The results highlighted that older working men are significantly less wage responsive in their work hours decision than younger male workers, while older working women are less wage responsive than their younger counterparts in their work hours decision. The estimated other household income elasticities of work hours were very small and highlighted that only very large changes in other income would impact substantially on the work hours decision of all

workers, but that there were significant differences in the other household income elasticity between age groups, with younger workers being more responsive in their supply of labour to other income changes.

What are the avenues that could be taken to extend this work further? Firstly the work of this chapter could be extended to control for the selection bias that is apparent in the data. Use of the procedure suggested by Heckman (1979) would go some way to do this.[101] A second way in which this thesis could be extended would be to use the model developed by Lundberg (1988) that was outlined in chapter 2 to ascertain which is the correct modelling of older workers labour supply. Use of this model would require a larger number of older couples to be present in a dataset and the English Longitudinal Study of Ageing (ELSA) is a national survey of older people which now has multiple waves of survey data. Future work using this or another dataset with similar personal information to the BHPS could examine the labour supply of older workers. First it would be useful to split the sample of older couples into sub-samples based on their pension scheme membership so that the effects of pensions on the labour supply of the older worker can be examined.[102] Secondly, by comparing a younger sample of married couples to a sample of nearing retirement age couples, it would be possible to assess whether or not the influence of spouses' work is larger the closer retirement is. If this is the case then it is likely that the retirement decision is made between a household and not individually.[103]

Overall this chapter has outlined important differences in the labour supply of older workers when compared to younger workers and has provided an analysis of relevant and

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[101] See footnote 98 for a brief outline of the Heckman procedure to correct for selection bias.

[102] The sample could also be split according to other personal traits such as the level of their wage and trade union membership.

[103] An alternative procedure that may be carried out would be to split the sample according to age difference in the marriage. If there are stronger labour supply effects of partner's working tendencies in the couples that are closer in age then this too would tend to support the theory of married couples planning their respective retirement decisions together. This type of analysis will depend on the sample sizes however.

up to date data that extends previous work in the UK on older workers labour supply in particular.

Appendix – Chapter 4

Table A4.1: The determinants of working hours for younger men and women aged 24-49

Weekly Hours of Work	Men Random effects tobit		Women Random effects tobit	
	Coefficient	Standard error	Coefficient	Standard error
Highest educational qualification				
Other	0.492	0.120***	-0.811	0.077***
GCSE	0.788	0.104***	0.637	0.064***
A-level	0.301	0.106***	0.487	0.070***
Degree	0.650	0.088***	-0.555	0.067***
Health status				
Poor	0.238	0.107**	0.462	0.094***
Average	0.537	0.105***	0.739	0.091***
Good	0.614	0.105***	0.847	0.090***
Very Good	0.627	0.107***	0.887	0.092***
Marital Status				
Widowed	-0.450	0.326	0.177	0.120
Divorced	-0.200	0.061***	-0.090	0.045**
Single	-0.187	0.045***	0.017	0.051
Previous employment status				
Employed	2.919	0.103***	2.579	0.071***
Unemployed	1.272	0.068***	1.425	0.092***
Retired	-0.278	0.346	-1.233	0.072**
Long term sick/other	0.435	0.081***	0.865	0.048***
Housing Status				
Mortgage	0.246	0.040***	0.448	0.037***
Owned	0.150	0.052***	0.188	0.055***
Personal regressors				
Age	0.056	0.019***	0.146	0.020***
Age-squared	-0.0009	0.0003***	-0.0025	0.0003***
Number of children	-0.061	0.014***	-0.413	0.016***
Spouse retired	-0.079	0.159	-0.421	0.113***
Other income	-0.025	0.003***	-0.016	0.004***
Log Wage	-0.201	0.029***	-2.050	0.048***
Wave dummies included	YES		YES	
Region dummies included	YES		YES	
Constant	-1.289	0.372***	-0.326	0.397
Number of individuals	3376		3663	
Number of observations	18190		21452	
Wald	2727.52***		8142.77***	

Notes: See Table 4.3

A descriptive analysis of the movement into retirement

5.1: Introduction

When does an individual retire and what does the retirement process look like? This chapter of the thesis will aim to answer these two questions by looking descriptively at the movement into retirement using a British dataset. For the UK there has been some debate as to whether or not the retirement process is a gradual or sudden move. Bardasi *et al.* (2002) support the former, while Meghir and Whitehouse (1997) and Webb (1997) support the latter process.

As outlined in chapter 1 of this thesis, retirement and the movement into retirement are areas that are currently topics of increasing importance. The increase in the female state pension age from 60 to 65, the possibility of an increase in stage pension age in the future, the ability for individuals to defer their state pension and continue working and the New Deal 50 Plus that helps those over 50 who are out of work but want to return to work are all policies which will mean a change in the retirement process for the UK.[104] As such it is important to be able to examine the movement into retirement by individuals over time to analyse any changes that are occurring.

To achieve the aims of this chapter attention is first drawn to recent empirical work on UK data on the process of retirement, before the process of how the dataset is acquired is discussed. Next we will analyse the economic activity rates of the older worker and in so doing appraise the first research question for the chapter. This is achieved specifically in three ways: Firstly the basic economic activity rate of the older worker is discussed, detailing how people move out of the labour market, and assessing whether the process of retirement is a gradual or sudden decision; secondly the focus will shift to examining

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[104] For a more comprehensive discussion of these policies see chapter 1.4.

whether there are any changes in economic activity rates across time. This will be achieved by looking at groups of same age individuals in different pooled wave cohorts and by looking at different aged individuals from the same set of waves; thirdly the economic activity rates of men and women are analysed to note any differences and to see if there are any time trends when the data is disaggregated a level. The findings of all these analyses are discussed and the chapter finishes with a brief conclusion.

5.2: UK Empirical Studies

The evidence on the retirement process from UK empirical studies has already been reviewed in chapter 3 of this thesis and so this chapter will merely offer a brief reminder of the evidence and discuss the findings of Banks and Smith (2006).[105] For instance Webb (1997) and Meghir and Whitehouse (1997) adhere to retirement being a sudden move from one state to another, while Bardasi *et al.* (2002), using the BHPS as their dataset, argue that retirement is a gradual process.

Banks and Smith (2006) also look at the retirement process to analyse whether the movement into retirement for individuals is a sudden movement or a gradual process. They present figures of the working hours of men and women in the run up to retirement as evidence that highlights that retirement is a sudden transition from work to leisure. The figures presented indicate that there is a 7 hour drop in average weekly hours worked for men in the 10 years before retirement while for women there is a smaller drop as a larger proportion of women work part time.

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[105] Specifically see chapter 3.4.2 for a discussion of whether or not retirement is a gradual process.

5.3: Data

The British Household Panel Survey (BHPS) is used to analyse the movement into retirement using descriptive analysis. The BHPS is a nationally representative survey of randomly selected households with the first wave of interviews taking place in 1991.[106]

To begin all those that are identified to have retired while being part of the BHPS are included in the starting dataset. People aged 55 in waves 1-4, 5-7 and 8-10 respectively are then pooled together, and their job status at each year from the age of 55 is noted. The sample is then restricted to consist only of all individuals who were fully interviewed each year on and after the year of their 55th birthday.[107] For waves 1-4 we have a dataset of 268 55 year olds, for waves 5-7 272 individuals and for waves 8-10 302 individuals. Economically inactive includes all those who classed themselves as retired, long term sick or disabled, caring for family members, in full time education or those that classed themselves as 'other' when asked of their job status, while economically active people are those who classed themselves as self employed, employed or unemployed.[108]

5.4: The economic activity of the older person

The first stage of the analysis is to highlight the economic activity of pooled cohorts of workers across time using the BHPS. In doing so it is hoped that we can shed some light on how the retirement process takes place and when an individual retires. In the UK there has been some debate on whether retirement is a gradual process or a sudden one.

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[106] For a full discussion of the BHPS and see chapter 1.5 and also see Taylor (2001)

[107] For example, an individual who turned 55 on the 1st September 1995 and who was interviewed in the year of, and each year after, their 55th birthday would be included in the pooled cohorts of waves 5-7. An individual who turned 55 on the same day but who was not interviewed in wave 8 is not included in the sample.

[108] Job status is self reported in the full interview for the survey. The major problem with self reported findings is that some individuals may not yet want to class themselves as retired, and so state some other description as their current job status. Therefore it is of more use to examine economic activity rates than retirement rates. For a discussion of this issue see Banks and Smith (2006).

The next step is to split the sample by gender to examine whether there are any differences between men and women in their leaving the labour force, and then finally to examine individuals of different ages from the same set of waves to further analyse if there are any time trends in the movement out of economic activity.

5.4.1: Economic activity of a pooled wave of cohorts

Figure 5.1 highlights the economic activity rates by age of the individuals aged 55 pooled by waves. The main result that can be discerned from this graph is that the movement out of the labour market seems to be a **gradual process** at an aggregated level. However, there is relatively greater exit from economic activity at the ages of 60 and 65, which are the ages at which a woman and man become eligible for their national pension entitlements respectively. Not much information can currently be deciphered from the results of waves 8-10, for whom every member of the cohort sample has yet to reach 60 years of age.

What is also clear from the figure is that from the age of 55-60 there is little difference in the economic activity rates between the pooled cohort waves. Taking the figures for the cohorts of 55 year olds from waves 1-4, at age 55 just over 73% of the sample are economically active. This activity rate falls steadily up to the age of 59 where there is an activity rate of 57%. However, the figure does provide some evidence of a change across time in the economic activity rate in the years thereafter. From age 59 until 62 there is a larger activity rate for those cohorts aged 55 in waves 5-7 than those in waves 1-4. For example at age 60, the economic activity rate of the waves 1-4 cohorts is almost 43% while the rate for the waves 5-7 cohorts is 50%. However, the difference in size of the economic activity rates is only significantly different at the 10% level at the age of 60. So figure 5.1 suggests both a gradual process in the movement out of economic activity at an aggregate level and a change in economic activity rates across time.

Figure 5.1: The percentage of the sample economically active by age
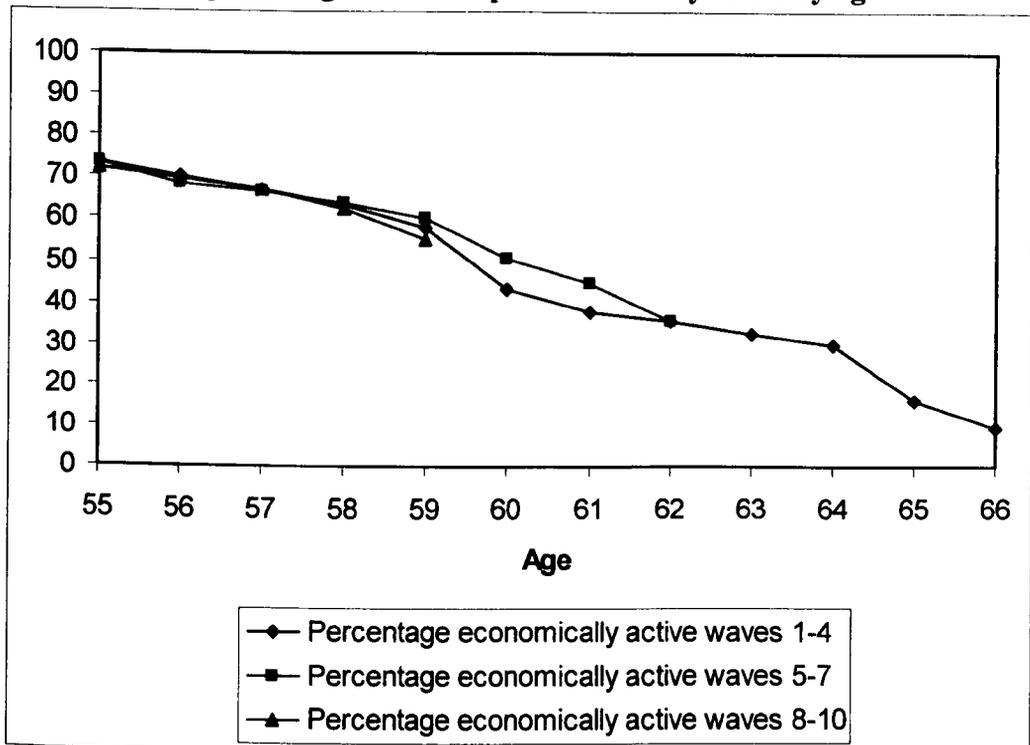
*Notes: Only those that were **fully** interviewed in the year of their 55th birthday and each year thereafter are included in the sample. For waves 1-4 54.1% of the sample were female, for waves 5-7 the figure was 54.0% and for waves 8-10 56.6%. The sample sizes reduce at certain ages for each set of waves. For waves 1-4 the sample falls to 191 (53.4% female) at age 64, 123 (55.2%) at age 65 and 62 (48.39%) at age 66. For waves 5-7 the sample is 163 (53.4% female) at age 61 and 73 (52.05%) at age 62. For waves 8-10 the sample size reduces to 187 (55.6% female) at age 58 and 85 (49.41%) at age 59.*

5.4.2: Economic activity rates of men and women

Figures 5.2 and 5.3 present the economic activity rates of pooled wave 55 year old cohorts by gender. Figure 2 highlights a lower economic activity rate amongst women aged in their late 50's as the 1990's progress. However, the only significant difference in economic activity rates occurs at aged 58 where the 55 year olds from waves 8-10 have a lower activity rate than both sets of 55 year olds from the other pooled waves, at the 10% level of significance. Figure 3 on the other hand tells us that men's economic activity in their late 50's has increased as the 1990's have progressed. At the age of 58 there is a significant difference in the economic activity rates of the waves 8-10 cohorts and both the wave 1-4 cohorts and wave 5-7 cohorts, at the 5% and 10% level of significance respectively. At the age of 60 and 61 there is a significant difference in the economic

activity rates of wave 5-7 cohorts and wave 1-4 cohorts at the 5% and 10% significance level for each age respectively.

Again the gradual process of exit from economic activity for workers as a whole seems to be being put across in both these figures. Women's economic activity rates fall from the most at ages 59 and 60, but again the slope of the fall in the economic activity rate is not extremely steep. For men there is a steep decline in economic activity for between the ages of 64 and 65, but from the age of 55 to the age of 63 economic activity declines from nearly 85% to just under 45%. From age 63 to 65 the rate falls from 45% to 22%. So for men there may be a process of retiring for retirement's sake once they have reached the their mid 60's, however there is still a personal decision process in action up to this age as each man decides at what age they will retire.

Figures 5.1-5.3 and the discussion above have highlighted the economic activity rates of 55 year old cohorts by pooled waves. The figures have shown that there are slight differences across waves, indicating slight trends across time in economic activity. The figures also point to the retirement process as an individual decision which is based on the feelings that individuals have and the situations they face. There is no common decision on retirement, it is a heterogeneous decision made by each person, and as such for each individual the onset of retirement could be either sudden or gradual.

Figure 5.2: Economic activity rate of 55 year old female cohorts by wave
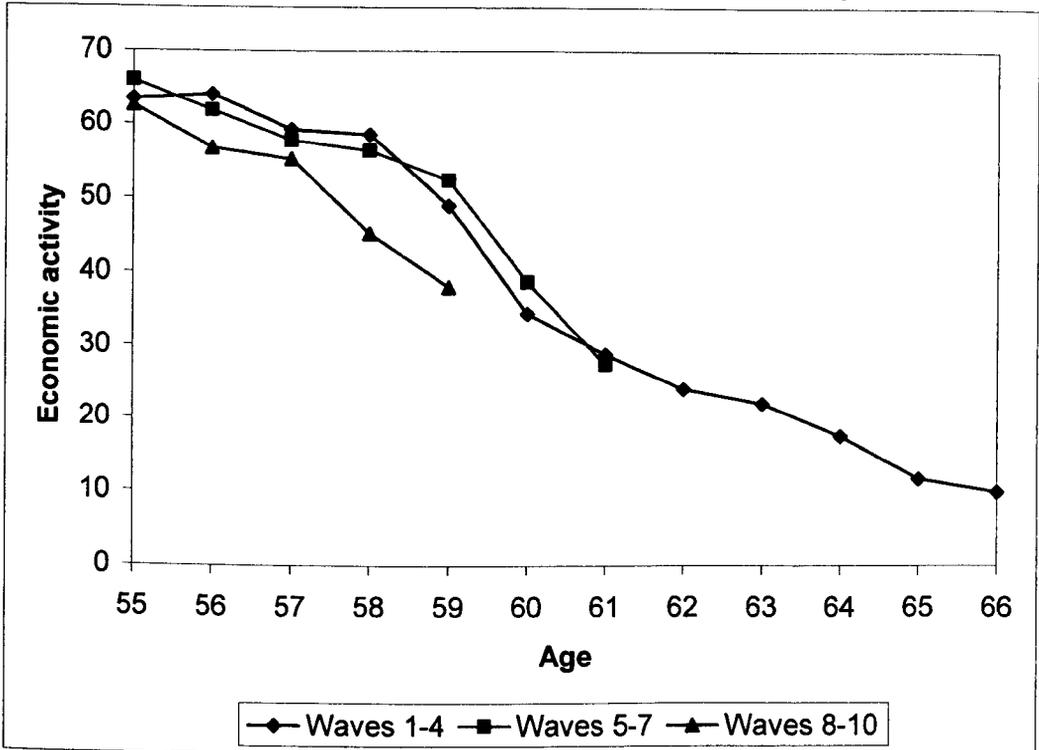
Figure 5.3: Economic activity rate of 55 year old male cohorts by wave
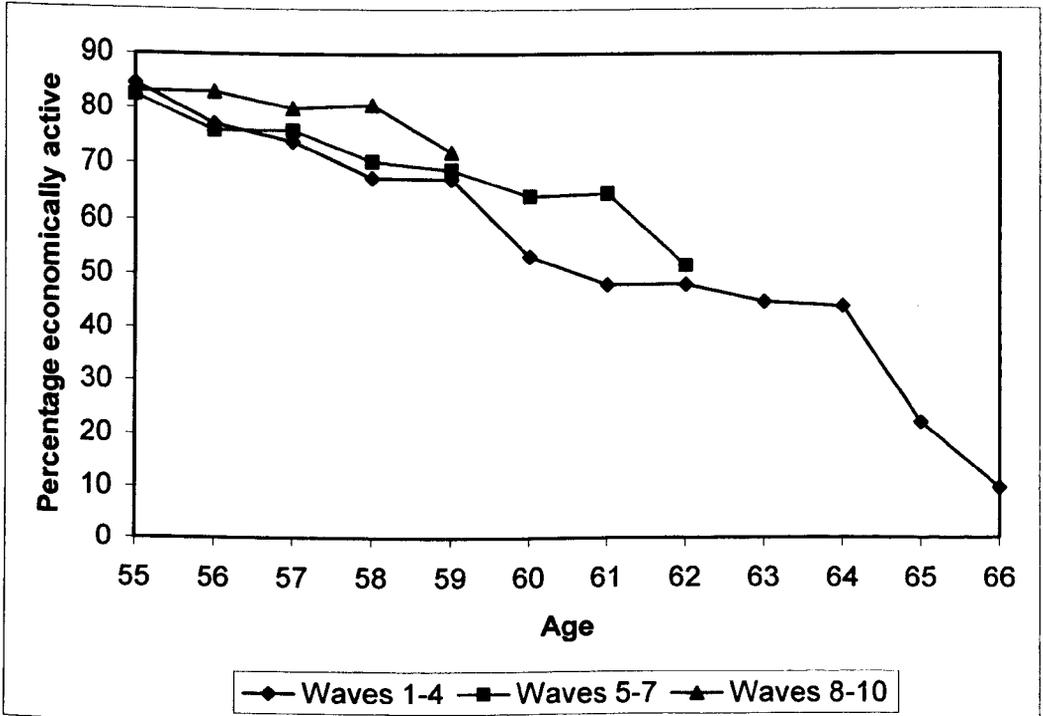
<u>5.4.3: Further analysis of time trends in economic activity rates</u>

To further examine any trends in economic activity, figures 5.4, 5.5 and 5.6 highlight the economic activity rates of 52-53, 54-55, 56-57, and 58-59 year old cohorts in waves 1 and 2 as a whole and by gender. For this part of the analysis the individual must only have been aged 52 or 53 for example in either of waves 1 or 2. All respondents in waves 1 and 2 are then examined across the waves as their age increases. Their participation in all waves is not required, giving varying numbers of observations but a more robust examination of economic activity rates.

Figure 5.4 shows the economic activity rates of the age cohorts as a whole. This diagram perfectly illustrates the gradual process of retirement for older workers as a whole, with the economic activity rate starting in the top left hand corner and finishing in the bottom right hand corner. The largest falls do again occur at the ages of 60 and 65. The diagram also holds some other interesting information. The younger cohorts are less economically active than the older cohorts. For instance between the ages of 59 and 61 there is a significant difference in the economic activity rates of at least one of the younger cohorts and the 58-59 year old cohort.

At 59 years of age both the 54-55 and 56-57 year old cohorts have a lower economic activity rate than the 58-59 year old cohort, which is significant at the 5% level in both instances. At age 60 all three younger cohorts have a significantly lower economic activity rate than the 58-59 year old cohort, while at age 61 the 54-55 year old cohort has a slightly significant lower economic activity rate than the 58-59 year old cohort.

At aged 60 the economic activity rates of the 52-53, 54-55 and 56-57 year old cohorts is around 43%, while for the 58-59 year old cohorts the economic activity rate is 54%. Do these figures indicate that there been a change in attitudes towards working in later life during the 1990's? Also is this attitude changing back, as the 52-53 year olds actually have the closer levels of economic activity to the 58-59 year olds? To analyse this further we examine the activity rates by age of men and women.

Figure 5.4: Economic activity by age in waves 1-2
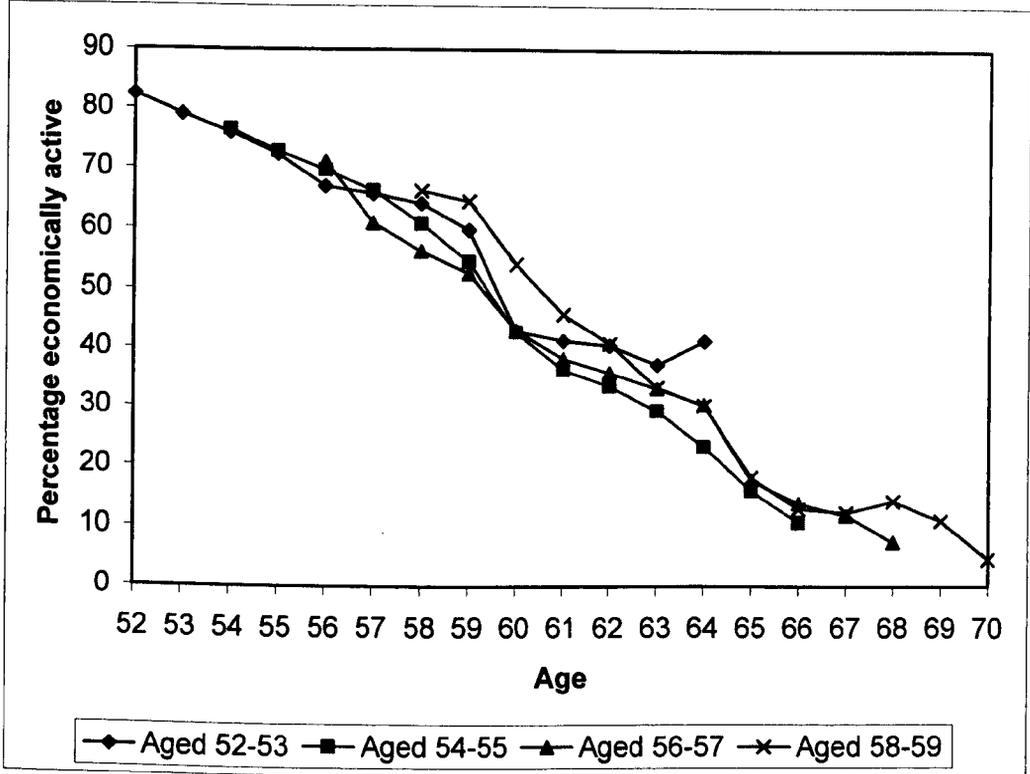
Figures 5.5 and 5.6 highlight the economic activity rates of women and men respectively by age in waves 1 and 2. The former figure both corroborates and negates the findings in the overall picture. The oldest cohort has the highest economic activity rate in their late 50's and early 60's. However at the ages of 57 and 58 the 56-57 year old cohort has a significantly lower, at the 10% level, economic activity rate than the 54-55 year old cohort. In their early 60's however, the 56-57 year olds have a higher economic activity rate than the 54-55 year old cohort, although the difference between the two rates is never significant. The retirement of women at age 60 does seem to have become more of the norm for women, as the two younger cohorts have greater falls in economic activity at this age: almost 16 and 17% falls for the 52-53 and 54-55 year old cohorts respectively compared with falls of around 10% for the 56-57 and 58-59 year old cohorts. However, this point does not imply that the withdrawal from the labour market is a sudden one.

Indeed the fall in the economic activity rate of 60 year old women has just increased as the 1990's have progressed.

Figure 5.6 highlights that men's withdrawal from economic activity is more pronounced than women's, but it still is nowhere near a complete vertical line where every person retires at a given point. The economic activity of the three younger cohorts of men is smaller than the 58-59 year old cohort from the age of 58 to 64, although the difference in activity rates is only significant: at the 10% level at 58 between 54-55 and 58-59 year old cohorts; at 59 there is highly significant differences in the activity rates of the 54-55 and 56-57 year old cohorts and the 58-59 year old cohorts; and at age 60 all three younger cohorts' economic activity rates are significantly different from the 58-59 year old cohort's activity rate at the 10% level.

Figure 5.5: Economic activity of women by age in waves 1-2
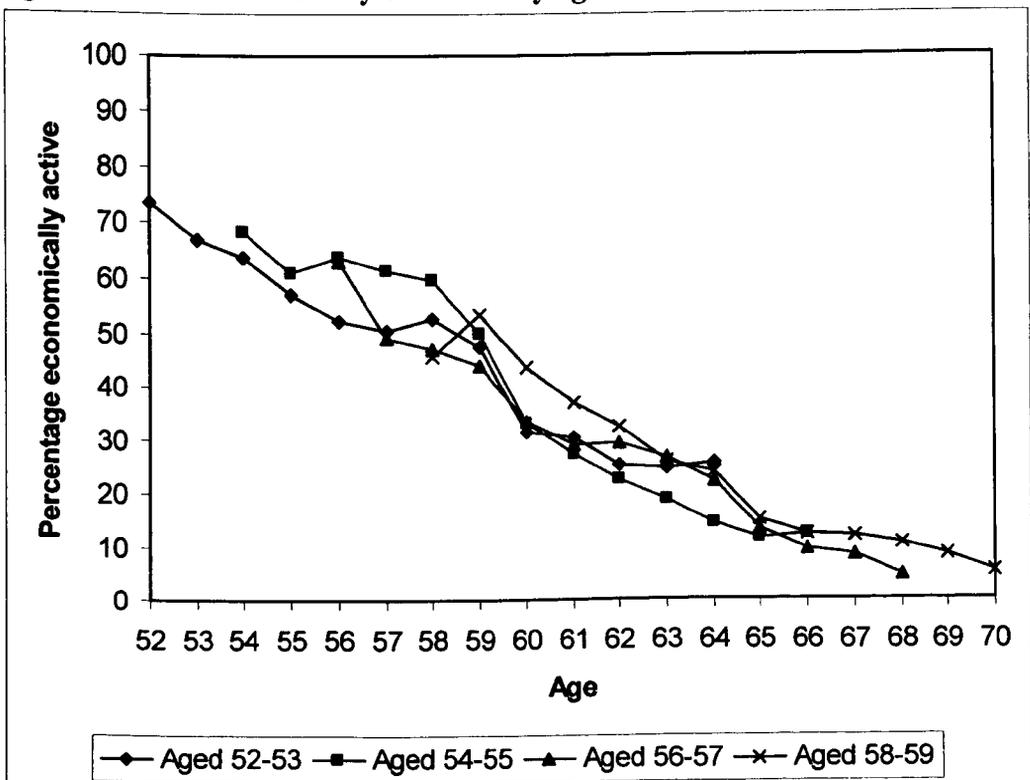
Figure 5.6: Economic activity of men by age in waves 1-2
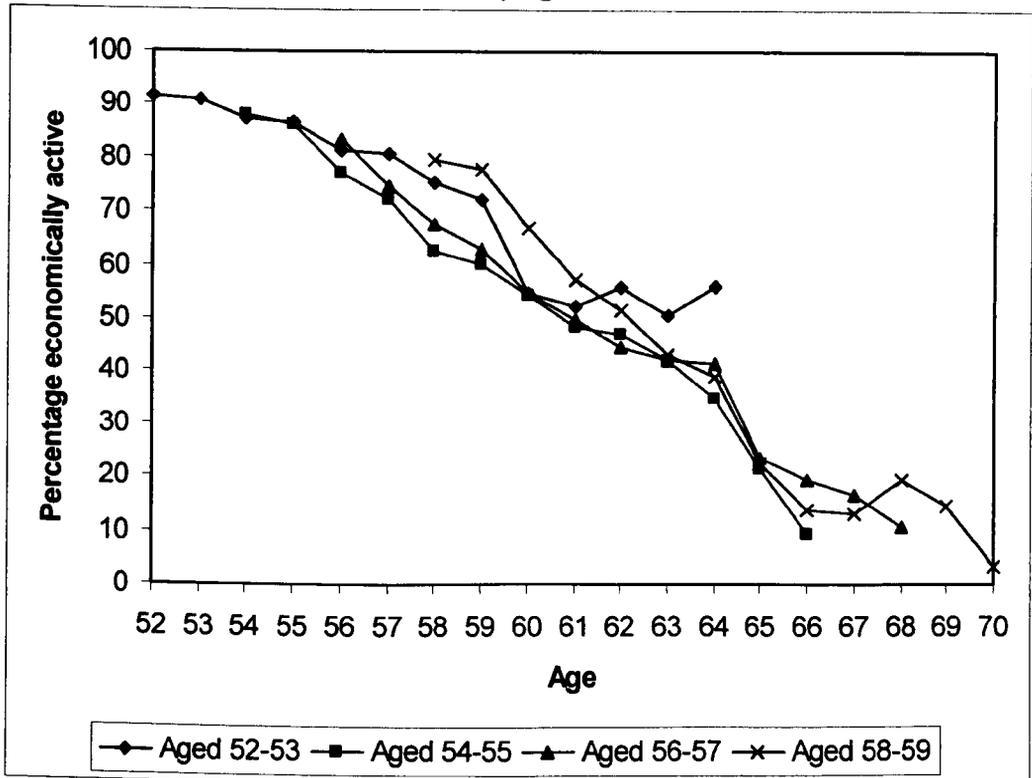
The above three figures seem to indicate a change in attitudes towards withdrawing from the labour market. As the 1990's have progressed early retirement has become more of the done thing, but it still has not really affected the economic activity of those above the age of 60, which has remained fairly constant.

To try and examine the individual decision to retire a little more closely, Table 5.1 presents the number of working hours that individuals worked prior to their retirement and also the proportion of individuals who worked part time in the years before their retirement.[109] While again this is looking at older workers on the whole some facts regarding individuals can be found. The information provided in table 5.1 gives mixed evidence to what has been shown so far in this chapter regarding retirement being a gradual process. The table highlights that workers face a sudden stop to their working hours when they retire, but that there are some changes in the number of hours worked and the proportion working part time as retirement approaches. For men there are small

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[109] Part time work is defined as anyone working less than 30 hours per week.

changes in the percentage of workers working part time and a small fall in the number of hours worked per week on average in the 4th, 3rd and 2nd years prior to retirement. There is a larger change in hours worked per week and the proportion working part time a year prior to retirement with 8% more men working part time compared to a year earlier and the average hours of work falls by almost 2 hours per week.

For women again there are similar changes to men in hours of work and the proportion of women working part time as shown in the 1st three columns of table 5.1. In the year prior to their retirement 5% more women work part time than 2 years prior to retirement, and the average hours of work per week falls by an hour per week on average in the same time period.

So for older workers on the whole the move into retirement seems to be a gradual process given the evidence in this section, however the evidence on the number of hours worked supports that it is more sudden. There is an increase in the number of workers who work part time in the year prior to retirement which suggests that there is some gradual movement into retirement, but for the majority the movement into retirement will bring about a sudden stop in work hours.

Table 5.1: Work commitments in the years prior to retirement

Years to Retirement	Year -4	Year -3	Year -2	Year -1
Men				
Hours worked (mean)	34.03	33.54	33.29	31.40
Part time (%)	20.1	22.0	22.8	30.8
n	154	164	171	234
Women				
Hours worked (mean)	24.36	23.34	23.47	22.37
Part time (%)	57.4	57.1	59.8	64.5
n	162	189	194	228

The results of this section have highlighted the gradual process of retirement for older workers as a whole. In terms of the modelling of heterogeneous retirement focussed on in chapter 3, the evidence from this chapter suggests that the life-cycle retirement model and the option value model of retirement would best explain the retirement decision.

The evidence has shown that while there are some ages where a lot of people will retire, most notably 60 and 65, there is no rapid fall from high economic activity to low economic activity within two or three years. However, this must be quantified solely as a gradual movement into retirement for older workers on the whole as individual older workers could find that retirement is a sudden movement from one state to another. Indeed evidence on work hours and part time work showed that the majority of workers will face a sudden fall in work hours while a large minority do reduce their work load prior to retirement.

The figures presented have also highlighted some significant changes over time in the economic activity rate of workers. Both men and women are leaving the labour market in greater numbers at the age of 60 as the 1990's have progressed. The significant increase in economic activity found for men around the age of 60 in figure 5.3 is backed up by figure 5.6 which highlights that 52-53 year olds have increased their economic activity around this age compared to 54 and 55 year olds, although not significantly so. The same analysis for women shows economic activity on the whole is falling in the mid to late 50's during the 1990's, although, like the activity rate of men, this trend has been reversed by the 52-53 year old cohorts.

5.5: Conclusion

The aims of this chapter were to assess the economic activity of the older worker to find out when individuals retire, also to decide whether retirement is a gradual process, and if there have been any changes over time in the economic activity rates of older workers.

Figures of the economic activity rates of same-age cohorts across pooled waves and of different aged cohorts from the same waves have highlighted that the movement into retirement is an individual decision which is not forced upon people by things out of their control. In terms of modelling retirement this would suggest that Lazear's (1979) theory

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of mandatory retirement outlined in chapter 3 is not fully true. The figures also highlighted that economic activity of people in their mid to late 50's has fallen, sometime significantly so, during the 1990's. More men and women retired at the age of 60 after 1992 than before 1992.

The decision of when to retire is a personal choice and will occur when the time is right. The majority of the evidence suggests that retirement is a gradual process for workers as a whole, concurring with the findings of previous papers using the same dataset. However, some evidence was presented that suggested that for the majority of individuals the movement into retirement was a sudden one with no reduction in working hours prior to retirement. For a large minority there was a reduction in working hours in the years prior to retirement, suggesting that at least for some older workers there is planning put in to when they will retire and their movement into it.

The next chapter of this thesis will go on to examine what happens to individuals as they move into retirement. Specifically what the thesis will examine is once the retirement decision has been made, what happens to an individual's income and happiness as they achieve their objective of following this decision through and moving into retirement?

The effects of retirement on income and happiness: A descriptive and multivariate analysis

6.1: Introduction

What happens to income and happiness when an individual retires? Can the causes of what happens to income and happiness as an individual moves into retirement be explained? This chapter of the thesis will aim to answer these questions using empirical analysis. In an economic theory context this analysis must concentrate on analysing what happens to an individual's budget constraint as they move into retirement. The analysis of chapter 2 on the labour supply of older workers is therefore relevant to this discussion.

To some extent the questions that this chapter intends to answer have been addressed in recent empirical studies. The papers of Bardasi, Jenkins and Rigg (2002) and Webb (1997) have examined income in retirement and the latter even examined how income changes between employment and retirement. However, there are still some ways to improve the analysis of UK data so far. For instance Bardasi *et al.* (2002) provide cross-sectional evidence as to what happens to income as individuals move into retirement that improves on the work of Webb (1997) who provides a descriptive analysis of the change in income of individuals working in 1989 but who were retired in 1994 using the British Retirement Survey. This chapter of the thesis can extend this analysis in three ways: 1) By using the same annual dataset as Bardasi *et al.* the chapter can extend their work to later waves; 2) By splitting the sample according to their year of interview in the dataset this chapter can examine whether there have been any changes to the change in income that occurs as the retirement process takes place over time; 3) By using multivariate analysis this chapter can extend the work of the two papers by examining what causes the

change in happiness as individuals retire. The last of these three improvements is an extension that has not as yet been attempted using UK data.

Specifically, this chapter also extends the work on what happens during the movement into retirement by examining what occurs to happiness and wellbeing over the retirement process. Retirement is not just about how much money an individual has to live on, it is also about how happy they are with their lifestyle. Therefore it will be interesting to see what occurs to happiness and wellbeing over the retirement process and the chapter will also examine whether these have been changing over time.

What happens to an individual's budget constraint as they move into retirement?

The key theoretical analysis underpinning this empirical work is to understand what is happening to an individual's budget constraint as they move into retirement. Figure 2.1c in chapter 2 of this thesis highlighted the situation where the budget constraint of an individual changed so that they preferred moving to part time work due to an increase in non-earned income. Therefore a similar diagram can highlight the possible scenarios that will face a person considering retirement who then retires. Figure 6.1 shows the budget constraints and indifference curves for an older worker considering their retirement decision and the three different outcomes that could occur when the worker retires. The analysis that follows in this chapter will look at what happens to income and happiness as an individual retires. It is generally well known that income will fall for the vast majority of individuals as they move into retirement, so in each instance of this theoretical discussion we are assuming that the retiree has a fall in income as they retire.[110]

What will not be known however is the happiness of the individual as they make their move into retirement. There are three possible cases: 1) the individual has an increase in happiness as they retire. This is highlighted in figure 6.1 when the individual has an

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[110] It is of course perfectly reasonable and straightforward to show how an individual would be observed to have an increase in income as they retired. In the case of figure 6.1 this could be where retirement income per day of Z_1 is above Y_1, the total income earned per day if the individual was in work.

increase in their retirement income *when compared to a possible previous retirement income*. Figure 6.1 shows how an individual who is working $L2 - L1$ hours in their current employment and earning a wage of $Y1-Y0$ per day ($Y0$ is unearned income such as savings and investments that are available to the individual whether they are retired or not) while they would be equally happy to retire with a retirement income of $Z0$ per day. If however they were to have an increase in their retirement income from $Z0$ to $Z1$ then the individual will retire and they will have had an increase in their happiness while a fall in their observed income, which falls from $Y1$ to $Z1$ per day. Possible explanations for this increase in retirement income could be because they have reached a certain age where a large lump sum is available to them from their employer provided pension or where there has been an upturn in the stock market which means that their retirement income is now larger than it was previously; 2) the individual's happiness remains constant as they move into retirement. In figure 6.1 this is highlighted again with the individual being indifferent between working $L2 - L1$ hours of work and getting a wage of $Y1-Y0$ per day or receiving a retirement income of $Z0$ per day. Once the individual's pensions and savings equal $Z0$ then the individual will retire and will remain just as happy as before. The individual's observed income as they move into retirement will fall from $Y1$ per day to $Z0$ per day; 3) the individual has a fall in happiness as they retire. This is highlighted in figure 6.1 with the individual having a fall in their budget constraint with it moving from the original budget constraint to the second budget constraint that runs from Y_0' to Y_2'. This is caused by the individual having a fall in unearned income. This could be caused by a stock market crash or unexpected expenditure on their housing or car for instance. The individual then moves to a lower indifference curve and will have the choice of working more hours ($L2 - L3$) for the same wage as before or retiring. If their retirement earnings are equal to Z_0' or more per day then the individual will retire immediately and will have had an observed fall in

happiness. Again the individual will be observed to have a fall in income as they move into retirement, with the individual earning Y1 pre-retirement and then earning Z_0' in retirement.[111]

Figure 6.1: The labour supply and retirement decision of an individual
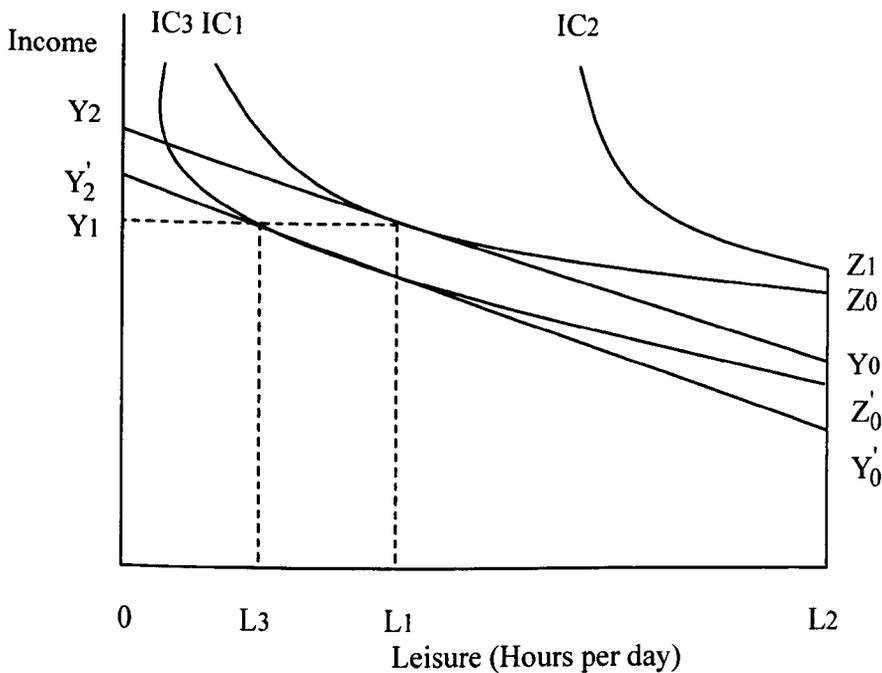
This theoretical discussion of what happens to an individual's income and happiness as they retire is an important consideration of the empirical work that follows. Therefore when considering the results of the descriptive and multivariate analysis of this chapter we will return to analyse the theoretical explanations.

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[111] Conceivably the individual that suffers a fall in unearned income could have an increase or no change in their happiness as they move into retirement. This would occur if they continued working after their fall in unearned income and then retired later in which case their observed happiness pre-retirement would be the indifference curve IC3. Another possibility is that the individual could have an increase or no change in happiness if they retired immediately after their fall in unearned income. This would occur if somehow their retirement income remained at Z_0 or above when they suffered their fall in unearned income. This would seem very unlikely but is theoretically possible.

The rest of the chapter will proceed as follows. To achieve the aims of this chapter attention is first drawn to the recent empirical work on UK data in the area of retirement, before the information used in this analysis from the British Household Panel Survey (BHPS) is outlined. The process of how the dataset is acquired and a discussion of the variables of interest for the next section follow this introduction.

The next topic of interest is to look at income, happiness and wellbeing levels of individuals before and after retirement, and in so doing focus on the second research question. Discussion will focus on whether there are any significant changes to income, happiness or wellbeing that occurs as a person retires, and on whether or not there are any time trends in the changes that occur to happiness and income levels as a person moves out of the labour market. A disaggregated discussion then follows with an analysis of the same descriptive statistics but by certain individual characteristics: gender, retirement age, and pension scheme membership. Here we can highlight the impact of retirement on individuals with a specific characteristic, and can also highlight any differences in the changes that happen as retirement occurs by characteristic by using hypothesis testing.

The next section then focuses on a multivariate analysis of change in happiness and wellbeing that occurs as a person moves from employment to retirement and in doing so will provide answers to the third research question. The sample selection process is discussed and descriptive statistics analysed, which is followed by an analysis of the distribution of the change in happiness that occurs as individuals retire by the sample as a whole and by certain sub-samples. The results and discussion of the multivariate analysis close this section. The chapter finishes with a brief conclusion.

6.2: UK Empirical Studies on retirement income

This chapter will concentrate on the changing income and happiness dynamics that occur as individuals retire. For the UK, empirical papers focussing on retirement have considered the effects of bad health on retirement, the dynamics of incomes and pensions in retirement and the probability of becoming poor as individuals move into retirement. This section of the chapter outlines two of the papers that use UK data to examine the effects of retirement.[112]

Bardasi, Jenkins, and Rigg (2002) examine the probability of becoming poor as individuals move into retirement. Using probit analysis the authors examine the probability of being in the poorest third of the income distribution in the year of retirement given that they were not in the poorest third in the year before retirement, *ceteris paribus*. The regressions were estimated separately for both men and women. For women, having an occupational pension significantly reduces the probability of moving into the poorest third of the income distribution. The marginal effect, other things equal, is 19 percentage points less likely to move into the lower income bracket. For men, full time work or being self employed significantly increases the likelihood of moving into the poorest third of the income distribution, while for women part time work and full time employment have the same effect, with the marginal effects for each being 34 and 30 percentage points for men, and 11 and 9 percentage points for women. There are also significant geographical and qualification effects for both men and women.[113]

Webb (1997) examines how income changes as individuals move into retirement. More specifically the author examines how incomes of particular retirees have changed over time, and compares them to pre-retirement income. The data is taken from the interviews

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[112] For a more comprehensive overview of the literature in this area see chapter 3.3. This section of the chapter briefly refreshes us with a brief description of the findings of the two papers that are of most importance to the work in this chapter.

[113] For men having A-levels or above is associated with a significant decrease in the likelihood of moving into the poorest third of the income distribution of 19 percentage points, while for women there is a significant decrease in the likelihood for those who have O-levels of 16 percentage points.

of 2114 individuals aged 55-69 in 1988/89 who gave full information in both interviews of the British Retirement Survey.[114] For the whole sample, mean incomes fell about 8% between 1988/89 and 1994, from £154.72 to £142.51, while median non-zero incomes actually rose slightly, by about 3% of 1988/89 median income, from £97.93 to £101.37.

However, when only looking at those who moved from employment to considering themselves as retired in between the two interviews, of which there were 599 individuals, over 65% of individuals had a 1994 income that was worth at most 100% of their 1988/89 pre-retirement income, indeed 1 in 5 of individuals had income in 1994 that was less than 50% the value of their 1988/89 incomes. However the survey also showed that 17% of individuals had income in 1994 of over 150% the value of their 1988/89 income. Average earnings amongst this group of individuals fell from £215.93 to £138.83 as they moved from working life to retirement. Non-zero median incomes fell from £172.93 to £105.45. When looking at those who were in full-time employment in 1988/89 whom then classed themselves as retired in 1994, a sample of 299 of the 599 individuals, nearly 80% of individuals had incomes worth less than what they did before they retired.

Looking at the household level, Webb finds that, for those households that had one or more of the individuals in the household move into retirement between 1988/89 and 1994, average income fell from 406.71 to 269.85, while non-zero median incomes fell from £364.14 to £217.91.

This thesis will extend the work achieved with UK data in the area of retirement so far by examining not only the descriptive change in income and happiness upon retirement, but also by analysing the change in happiness that occurs upon retirement using multivariate analysis. As such, this chapter will be the first to use UK data to consider how happiness changes as individuals retire, and whether or not this is linked to income

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[114] Two waves of survey for the British Retirement Survey took place, the first in 1988/89 and the follow up survey in 1994.

change. Attention is now turned to the information that is used in this analysis which is taken from the British Household Panel Survey.

6.3: Data

The British Household Panel Survey (BHPS) is use to describe the effects of retirement using both descriptive and multivariate analysis. The BHPS is a nationally representative survey of randomly selected households with the first wave of interviews taking place in 1991.[115]

The BHPS contains much information on work, life, families, feelings and incomes. As such it is a vastly useful dataset for empirical work. For this study information is needed not only on work related issues, such as pension schemes and income, but also on other financial aspects (savings, benefit incomes, national pensions), individual characteristics (marital status, gender, race) and individual feelings on issues (life satisfaction, general happiness, subjective wellbeing). For the next three sections of descriptive statistics the following variables from the BHPS are utilised: monthly personal income; monthly household income; job status; general happiness, subjective wellbeing; and life satisfaction. The details behind how these variables are derived are explained below:

Income variables

Weekly and household income is calculated from the derived variables for total personal income in the last month before the interview and total household income in the last month before interview. These variables are then converted to weekly indicators by dividing by 4. The variables are also converted to real personal and household weekly income using the Retail Prices Index, with a base of September 1991.

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[115] For a full discussion of the BHPS and see chapter 1.5 and also see Taylor (2001)

Job status

Each individual in every interview is asked of their job status. In this study the job status variable from the BHPS is utilised to analyse the economic activity rates of the older worker.

Subjective wellbeing

The first indicator of wellbeing of pre and post retirees is based on 12 questions that used to be part of the General Health Questionnaire (GHQ) section of questions that were originally developed as a screening instrument for psychiatric illness. The responses to the twelve questions are often now used as an indicator of subjective wellbeing. The questions ask how the respondent is feeling on a variety of issues such as their concentration levels, any loss of sleep they are having, whether they are unhappy or depressed and whether they enjoy day to day activities. There are four possible answers numbered one to four, with the potential responses being:

1: More than usual

2: Same as usual

3: Less so

4: Much less

The variable used in this study is the summed values of the answers to the 12 questions so as to convert the answers in to a single scale, where those who answer 1 and 2 to a question are recoded to 0 and those that answer 3 or 4 to a question are recoded to 1. Therefore the scale runs from 0 to 12, with 12 being the most distressed.

General happiness

The final question of the twelve GHQ questions is a question on individual's general happiness, and this question's responses are also used in this chapter on their own as well as in the derived variable. The question asks:

'Have you recently been feeling reasonably happy, all things considered?'

To which the potential responses are the same as outlined above for the derived GHQ variable.

Life satisfaction

The final variable used in the descriptive statistics section of the chapter is a question asking an individual of their life satisfaction. Specifically the question asks:

'How dissatisfied or satisfied are you with your life overall?'

There are seven possible answers, from 1 to 7, with 1 being *'not satisfied at all'* and 7 indicating that the individual is *'completely satisfied'*. Unfortunately this question was only introduced to the BHPS in wave 6, and was not asked at all in Wave 11, meaning that this variable is only of limited use.[116]

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[116] In the following sections the life satisfaction variable is only used when analysing waves 8-10 cohorts and when assessing the differences between certain groups. The variable is not of much use when looking at changes across time simply because the number of individuals asked in each year varies and the numbers are generally quite small.

6.4: Descriptive analysis of the change in income and happiness as an individual moves into retirement

In chapter 5 of this thesis descriptive analysis was presented that evaluated the economic activity rate of older workers, and assessed any changes across time. But once a person makes the decision to leave the labour market, how does this affect their life? In other words what are the consequences of retirement? This chapter concerns itself with describing the changes in income and happiness of those that move into retirement, again using the BHPS. Again, by using the BHPS, the longitudinal nature allows us to examine any trends through the 1990's in well-being and income. Both the papers by Bardasi *et al.* (2002) and Webb (1997) examine income changes as the retirement process takes place. The latter paper only examines two waves of the British Retirement Survey taken five years apart, and the former paper is more concentrated on determining poverty than examining the changes in income as retirement takes place. Therefore this analysis can be of use in extending the literature to date on income and there is no literature to this author's knowledge on the effect on happiness of retirement.

Cohorts are pooled together by waves, waves 2-4, 5-7 and 8-10.[117] The data presented looks at the changes from one year before retirement to 2 years after their initial year of retirement. In each instance, an individual is included in the dataset if they were in full time employment at the time of their first interview, they were fully interviewed for all four years that are analysed, and they must have retired by the time of their second interview in this dataset. They must also have remained retired for the remaining part of the analysis.[118]

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[117] Wave 1 is not used since the aim of this part of the chapter is to analyse what happens to income and well being **before** and after retirement. One cannot see the pre-retirement values of wave 1 retirees in the BHPS.

[118] As will be seen in chapter 7 of this thesis, many individuals actually move out of retirement and back into work. For this analysis we want to simply quantify what happens to income and happiness when you retire. The movement back into work will be an effect of the changes in income and/or happiness that occur as an individual retires.

For example, an individual that was interviewed in waves 1, 2, and 3, and 4 who was aged 55, who was in full time employment at the time of interview in wave 1 and who was retired by the time of interview of wave 2 and remained retired thereafter would be in the set of cohorts for waves 2-4. Similarly an individual who was interviewed in waves 3, 4, 5, and 6, and who was retired by the time of interview in wave 4 and remained retired thereafter, but was in full time employment in wave 3, would also be included in the waves 2-4 cohort of retirees.

Table 6.1, which is split into three parts for waves 2-4, 5-7 and 8-10 respectively, highlights the personal incomes, household incomes, general happiness and the subjective wellbeing of the retired cohorts from the year before their retirement to two years after the year of their retirement. In table 6.1c for wave 8-10 life satisfaction is also included. As mentioned above life satisfaction was only introduced in wave 6 of the BHPS and was omitted from wave 11, therefore there are only sufficient numbers of interviewees who were asked this question in the wave 8-10 cohorts.[119] Underneath the year 0 and year +2 figures are t- or z-statistics which are the value of the test of the equality of means between Year 0 and year -1 and year +2 and year -1 respectively.

Table 6.1a indicates that wave 2-4 cohorts lose almost 50% of their pre-retirement income after retiring. This fall in income is highly significant and is sustained as the number of years retired increases. Household income also falls significantly post-retirement, with a fall of 35% of pre-retirement income. Immediately after retirement there is a large but insignificant increase in the percentage of cohorts who report being more happy than usual. This increase is short lived as individuals adjust their views on what counts as the 'usual'.[120] Unhappiness levels remain fairly constant across the move from working life to retirement. Interestingly there is a significant increase in the number

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[119] Life satisfaction is included when the chapter moves on to looking at the differences between groups by certain characteristics, where the waves are all pooled together and trends over time ignored. It is included in the wave 8-10 analysis but is not discussed in great detail.

[120] When an individual initially retires their 'usual' or status quo situation will generally be the working life, but as the number of years into retirement increases so the 'usual' situation moves from work life to the life of a retired individual.

of cohorts whose subjective wellbeing has worsened immediately after retirement. This increase in poor subjective wellbeing scores is not sustained however as the number of years retired increases.

The results for wave 5-7 cohorts are remarkably similar as shown in table 6.1b. Personal income falls significantly by about 50% of pre-retirement income once an individual has retired, and household income also falls by almost 35% of pre-retirement household income. Again there is a large but insignificant increase in the number of individuals reporting being more happy than usual immediately after retirement. There are slight differences in the statistics however. There is no significant worsening in the number of high scores recorded for subjective wellbeing, and there is a large, though insignificant, increase in the number of individuals reporting scores 0 or 1 for subjective wellbeing. Pre-retirement waves 5-7 individuals have 10% fewer getting 0-1 in the tests of subjective wellbeing compared to waves 2-4.

Table 6.1a: Income and recent happiness of wave 2-4 cohorts pre-and post-retirement

	n	Year -1	Year 0	Year +1	Year +2
Personal Income *weekly income in £'s*	126	264.58	127.60 *(-7.54)****	143.33	141.38 *(-6.78)****
Household income *weekly income in £'s*	126	431.60	277.88 *(-5.01)****	280.43	281.64 *(-4.90)****
General Happiness *Percentage more happy than usual*	114	8.77	15.79 *(1.61)*	8.77	7.89 *(-0.24)*
General Happiness *Percentage less/much less than usual*	114	7.02	7.89 *(0.25)*	7.02	6.14 *(-0.27)*
Subjective Wellbeing *Percentage scoring 0-1*	103	75.73	75.73 *(0)*	79.61	78.64 *(0.50)*
Subjective Wellbeing *Percentage scoring 9 or above*	103	0	3.88 *(2.02)***	0	0.97 *(1.00)*

Notes: t- (z-) statistics are given in parentheses for the test of the equality of means (proportions) of the income (happiness or subjective wellbeing) of cohorts before and after retirement. *** indicates significant at the 1% level, ** indicates significant at the 5% level, and * indicates significance at the 10% level.

Table 6.1b: Income and recent happiness of wave 5-7 cohorts pre- and post-retirement

	n	Year -1	Year 0	Year +1	Year +2
Personal Income *weekly income in £'s*	126	249.23	124.60 *(-6.98)****	129.24	127.11 *(-6.94)****
Household income *weekly income in £'s*	126	453.08	317.03 *(-2.95)****	306.26	298.05 *(-4.70)****
General Happiness *Percentage more happy than usual*	113	8.85	15.93 *(1.62)*	11.50	10.62 *(0.45)*
General Happiness *Percentage less/much less than usual*	113	11.50	7.08 *(-1.14)*	9.73	12.39 *(0.21)*
Subjective Wellbeing *Percentage scoring 0-1*	104	64.42	73.08 *(1.35)*	71.15	74.04 *(1.50)*
Subjective Wellbeing *Percentage scoring 9 or above*	104	4.81	4.81 *(0)*	3.85	6.73 *(0.59)*

Notes: see notes for Table 6.1a.

Table 6.1c highlights the descriptive statistics of wave 8-10 retirees. Again there are significant falls in both personal and household income, with a loss of nearly 50% and 28% of pre-retirement personal and household income levels respectively. As with the cohorts for the previous pooled waves there is again a large yet insignificant increase general happiness immediately after retirement. Immediately after retirement there is a slightly significant decrease in the number of unhappy individuals in terms of life satisfaction. This fall in unhappiness levels of life satisfaction is only temporary however.[121]

It is now possible to compare the findings in terms of income change with the findings of previous empirical papers. Webb (1997) finds that average personal income fell by 35% and household income 33% as individuals moved from working life to retirement. This analysis highlights that the fall in household income is in line with that of Webb, with a fall of between 28 and 35% depending on which wave you look at and how many years into retirement the individuals are. However, in the movement from work to

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[121] That retirement has some positive effect on life satisfaction and well-being is in direct contrast to the effects of unemployment on happiness levels. For example see Clark and Oswald (1994).

retirement personal income falls between 47-52%, again depending on the wave analysed and the number of years into retirement examined. There is a massive difference in the fall of personal income between these two studies.

Table 6.1c: Income and recent happiness of wave 8-10 cohorts pre- and post-retirement

	n	Year -1	Year 0	Year +1	Year +2
Personal Income	152	269.01	133.92	138.23	144.93
weekly income in £'s			*(-6.58)****		*(-6.11)****
Household income	152	447.28	302.17	295.75	323.25
weekly income in £'s			*(-4.66)****		*(-3.61)****
General Happiness	143	9.79	15.38	15.38	10.49
Percentage more happy than usual			*(1.43)*		*(0.20)*
General Happiness	143	8.39	7.69	4.90	16.08
Percentage less/much less than usual			*(-0.22)*		*(1.98)***
Subjective Wellbeing	131	72.52	76.34	77.86	70.99
Percentage scoring 0-1			*(0.71)*		*(-0.28)*
Subjective Wellbeing	131	3.83	1.53	3.82	3.82
Percentage scoring 9 or above			*(-1.15)*		*(0)*
Life Satisfaction		86.81	90.28	90.72	90.82
Percentage happy			*(0.92)*		*(0.96)*
Life Satisfaction		4.17	0.69	3.09	3.06
Percentage unhappy			*(-1.92)**		*(-0.45)*
Number of obs. for Life Satisfaction		144	144	97	98

Notes: See notes for table 6.1a.

Table 6.2 allows the discussion to now focus on whether there are any trends in the changes to income, happiness and wellbeing levels that occur as retirement does. The table highlights that there are no trends in the changes that occur to either personal or household income as retirement takes place. However, there are trends in the effects of retirement on happiness and wellbeing levels. Both wave 5-7 and 8-10 cohorts have significantly greater increase in scores of 0-1 for subjective wellbeing and greater falls in

scores of 9 and above. Over time there seems to be an improvement in the effect of retirement on subjective wellbeing.[122]

Tables 6.1 and 6.2 and the discussion above have highlighted that income falls significantly once an individual moves into retirement, and for personal income the fall is as much as 50% of personal income in the year before retirement. Happiness levels do not seem from this initial analysis to be significantly affected by retirement. The evidence also suggests that there is little trend in the change in income that occurs as the retirement process take place, but a trend in the effect of retirement on subjective wellbeing does seem to be present.[123]

Table 6.2: Z-statistics of the test of equality of proportional changes in income and happiness levels between waves

	A	B	C
Weekly income	0.39	-0.07	-0.48
Household income	-0.09	-1.26	-1.17
General Happiness *Percentage more happy than usual*	0.02	-0.47	-0.67
General Happiness *Percentage less/much less happy than usual*	3.03***	-0.13	-1.95*
Subjective Wellbeing *Percentage scoring 0-1*	3.05***	2.01**	-1.61
Subjective Wellbeing *Percentage scoring 9 or above*	-2.03**	-2.75***	-1.56

Notes: Column A presents the z-statistics of the test that the proportionate change in income/happiness/wellbeing that occurs between post- and pre-retirement is the same for both wave 2-4 cohorts and 5-7 cohorts. Column B presents the same but testing the equality of proportionate changes between waves 2-4 and waves 8-10 cohorts. Column C tests the equality of proportionate changes between waves 5-7 and waves 8-10 cohorts. For the income variables the post-retirement year used is Year +2, while for the happiness and wellbeing variables year 0 is used as the post-retirement year. *** , **, and * indicate significance at the 1, 5, and 10% level respectively.

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[122] Also of note is that while insignificant, the improvement in subjective wellbeing for wave 8-10 cohorts is almost significantly greater than the change for wave 5-7 cohorts at the 10% level of significance for both the number of individuals scoring 0-1 and those scoring 9 or above.

[123] Blanchflower and Oswald (2004) show that for the USA there was a downward trend in life satisfaction over time, while for the UK there was no trend in life satisfaction overall. For both countries however life satisfaction was convex in age.

6.5: Descriptive Statistics by individual characteristics

The previous section pointed towards large changes in income as retirement took place, while there were few significant changes in happiness or wellbeing levels. The significant falls in both household and personal weekly income remained for the three years of retirement examined. Little variation in the changes in income as retirement took place was found across time, while there did seem to be an improvement in the effect of retirement on subjective wellbeing. This section moves the focus to the change in happiness and income that occurs with retirement, when looking at different individual characteristics across waves.

For this analysis all the cohorts from the waves studied, waves 2-10, are grouped together and then separated by their retirement age, gender and pension scheme membership. This examination will be able to highlight any differences that occur due to individuals having certain traits, but it will not be able to examine these any changes between the groups that occur over time. Each group's personal income levels, household income, general happiness, subjective wellbeing and life satisfaction will be watched from one year before retirement, year -1, to the third year of retirement, year +2.

6.5.1: Income and happiness as individuals retire by gender.

Table 6.3 presents average income and happiness levels by gender for waves 2-10. Under the figures for year 0 and year +2 are t- and z-statistics for testing the equality of the means of post- and pre-retirement levels of income and happiness or subjective wellbeing respectively.

The table shows that both men and women have significant falls in both personal and household income once they have retired. For men and women personal weekly income falls by nearly 50% in real terms once they have retired. At the household level income falls by 37% for men but only 26% for women by year +2, and this difference in the fall

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of household income is significant. So the change in income after retirement at the household level is greater for men than for women.

For men there is a small but not significant increase in recent happiness after retirement, but for women there is a highly significant increase in recent happiness immediately after retirement, but as with the previous section, this increase is not sustained as the status quo of the individuals change. The change in male and female general happiness levels from before to after retirement are significantly different. Women are happier than men immediately after retirement. In terms of unhappiness, it is immediately clear that women have much higher levels of unhappiness in the year before retirement, but this continues after retirement as well, whereas for men unhappiness falls immediately after retirement, but not significantly, but then rises to a similar level as female unhappiness by year +2, and this rise in unhappiness is significantly different from pre-retirement unhappiness at the 10% level.

Men's subjective wellbeing improves in the first two years of retirement, both in the increase in number of low scores and in the reduction in number of high scores. However, neither of the improvements is significant and the number of low scores falls back to pre-retirement levels in year +2. For women there is a continued rise in both the occurrence of low and high scores as the number of years' retired increases. Women feel the greater psychological impact of retirement, both in the terms of improving and decreasing wellbeing. Men seem to be more psychologically sound through retirement.

Life satisfaction increases for both men and women immediately after retirement, although neither increase is significantly different from the pre-retirement level. However, for men there is a decrease in the level of unhappiness immediately after retirement that is significant at the 10% level. As the number of years of retirement increase men's life satisfaction falls slightly and levels of unhappiness increase but not significantly, while for women life satisfaction remains roughly similar after retirement as before retirement.

Tables 6.4 and 6.5 highlight the differences in income and happiness levels due to retirement age and pension scheme membership. Those whom retired 'early', that is up to and including the age of 59 for women and 64 for men, and those whom retired 'late', that is women whom retire at age 60 or above and men who retired at 65 or above, are highlighted in table 6.4. Again there is a significant fall in both personal and household weekly income once an individual has retired, irrespective of their retirement age. Income falls 51% after retirement for those who retire early, but for those who retire late income has only fallen 42% in year +2 of retirement.

The general happiness of 'early' retirees is significantly increased immediately after retirement, but again this increase is short lived as their 'usual' changes from working to retired. For 'late' retirees general happiness increases slightly but not significantly immediately after retirement, and falls back to pre-retirement levels pretty quickly. Subjective wellbeing increases significantly after retirement for men in the number of low scores and this increase is sustained as the number of years retired increase. The number of high scores in the subjective wellbeing also falls significantly, at the 10% level, as the years of retirement increase. For 'late' retirees the number of low scores remains fairly constant as retirement occurs, while the number of high scores recorded increase significantly as the number of retirement years rise. Early retirement significantly reduces unhappiness levels of life satisfaction in the immediate aftermath of retirement, while for 'late' retirees life satisfaction is not altered to a great extent after retirement.

Table 6.5 highlights income and happiness levels for those who were a member of their employers pension scheme in the year before their retirement and those who were not. Again personal and household income is significantly reduced once an individual retires. However the relative size of the fall in incomes depends on whether you were a member of a pension scheme in the year before retirement or not. Again for those who were

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members of a pension scheme there is a significant immediate impact of retirement on general happiness, and again this impact is short lived. Unhappiness levels increase significantly amongst non-pension scheme members as the number of years retired increases.

Table 6.6 presents z-statistics of the tests of equality in mean differences between pre- and post-retirement levels by characteristics in terms of percentage changes. The table highlights that women have a significantly larger increase in their general happiness immediately after retirement than men do, while men have a significantly larger proportional fall in household income once retired than women do. Those who retire early have a significantly greater increase in happiness than those who retire late, but the former have a significantly greater fall in both personal and household income. Pension scheme members have a significantly greater increase in happiness post-retirement, and their household income is not significantly affected in any different way to those who were not a member of their employers' pension scheme in the year before they retired.

This section and section 6.4 of the descriptive statistics have examined the second research question posed at the beginning of this chapter. Section 6.4 showed the overall picture, where there is significant falls in income as individuals retire, but no significant changes in happiness or any time trends. This section has highlighted that for certain groups of individuals across waves retirement has a greater impact on them than on other individuals. Those whom retire early, and pension scheme members all have significant increases in general happiness immediately after retirement. For these two groups and women the increases in happiness are also significantly greater than the increases in general happiness of their respective counterparts: 'late' retirees, men and non-pension scheme members. Interestingly the results of this section have also shown that the **percentage** fall in personal income after retirement is no different between men and women, and the fall is only greater for pension members and early retirees compared to their counterparts, and this only at the 10% level.

How do these findings relate to the theory of individual labour supply that was discussed at the beginning of the chapter? The findings suggest that early retirees and pension scheme members have an increase in happiness as they move into retirement. This occurs despite an observed fall in income at the same time. So an early retiree who is a pension scheme member is much more likely to have an increase in happiness. This finding would link in with the idea that individuals retire when they reach a certain age when a lump sum of their pension becomes available and so their potential retirement income increases. Given this increase they would be happier if they gave up work and moved into retirement. The next section moves on from a descriptive analysis to examine what affects the change in happiness as individuals retire using multivariate analysis.

Table 6.3: Descriptive statistics of wave 2-10 retirees by gender

Variable	Males n	-1	0	+1	+2	Females n	-1	0	+1	+2
Weekly income	198	359.20	177.35	186.31	189.53	206	167.51	82.61	89.64	88.99
			(-10.55)***		(-9.94)***			(-9.10)***		(-8.66)***
Household income	198	514.52	316.68	316.43	325.79	206	376.61	282.46	272.93	279.94
			(-7.44)***		(-7.04)***			(-3.02)***		(-3.77)***
General Happiness	177	10.73	12.99	11.86	7.91	193	7.77	18.13	12.44	11.40
Percentage more happy than usual			(0.66)		(-0.91)			(3.03)***		(1.21)
General Happiness	177	6.21	2.82	1.69	11.30	193	11.40	11.92	11.92	12.44
Percentage less/much less happy than usual			(-1.54)		(1.69)*			(0.16)		(0.32)
Subjective Wellbeing	165	78.18	82.42	84.24	78.79	173	64.16	68.21	68.79	69.94
Percentage scoring 0-1			(0.97)		(0.13)			(0.80)		(1.14)
Subjective Wellbeing	165	3.03	1.82	0.61	1.21	173	2.89	4.62	4.62	6.36
Percentage scoring 9 or above			(-0.71)		(-1.15)			(0.85)		(1.54)
Life satisfaction		90.91	91.65	86.76	88.03		82.80	86.36	87.74	86.47
Percentage happy			(0.18)		(-0.66)			(0.70)		(0.76)
Life satisfaction		3.41	0	3.81	6.84		4.30	3.64	4.72	3.76
Percentage unhappy			(-1.93)*		(1.08)			(-0.24)		(-0.20)
Number of obs. for life satisfaction		88	107	105	117		93	110	106	133

Notes: Z- and t-statistics for the test of the equality of means between post- and pre-retirement are in parentheses. So the t-statistic of -10.55 under the weekly income of year zero is the test of equal means between weekly income in year -1 and weekly income in year 0. T-tests are only performed on the income variables, and are tests of equal means using Welch's approximation for the degrees of freedom. For life satisfaction figures the number of observations vary since this variable was only included in the BHPS from wave 6 and was not asked in Wave 11. *** indicates significant at the 1% level, ** indicates significant at the 5% level, and * indicates significant at the

Table 6.4: Descriptive statistics of wave 2-10 retirees by retirement age

Variable	Early retirement					'Late' retirement				
	n	-1	0	+1	+2	n	-1	0	+1	+2
Weekly income	161	376.57	166.40 (-10.17)***	175.63	184.37 (-9.39)***	243	185.19	104.29 (-8.81)***	111.43	107.73 (-8.71)***
Household income	161	570.48	331.04 (-7.95)***	331.91	348.65 (-7.19)***	243	360.54	278.16 (-3.06)***	269.30	271.77 (-3.96)***
General Happiness	147	10.20	21.09 (2.57)***	17.01	11.56 (0.37)	223	8.52	12.11 (1.25)	8.97	8.52 (0)
Percentage more happy than usual										
General Happiness	147	9.52	4.76 (-1.58)	4.08	8.84 (-0.20)	223	8.52	9.42 (0.33)	8.97	13.90 (1.80)*
Percentage less/much less happy than usual										
Subjective Wellbeing	137	68.61	79.56 (2.07)**	81.02	78.83 (1.92)*	201	72.64	72.14 (-0.11)	73.13	71.14 (-0.33)
Percentage scoring 0-1										
Subjective Wellbeing	137	4.38	2.19 (-1.02)	0.73	0.73 (-1.91)*	201	1.99	3.98 (1.17)	3.98	5.97 (2.04)**
Percentage scoring 9 or above										
Life satisfaction		87.84	91.76 (0.82)	87.64	91.49 (0.78)		85.98	86.36 (0.08)	86.89	84.62 (-0.30)
Percentage happy										
Life satisfaction		5.41	0 (-2.17)**	3.37	6.38 (0.26)		2.80	3.03 (0.10)	4.92	4.49 (0.70)
Percentage unhappy										
Number of obs. for life satisfaction		74	85	88	94		107	132	122	156

Notes: See notes for table 6.3.

Table 6.5: Descriptive statistics of wave 2-10 retirees by employer pension scheme member status in year before retirement

Variable	Pension scheme member					Non-pension scheme member				
	n	-1	0	+1	+2	n	-1	0	+1	+2
Weekly income	155	349.00	152.53 (-9.37)***	166.25	169.26 (-8.72)***	249	206.96	114.42 (-8.49)***	118.81	118.98 (-8.12)***
Household income	155	544.20	326.93 (-6.78)***	339.91	348.59 (-5.84)***	249	381.96	281.99 (-3.76)***	265.82	273.66 (-4.97)***
General Happiness	138	9.42	21.74 (2.82)***	15.94	10.14 (0.20)	232	9.05	12.07 (1.06)	9.91	9.48 (0.16)
Percentage more happy than usual										
General Happiness	138	7.97	4.35 (-1.24)	3.62	5.80 (-0.71)	232	9.48	9.48 (0)	9.05	15.52 (1.97)**
Percentage less/much less happy than usual										
Subjective Wellbeing	128	72.66	80.47 (1.48)	82.81	84.38 (2.28)**	210	70.00	71.90 (0.43)	72.38	68.10 (-0.42)
Percentage scoring 0-1										
Subjective Wellbeing	128	4.69	2.34 (-1.02)	1.56	0.78 (-1.92)*	210	1.90	3.81 (1.18)	3.33	5.71 (2.04)**
Percentage scoring 9 or above										
Life satisfaction		86.42	92.71 (1.38)	88.46	88.00 (0.29)		87.00	85.12 (-0.40)	86.47	86.86 (-0.03)
Percentage happy										
Life satisfaction		4.94	0 (-2.20)**	3.85	6.67 (0.46)		3.00	3.31 (0.13)	4.51	5.11 (0.80)
Percentage unhappy										
Number of obs. for life satisfaction		81	96	78	75		100	121	133	137

Notes: See notes for table 6.3.

Table 6.6: Z-statistics for tests of the equality of mean differences between post- and pre-retirement values by group

	Men and Women	Early and 'Late' retirees	Pension and non-pension members
Weekly income	0.07	1.82*	1.76*
Household income	2.39**	3.05***	1.60
General Happiness Percentage happy	-3.16***	2.79***	3.51***
Subjective wellbeing Percentage scoring 0-1	0.09	5.19***	2.65***

Notes: Z-statistics are the test results of testing the equality of the **percentage** difference in income or happiness after retirement compared to pre-retirement for each group respectively. Therefore the weekly income z-stat of 0.07 for men and women suggests that there is no significant difference in male and female's **change** in weekly income that occurs after retirement. For the income variables the z-stats are comparing the percentage difference in incomes at Year +2 and Year -1, while for the happiness variables the Z-stats are for the comparison of the percentage point difference in happiness levels between Year 0 and Year -1. *, ** and *** indicate that there is a significant difference in the change in income/happiness levels between post- and pre-retirement by groups at the 10, 5, and 1% level respectively.

6.6: Multivariate analysis of happiness changes upon retirement

The previous sections have analysed descriptive findings of what occurs to different samples of employees who move into retirement based on age and year of retirement. However, multivariate analysis must be used to proceed any further as to what personal traits cause the change in happiness as individuals move from working to retirement. The rest of this section looks at answering the third question proposed at the beginning of the chapter, that is what causes the changes in happiness as an individual retires?

Most of the factors that are likely to affect an individual's happiness as they move into retirement have already been outlined in the previous sections of this chapter. Pension status is likely to be important in affecting the change in happiness, and retirement status and gender should also affect how happiness changes as an individual moves into retirement. Added to these are other possible factors such as job sector, which will also be included as a possible factor in affecting the change in happiness upon retirement, but because of the small size of the dataset the analysis only focuses on differences between

the public and private sector. Interactive dummy variables are also included to examine any joint effects between some of the variables.[124]

To answer the question posed of what affects the change in happiness upon retirement, a sample of individuals who move from employment to retirement between waves 2 and 11 is examined. How this sample of individuals is selected is first discussed before moving on to some basic statistics of the dataset. Also analysed in more detail is the average tenure of individuals in the job they had immediately before their retirement so as to again point out further evidence of the gradual process of retirement.

The section then continues by examining the both the distributions of the changes in happiness and life satisfaction that occurs as the individuals move into retirement. A model of the change in happiness is then outlined, with an *ex ante* examination of the direction of effect on the change in income of the variables included in the model. Results are then presented and discussed, and issues in the estimation process are also outlined, which leads to a discussion in areas where future research could improve the estimation. This includes the possibility of improving these estimations whilst still using the same dataset.

As outlined in the previous paragraph this section will use two dependent variables in its analysis of what causes the change in happiness upon retirement. The first measure of happiness used in the analysis is the change in the GHQ derived variable as retirement occurs. As explained in section 6.2, the answers to 12 questions were re-coded into 0 and 1's and then the number summed up, and so the scale goes from 0 – 12. The change in this variable between work and retirement can thus go from -12 to 12 in scale, with negative scores indicating that the person is happier in retirement and positive scores indicating that the person is unhappier in retirement. The second measure of happiness is the change in life satisfaction as retirement occurs. The sample size for this variable is

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restricted because the question was only asked in later waves. The question has answers from 1-7 and so the change in life satisfaction variable is scaled from -6 to 6, with negative scores meaning that the individual is less happy in retirement and positive scores indicating a person being happier in retirement. For each dependent variable an ordered probit regression of the change in happiness will show which factors are important in determining what causes a change in happiness upon retirement.

6.6.1: Sample selection and descriptive statistics

Sample Selection

To begin all twelve waves of the BHPS dataset are used with 28243 individuals and 146674 observations. Only individuals who are **observed** to move from employment to retirement and then remain in retirement for at least another year are included in the final dataset. As a result only those individuals who retired in waves 2-11 are included in the dataset. This leaves us with 643 individuals who were observed to retire in the BHPS. All observations that either came from additional sub-sample individuals or were not from a full interview were removed leaving a sample of 550 individuals. Only those with full information on all the variables necessary for the estimation are included, leaving a sample of 480 individuals. Only those individuals who have one movement into retirement in the BHPS are included, and any individuals whose information indicated they were working when classing themselves as retired were removed.[125] Finally, three outlying observations were removed from the sample because of what was considered very large figures in the independent variables that are considered in this section. Therefore the final sample is of 329 individual observations of the first year in which

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[125] Also removed were any individuals who classed themselves as retired when asked what their job status was in the year before the interview. This was done using the variable JBSTATL from the BHPS. Only the variable JBSTAT was used in creating the indicator for moving into retirement and so as such this was a secondary check to remove any individuals who were already retired and thus were not observed to retire in the BHPS.

individuals considered themselves to be retired after working in employment in the previous year.

Descriptive statistics

Descriptive statistics for the sample used in the change in happiness analysis are shown in figures 6.2, 6.3 and Tables 6.7 and 6.8 below. Figures 6.1 and 6.2 show the dispersion of the change in happiness as measured by the GHQ variable and the life satisfaction variable respectively. The former table shows how the sample's happiness changes as they move into retirement, while the latter table shows the descriptive statistics for the change in happiness sample as a whole.

The change in happiness as measured by the GHQ variable and the life satisfaction variable are presented in figures 6.2 And 6.3 below. For the derived GHQ variable around 40% of older workers as they move into retirement have no change in the derived variable, while over 56% of the smaller sample had no change in their life satisfaction around retirement.

In terms of the theoretical analysis of the change in happiness that occurs around retirement that was presented in the introduction to this chapter it would seem that the majority of individuals have no change in happiness or very small negative or positive changes in happiness as they retire. This would be as expected since an individual who is a year away from retiring are unlikely to alter their retirement income to a great extent and so they are very likely to remain on the same budget constraint. It may be of interest for future analysis to examine what occurs to the happiness of individuals when they are retired compared to 10 years before their retirement. If it is also possible to examine their change in income over this time it would be possible to see what has changed in their budget constraint, indifference curve analysis.

Figure 6.2: The change in happiness as measured by the GHQ derived variable
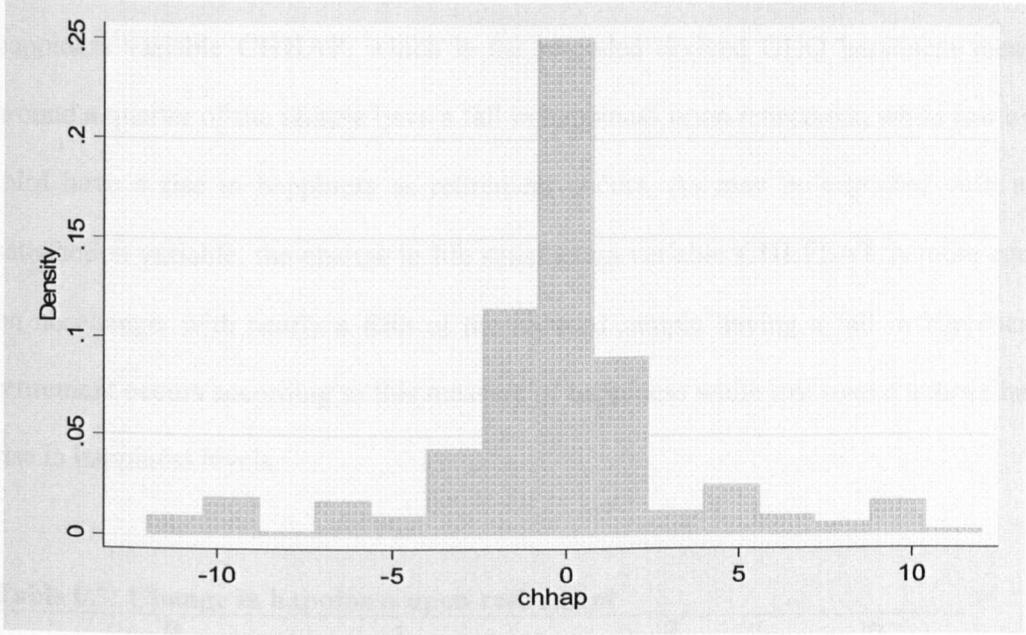
**Figure 6.3: The change in happiness as measured by life satisfaction**
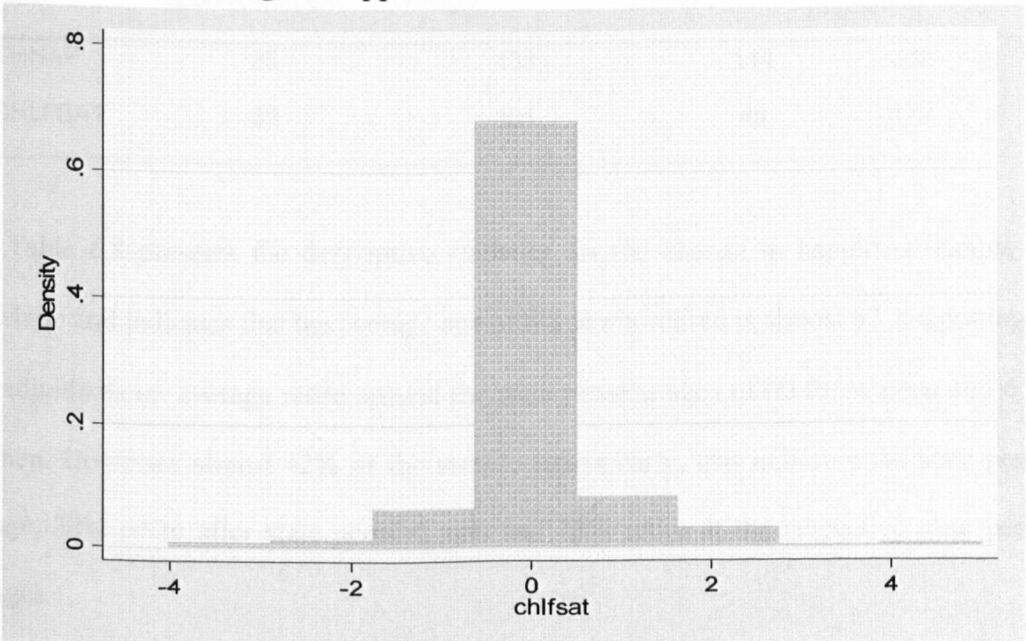
Table 6.7 presents the change in life satisfaction and change in the derived GHQ variables when they are re-coded to a 0-2 scale, with 0 indicating that they are less happy in retirement than they were in work, 1 indicating no difference, and 2 indicating that the person is happier in retirement than they were in work. The table shows that with either

measure more people become happier moving into retirement. Looking at the change in happiness variable **CHHAP**, which is the re-coded derived GHQ happiness measure, around a quarter of the sample have a fall in happiness upon retirement, while just over a third have a rise in happiness as retirement occurs. As may be expected with a life satisfaction variable, the change in life satisfaction variable **CHLFSAT** is more centred on no change, with nearly a fifth of the reduced sample having a fall in happiness as retirement occurs according to this measure of happiness while just over a quarter have a rise in happiness levels.

Table 6.7: Change in happiness upon retirement

	0	1	2	n
Variable	Happiness falls upon retirement	Happiness does not change	Happiness rises	
CHHAP	85	133	114	332
CHLFSAT	32	101	46	179

Table 6.8 presents the descriptive statistics for the change in happiness sample as a whole and indicates that the average age of the newly retired is almost 62, suggesting that individuals on average retire around the state pension ages of 60 for women and 65 for men. However, almost 42% of the sample retires early, that is before the state pension age, 34% retire after state pension age, and 23% retire at the respective state pension ages.

The genders are almost equally represented in the sample, while more than half of the sample were members of their employer's pension scheme in the year before their retirement. 35% of the sample worked in the public sector in the year before their retirement, only 9% reported their health as being poor or very poor in the year before their retirement, 38% of the sample were not receiving an employer pension in the year

of their retirement, the average tenure in their job before retirement is around 12 years and the average real wage in the year before retirement £236 a week.

Is the retirement process a gradual one?

In chapter 5 of this thesis evidence was presented on the movement into retirement for individuals. The conclusions of this chapter were that there was a gradual movement into retirement for workers as a whole but for individuals there was evidence that the movement was very heterogeneous, with some gradual movements and some sudden movements into retirement. What can also be of interest from the descriptive statistics presented below is that the average tenure in their last job before an individual retired was 12 years. This could be indicative of not a great deal of movement in jobs before individuals retire, giving some support to the idea that the movement into retirement is more of a sudden stop to work rather than a gradual movement. Conversely it may be the case that many individuals will change their work hours or job descriptions with their current employers rather than move to new employers as an individual moves towards retirement.

The evidence of retirement being a gradual process is also supported when the analysis looks beyond the simple average tenure in an individual's last job prior to retirement. 7.9% of the sample worked for their last job for under a year prior to retirement, while 11.2 and 10.3% of the sample worked for between 1-3 and 3-5 years respectively.[126] So while the evidence highlights that the majority of individuals stayed in the job they were in immediately before their retirement for a long period of time, there is a large minority of individuals who moved to new jobs close to their retirement. This finding backs the analysis of Ruhm (1990) and Bardasi et al (2002) with the former showing that only 36% of all workers in the USA retired from their 'career employment' while the latter showed

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[126] 18.2% of the sample had been in the job they had immediately before their retirement for more than 20 years.

that there is a movement away from full time work as retirement approaches in the UK.[127]

Table 6.8: Descriptive statistics of variables used for multivariate analysis of sample

Variable	Variable Name	Mean (*Percentage yes*)
Dependent variable		
Change in Happiness	CHHAP	**1.09**
Change in Life Satisfaction	CHLFSAT	**1.08**
Personal variables		
Age	AGE	**61.75**
Male	MALE	*49.54*
Retired early	RETSTATUS	*42.25*
Health status poor	HLTHPOOR	*8.81*
Work variables		
Member of firms private pension before retirement	PENM	*53.50*
Not receiving employer pension once retired	NOTREC	*37.99*
Tenure in job before retirement	TENURE	**4397.25**
Weekly wage before retirement	WAGE	**236.74**
Worked in public sector before retirement	PUBSECT	*34.95*
Joint Interaction Variables		
WAGE x PENM	PENWGE	**332.92**
PENM x NOTREC	NOEMP	*8.81*
PUBSECT x PENM	MMBRPBLC	*24.62*
MALE x PENM	MANMEM	*31.31*
TENURE x PENM	TNREMMBR	*2717.33*
PHEALTH x EARLYRET	ERLYHLTH	*4.56*
EARLYRET x PENM	MEMERLY	*34.95*

Notes: Tenure is measured in days. Figures in *italics* represent the percentage reporting in the affirmative to a question which is then used to derive a dummy variable, while those in **bold** represent the mean value.

6.6.2: Results

The results of estimating robust ordered probit regressions of the change in happiness around retirement are shown in table 6.9 below. Different variations were modelled and the best fitting models are presented. Gender, health status, occupational pension membership, and whether you worked in the public or private sector before retirement were never significant in any of the specifications. The interaction variables included were also never significant. Any analysis of the modelling of CHHAP must be done with caution since the Wald test that the variables have an effect on the dependent variable is never significant. What the results of using this variable to measure the change in

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[127] For a more comprehensive discussion of the process of retirement see also chapter 3 of this thesis.

happiness highlight is that the longer your tenure in your job before retirement the more unhappy you become in retirement.

The results for the change in happiness around retirement as measured by the change in life satisfaction are more interesting and more significant. The Wald test suggests that there are significant effects of the explanatory variables on the change in life satisfaction. The results show that if you retire after the state pension age compared to those who retire at the state pension age then you are significantly more likely to have had a fall in your life satisfaction because of retirement. The results also seem to indicate that money does make you happy since the larger the wage of the retiree before their retirement the happier they are with the move into retirement.

What these findings indicate can be looked at from two points of view. On the one hand for the wage result those with a higher wage before retirement should have a better pension and therefore are happier in retirement than someone with lesser retirement savings while on the other hand it may be that those on a higher wage are happy to be out of a higher pressure job which should be associated with higher wages. The results for late retirees can also be interpreted in a variety of ways: it may be that a late retiree has a fall in happiness compared to someone who retires at the state pension age because they enjoy work and realise they miss it once they have left for retirement; similarly it may be that the late retiree has been forced out of work against their will; or it could be that the late retiree does not have as much retirement income as someone who retires at state pension age, as the analysis earlier in the chapter highlighted.

This section of the chapter has analysed what reasons there are behind changes in happiness as an individual moves from employment to retirement. Two variables were used to capture the change in happiness, a derived GHQ variable that indicates an individual's wellbeing from answers to 12 questions and a life satisfaction variable. The results with the former variable indicate that tenure in their last job before retirement is important in happiness, with the longer you are in employment in the same job before

retirement the less happy you are once you have retired, although this result must be treated with caution since the overall significance of the models estimated is very low. Using the latter variable to measure the change in happiness does restrict the sample size somewhat but indicates that the higher the wage before you retire the more happy you will be once you have retired, while late retirees are have a fall in happiness around retirement compared to those who retire at state pension age.

Table 6.9: Ordered probit of the change in happiness upon retirement

Dependent Variable	CHHAP	CHHAP	CHLFSAT	CHLFSAT
RETSTATUS: EARLY	0.117 (0.176)	0.100 (0.175)	-0.227 (0.237)	-0.166 (0.244)
RETSTATUS: LATE	0.051 (0.170)	0.054 (0.172)	-0.508** (0.232)	-0.513** (0.231)
PENM	0.187 (0.189)	0.268 (0.194)	0.190 (0.266)	0.149 (0.269)
MALE	0.066 (0.186)	0.070 (0.186)	-0.303 (0.238)	-0.308 (0.236)
TENURE		-0.00004** (0.00001)		0.00003 (0.00003)
PUBLIC SECTOR	0.0385 (0.137)	0.039 (0.139)	0.086 (0.197)	0.093 (0.198)
WAGE	-0.00005 (0.0002)	-0.00006 (0.0002)	0.0008* (0.0005)	0.0007* (0.0004)
MANMEM	-0.098 (0.253)	-0.082 (0.254)	-0.105 (0.340)	-0.127 (0.345)
EARLY*HEALTH	0.415 (0.370)	0.371 (0.370)	-0.060 (0.510)	-0.047 (0.513)
HEALTH GOOD/EXCELLENT	0.0148 (0.142)	0.027 (0.143)	-0.029 (0.209)	-0.031 (0.209)
Pseudo R^2	0.008	0.016	0.038	0.043
Wald	5.26	11.61	15.65	21.44
Prob. Wald > χ^2	0.64	0.31	0.075	0.018
n	332	332	179	179

Notes: Standard errors in parentheses. *, **, and *** indicate significance at the 10, 5 and 1% levels respectively.

6.7: Conclusion

The aims of this chapter were: to look at what happens to an individual's income, happiness and wellbeing as they retire, examining whether there are significant changes in any of these variables; to discuss whether or not there have been any trends in these changes over time, and whether having a certain characteristic affects an individual's happiness or income level changes as they move out of the labour market; to perform a

multivariate analysis of the change in happiness as individuals move into retirement to examine what effects this change in happiness. How this chapter investigated each of these issues is now discussed in turn.

Income is significantly reduced once a person stops working and moves into retirement. The average fall in income is 50% of pre-retirement income. Household income is also significantly affected by the move into retirement, but the fall in income is not as much as at the personal level. There is a significant short term impact on general happiness once a person has retired, but this is only found when looking at specific groups of individuals with a certain characteristic.

No significant time trends in the effect of moving into retirement from working were found for either of the income variables, but the results did suggest that there was a trend in the change in subjective wellbeing as retirement occurs. Significant differences in the change in household income from pre- to post-retirement were found between males and females and early and 'late' retirees respectively. Women's general happiness also improved to a significantly great extent than men's, as did early retirees and pension scheme members compared to 'late' retirees and non-pension scheme members.

An interesting discussion that was raised in the chapter is how the findings of the empirical analysis reflect the theory of an individual's labour supply decision. The results of the chapter suggested that for most individuals there is no significant change in happiness even though they had a fall in income, while for certain groups of individuals there was a significant increase in happiness upon retirement. The chapter provided theoretical evidence of how an increase in happiness could occur despite a fall in income. Early retirees and pension scheme members were significantly happier once they had retired than previously. This would link in with the idea of a lump sum being made available to an individual once they reach a certain age which would change their preferences for work and leisure.

Multivariate analysis of the change in happiness as retirement occurs based on a restricted sample of a life satisfaction variable indicated that time of retirement and pre-retirement wage were important determinants of one's happiness. Those who retire late, that is after the state pension age of 65 for men and 60 for women, were significantly more likely to be unhappier in retirement than those who retired at state pension age. The higher one's wage before retirement the happier you will be in retirement. Different explanations as to why these results should be were put forward.

Extensions to this analysis would need to include the use of an instrument variable to remove the endogenous retirement decision variables that are included in the estimation. A further extension would be to examine what happens to individual's happiness and income as they retire compared with their income and happiness earlier in their working life. In this way it would be possible to further examine whether the evidence found can link in with the theory of labour supply. Further extensions could also include increasing the size of the dataset by including those who retired more than once and those who retired from a job status other than employee.

As this conclusion highlights, the questions posed at the beginning of this chapter have been answered in great detail, and as such this analysis gives a thorough insight into the retirement process and what occurs to an individual's income and happiness as the process takes place.

Appendix – Chapter 6

Table A6.1: Variables used in chapter 6

Variable Name	Description	Notes
Independent Variables	.	
Change in Subjective Wellbeing (CHHAP)	Change in subjective well being that occurs as an individual moves into retirement.	-12 to 12 (become more well in retirement to become extremely distressed in retirement)
Change in Life Satisfaction (CHLFSAT)	Change in how satisfied/dissatisfied a respondent is as they move into retirement.	-6 to 6 (Completely dissatisfied with life as they move into retirement to very satisfied with life as they retire)
Personal characteristics		
Age	Age of respondent on 1st December of wave year.	
Age squared	The square of Age	
Gender (MALE)	Binary variable indicating whether the respondent is male or female	0 – Female 1 – Male
Retirement status (RETSTATUS)	Variable recording whether a respondent retired before, at or after the state pension age	0 – at state pension age 1 – retired early 2 – retired late
EARLYRET	Binary variable indicating whether or not the individual retired before the state pension age.	0 – No 1 – Yes
Health Good/Excellent	Binary variable indicating If the respondent reported their health as good or very good.	0 – Very poor-fair 1 – Good/Very good
Previous Job characteristics		
WAGE	Indicates the respondent's weekly wage in their last job before retirement	
PENM	Binary variable indicating whether or not the respondent was a member of their employers occupational pension scheme in their employment before retirement	0 – No 1 – Yes
NOTREC	Binary variable indicating whether or not they were receiving their occupational pension once they had retired	0 – Yes 1 – No
TENURE	The number of days the respondent worked in their last job before retirement	
TENURE Squared	The square of TENURE	
PUBSECT	Binary variable indicating the respondent worked in the public sector before retirement.	0 – No 1 – Yes

An empirical analysis of what makes retirees return to work

7.1: Introduction

This chapter of the thesis moves on to examining beyond the retirement decision. So far this thesis has examined the labour supply of older workers, the retirement decision and its effects on income and happiness as individuals move into retirement, and now this chapter will focus on analysing why some retirees decide to go back to work. Do they return to work because they have retired early and thus still feel young enough to go back into work? Is it that some individuals decide that they would actually prefer to return to work rather than spend their time doing some other past time, for example because it will increase their social network or is something that they enjoy doing? Is it a decision borne of necessity in that a household finds that they do not have enough income to live on in their retirement? The question of why an individual who is retired goes back to work also leads to other similar questions that can be asked: does health have a part to play in the decision process of going back to work? What type of work does a retired individual go into? Is the work part time or full time? Does moving back to work alter their happiness in any way? Once you have made the decision to move back into employment from retirement once does this make it easier to make the same decision again? In other words, are repeated movements from retirement to employment likely, and how often do they occur?

So the aims of this chapter are to answer the above questions, in particular to focus on the determinants of the decision by a retiree of whether to return to work. This will be important for government policy again which, as described in detail in chapter 4 of this thesis, is currently aiming at increasing the labour supply of older individuals. For example some individuals who retired early may not need to return to work because of

financial reasons but do anyway. For others there may be a financial necessity to returning to work because of financial mismanagement or incorrect planning or simple bad luck. Therefore it is not only important for policy that it is known what causes a retiree to return to work so as to possibly encourage this to increase labour supply but also it may be important in highlighting that planning for retirement may need to be improved.

7.1.1: Older workers in the UK

Before the rest of this chapter goes on to analyse what determines why an individual goes back to work after being retired and the other questions that arise from this it is useful to look at employment of older workers in the UK as a whole. National data for the percentage of individuals over the state pension age of 60 for women and 65 for men that are economically active only began in 1992.[128] In the last quarter of 1992 7.9% of those over the state pension age were economically active according to the Labour Force Survey. The percentage economically active by the end date of the sample used in this analysis, quarter 3 of 1998, was 7.7%. Economic activity of those of state pension age throughout the period hovered around 8%. In most cases women had a slightly higher percentage economically active than men.[129] Looking beyond our sample dates the economic activity rate of those over state pension age stayed just above 8% and only started rising in 2001. By quarter 2 of 2003 9% of those over state pension age were economically active, 10% were economically active in quarter 2 of 2005 and the economic activity rate for quarter 1 of 2007 was 11.1%.

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[128] The data is available at http://www.statistics.gov.uk and can be downloaded from http://www.statistics.gov.uk/statbase/tsdtables1.asp?vlnk=lms The table required is 12.1: Economic activity by age: LFS Time Periods. The Central shared Database Identifier for each separate time series are: MGWS for the overall economic activity rate of all those over state pension age; MGWT for the economic activity rate of all men over 65; and MGWU for the percentage of all women over 60 who are economically active.

[129] For the dates of the sample used in the analysis, September 1990 to September 1998, of the data available on the economic activity rates of those over state pension age only in 5 quarters did men over 65 have a higher economic activity rate than women over 60. These were in 1992 quarters 2 and 3, 1994 quarter 4 and 1995 quarters 1 and 2.

What jobs are the older workers doing? The 2001 census showed that 19% of men in employment older than 65 worked in skilled trades, while 19% of older men had positions of management or senior officials. 14% of men in employment over the age of 65 worked in professional occupations, while 14% also worked in elementary occupations. For women over the age of 65, 22% worked in administrative and secretarial occupations, 19% of 60-64 year olds worked in elementary occupations, and 12% of 60-64 year olds work in personal service occupations.[130] (Yeandle, 2005)

As outlined above the percentage of older people who are economically active has been increasing in recent years. To some extent this will be due to government policy. The government is trying to increase the number of people who work over the pension age. Firstly they are phasing in an increase in the state pension age of women to 65 years of age by 2020. They are also increasing weekly pension payments for those that defer their pension and continue working.[131] Of more interest to this chapter however are the laws and policies which affect those who have *already* retired and who then decide to move back into work. To bring the UK in line with EU policy directive 2000/78/EC that requires the removal of all forms of discrimination from the workplace new laws came into force on 1st October 2006.[132] The Employment Equality (Age) Regulations 2006 prevent any discrimination in the workplace on the basis of age.[133] So the new law prevents any difference in treatment on the grounds of age in the workplace, but it does not prevent employers from having a retirement age. The regulations set a default retirement age of 65 but employers can have a retirement age below the default age so

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[130] Taken from Tables 1 and 2 in http://www.jrf.org.uk/bookshop/ebooks/1859353444.pdf. The tables are 2001 Census Standard Tables.
[131] For a more thorough discussion of these government policies see chapter 4.2 of this thesis and the footnotes therein. Also see chapter 1.4 of this thesis for a thorough overview of all new government policies and laws that are affecting the older worker.
[132] See http://europa.eu.int/comm/employment_social/news/2001/jul/directive78ec_en.pdf for the full directive from the European Union. (The European Union, 2000)
[133] Also see http://www.opsi.gov.uk/si/si2006/20061031.htm for an online text version of the Employment Equality (Age) Regulations 2006.

long as they could justify it. On the other hand the regulations also stated that employers must consider any request by an employee to work beyond the retirement age.[134]

The current government has also introduced the New Deal 50 Plus, which went nationwide in April 2000. It is aimed at those people who are over 50, who have been out of work for over 6 months and who want to go back into employment. By joining the New Deal 50 plus an individual is: allocated a personal adviser who gives the individual personal help in their job search; able to gain working tax credits dependent on their income; able to apply for a training grant which is available to them once they are in work.[135]

The New Deal 50 Plus will help potential older workers in that it will remove some of the obstacles that they may face in terms of gaining employment as an older worker. On the demand side employers may not immediately think of hiring older workers over someone who is younger either through discrimination because they think the younger worker will be able to do the work better or because of other reasons. On the supply side potential older workers may be discouraged from working because of the difficulties in finding a job, which will increase the costs of gaining new employment. The New Deal 50 Plus removes some of the costs that a potential older worker could face, encourages and helps them to find work, and because of the increased availability of potential older workers it will also encourage employers to employ them.

The introduction of new laws against age discrimination and the availability of help in searching for jobs mean that individuals who are retired should now find moving back into work with less difficulty. Indeed while a retirement age is still allowed within the regulations introduced in 2006 on employment equality and age many companies are

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[134] See http://www.age2006.org/index.php?option=com_content&task=blogcategory&id=69&Itemid=40 and the links therein for an overview of what the new regulations mean.
[135] See http://www.jobcentreplus.gov.uk/jcp/Customers/New_Deal/New_Deal_50_plus/ and http://www.agepositive.gov.uk/newdeal/index.asp and the links therein for more information on the New Deal 50 plus.

now employing workers over the age of 65.[136] Also their introduction has contributed to increased economic activity of those over pensionable age that has been discussed in the paragraphs above, and the strong economy will also have been a factor in this.

Given the increased opportunity and availability of jobs for those over the state pension age there is a need for an analysis not only of what determines whether an individual will stay on in work or retire but also of what determines why some individuals will leave retirement and move back into employment. Chapter 4 of this thesis discusses the former of these issues, and so it is left to this chapter to analyse what it is that determines why individuals will leave retirement and move into work.

7.1.2: Why go back to work?

What reasons might an individual have for moving back into work? Is there anything that will make an individual more likely to go back to work? Firstly happiness is likely to be an important reason for going back to work or a lack of it. The unhappier you are the more likely you are to look for something to do and one of those options that you can do is to get a job. So if you find that you cannot fill your time and are bored once you are retired then are you more likely to find a job than someone who is not bored? Or is it that we are looking at different moments in time and those who are bored are facing the same options as those who are happy did just a little while earlier? So you are bored and then you have the option to join some senior citizen clubs, take up a new pastime or get a new job, after which you become happier than you were.

It may also be the case that an individual realises once they have retired that they enjoy working, and it is possible to both work and enjoy their retirement. Once an individual is receiving their pension income then they will find that they can enjoy flexible working

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[136] http://www.agepositive.gov.uk/case_studies/index.asp contains many examples of specific companies and their policies towards older workers. See also
http://www.age2006.org/index.php?option=com_content&task=view&id=102&Itemid for another example of changing policy in the workplace towards older workers.

conditions in some occupations while still finding time for other activities in their retirement. So some individuals will go back to work because they enjoy it, while others will return to work because they enjoy it and because they are able to work flexibly and avoid any full time work because of their pension income.

Another factor that will be a reason for getting a job is your income and pensions. The less you have, *ceteris paribus*, the more likely you are to need a job once you have retired. But when looking at low income individuals and high income individuals pre-retirement, who is the more likely to get a job after they have retired? Is it the low income individual who needs to supplement their relatively small post-retirement income, or is it the high income individual who is likely to have the larger percentage fall in income once they retire?[137] To some extent this will depend on the lifestyle an individual wishes to achieve once they are retired. If they want to have the same level of lifestyle or as near as possible to the one they had before they retired a person with an expensive lifestyle will need more income meaning they will need a job.

Another possible pecuniary reason for returning to work may be that once you are retired you may have lower fixed costs of working. For example a retiree over state pension age may qualify for a free bus pass and eliminate one of the fixed costs of going to work.

Health will be an important factor in determining whether an individual goes back to work or not. The unhealthier you are the less likely you are, *ceteris paribus*, to want to move back into employment. Age may still be a factor as well in the likelihood of moving back to work? What has to be remembered here is that while now regulations ban age discrimination and any firm who has a retirement age below the default age of 65 has to have a reason for this, for the sample being examined here age discrimination and low retirement ages may have been more widespread. It may well be that there are jobs

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[137] See sections 6.4 and 6.5 in chapter 6 of this thesis for a discussion of income falls as an individual moves from pre-retirement to post-retirement.

that are fine for any aged worker to do, be they 16 or 80, but it must be kept in mind that one form of age discrimination or another may have restricted the availability of jobs to some retirees of a certain age. Your previous employment may also affect your likelihood to go back to work. For example it is probably the case that refuse collectors are less likely to be asked back on a consultancy basis than an accountant. Your education level is also likely to affect your ability to be employed. The greater your qualifications the more likely you are to be demanded by employers. On the other hand it may be that education is not what is required when employers look at older workers but what they actually are looking for is experience. If this is the case then those qualifications are unlikely to play a large role in your likelihood of getting a job. Where you live could also affect your likelihood of getting a job. So a retiree living in a high unemployment area may find it harder to get a job than a retiree living in an area with low unemployment.

There are also many links between these reasons for going back to work and the likelihood that you will get a job. For example do those with more qualifications get bored easily with retirement, or is it the other way round? Those with higher qualifications are more likely to have earned more and have larger pensions than those with no qualifications. Age and health may also be linked and may be a reason why employers are less likely to employ older workers. All of the above reasons for wanting to get a job and the things that may increase your likelihood of getting a job are investigated in the rest of this chapter

7.1.3: Chapter outline

The rest of the chapter will be presented as follows: following the introduction a literature review will analyse past work in the area of moving out of retirement, and highlight how there is very little work that has been done so far, and none in the UK. The section will also provide a brief look at the psychology of retirement and what changes

for individuals once they have retired for this will be a major area of importance in the decision to go back to work. The literature review will end with a brief look at duration analysis in other economic areas such as unemployment.

Following the literature review the chapter will outline the data used and present descriptive statistics. The first 8 waves of the British Household Panel Study (BHPS) are used in this analysis and the final dataset used has a sample of 647 retirees who have 751 spells of retirement, with some continuing in retirement throughout the sample while others at one stage or another move into employment from retirement.

The next section will then go on to explain the econometrical specification of the model. Instead of using a parametric survival model to estimate the movement out of retirement, the chapter uses the methodology devised by Jenkins (1995) which allows duration analysis to be measured using a simple logistic model. The results follow and highlight that both pecuniary and non-pecuniary factors such as health play an important role in the probability of an individual leaving retirement and moving back into employment. There is then a conclusion to the chapter which discusses the possible policy implications of the results.

7.2: Literature Review

For the UK there has been plenty of descriptive analysis of the movement into retirement (see chapters 5 and 6) and on the likelihood of continuing work beyond retirement age, while little work has specifically analysed why individuals move back to work from retirement.[138] There is one paper which does look at this using multivariate analysis, which is the paper of Butler, Anderson and Burkhauser (1989) which uses American data to examine the reasons for returning to work from retirement in the USA.

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[138] Also see chapter 3.4.3 for a brief review of the findings of Tanner (1997) and Ruhm (1990) regarding returning to work after retirement.

So attention is first turned to some of the literature which examines the movement *into* retirement in the UK before looking at work that focuses on working beyond retirement age in the UK, and specifically on those papers which offer some perspective on the possible reasons why an individual who is retired may decide to return back to work. Papers using non-UK data that examine the movement out of retirement and back into work are then discussed including the paper of Butler, Anderson and Burkhauser.

7.2.1: The UK perspective of moving into retirement

Many papers have examined the movement into retirement and how this will affect people for the UK. Chapter 6 of this thesis provides a review of the effects of moving into retirement for those living in the UK. There have also been recent papers focussing on the UK which have examined the factors which *determine* the movement into retirement which include Disney, Emmerson and Wakefield (2002) and Meghir and Whitehouse (1997).[139] Many other papers looking at UK data have focussed on the movement into retirement or the continuation of work past the retirement age, and some of these have to a certain extent analysed the movement out of retirement and back into work. A few of these papers are now examined.

Yeandle (2005) discusses the work-life balance of older workers, in the majority looking at the decisions people make in moving in to retirement. In her discussions the author discusses various different retirement experiences that workers may face. Some of the different experiences suggest that there will be some individuals who carry on working and not retire, while there may be some individuals, such as the 'career changers' described in her Table 3, that may take a break from work at some stage, and so in effect retire, before going on to try something new. There are also those in the author's discussion who may be forced back into work once they are retired. So the 'exit

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[139] This section does not discuss the work of Disney, Emmerson and Wakefield (2002) or Meghir and Whitehouse (1997). The papers were discussed earlier in the thesis and this can be found in chapter 3.3.2.

strategists' may have planned their retirement with their spouse or partner but they may misjudge their financial situation and need to return to work at some stage of their retirement. The same could be said of 'rejected workers' if they need to supplement their retirement income and 'identity maintainers' if they have retired after using their skills in another occupational setting, they may wish to reconsider their retirement decision and go back to work.

Smeaton and McKay (2003) look at working after the state pension age in the UK. The authors examine the work decision of older individuals, the types of job they are likely to have, the dynamics of retirement and the effects working past state pension age has on the financial situation and health of older individuals. Again this study concentrates on continuing work after the state pension age rather than *returning* to work after state pension age. Their descriptive analysis highlights that the vast majority of those older workers that they examine are those who have continued in the same job after state pension age as before. Part time employment and self employment increases with age for both men and women, but there is a jump in these employment types after state pension age. Their analysis also shows that those working after state pension age will be better off financially than those who are not working. Those still working past state pension age are also better off in terms of their reported health and unhappiness levels.

Smeaton and McKay use logistic regressions to examine the factors that affect the probability of an individual working after the state pension age. For men, having good health, having a mortgage rather than owning your home outright, education, and having a working partner increased the likelihood of working beyond state pension age.[140] Age, Caring for more than 10 hours a week, renting rather than owning your home outright, low education, and having an occupational pension reduced the likelihood of an older man continuing work after state pension age. For women the same variables significantly

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[140] Educational qualifications are measured in these regressions by age that the individual left full time education.

affected their likelihood to continue working beyond state pension age, but in general the effects were not as strong. Their conclusions point to three reasons for working beyond state pension age: firstly there are those who make joint retirement decisions with their spouse or partner and so some people will continue working until their spouse retires; secondly is that some individuals will wish to maintain their living standards; and thirdly some people enjoy working and so wish to continue past state pension age.

Following on from the quantitative work of the previous paper analysed, Barnes, Parry and Taylor (2004) present a descriptive analysis of working after state pension age. Again the paper focuses primarily on continuing working after retirement rather than moving into retirement and then back out again. However, their paper does provide some insight into the reasons as to why older people stayed in work beyond state retirement age. Based on a small sample of individuals aged over 50, Barnes *et al.* found that the reasons why people would work after state pension age include: their orientation towards work, so for example creative self employed workers felt no need to retire as their job was a major part of their life; their financial situation, with some finding that working beyond state pension age allowed them to have a better life or being able to defer some pension benefits. In the main the financial consideration was never the prime motivation for continuing work but was a secondary consideration; the employer that they work for before retirement age, as for example some employers retirement age of 65 meant that women could make a choice about continuing in work beyond 60 while other firms were flexible towards working beyond retirement age; the social side of working was also an important factor, whether it be with long term relationships with clients or work colleagues or just the ability to meet people; health issues were also an important factor in remaining in work, the majority of those who continued in work in the sample did so for as long as they were able to, while for some who retired it was based on the timing of health issues; and a final reason for continuing work beyond state pension age is because of their joint decisions with their partners, so some will retire at the same time which

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could mean for those with age differences that some continue working beyond state pension age, while for others they remain in work to support an ill or already retired partner.[141]

Cappellari, Dorsett and Haile (2005) examine the labour market transitions of the over 50s in the UK using a sample of just over 26000 men aged 50-64 and women aged 50-59 over the period 1993-2003 from the Labour Force Survey. As with the other work in this area using UK data the majority of the paper examines the movement from work to retirement. However, the authors also examine the movement out of what they class as type 2 inactivity, which includes retirement. Cappellari *et al.*'s descriptive analysis highlights that only 3% of men in type 2 inactivity when they were first interviewed, which includes the long term sick or disabled as well as those who are retired, had moved into employment by the time of their last interview.[142] For women the same figure was 4%. Their results of the transitions from type 2 inactivity for men and women highlight that transitions from inactivity take place mainly within the first 3 years of being type 2 inactive. Both men and women with temporary sickness or disabilities are more likely to leave type 2 inactivity than other individuals with different reasons for their type 2 inactivity. The older you are the less likely you are to leave type 2 inactivity, while those who do not own their own house or who have dependent children are more likely to leave type 2 inactivity. There are also some regional effects on the likelihood of leaving type 2 inactivity. The authors also look at the transitions from type 2 inactivity excluding those who are retired and the results highlight that there are fewer transitions for these individuals. So retirees are more likely to leave type 2 inactivity than those who are type 2 inactive for other reasons. Again however, in terms of this chapter of work, the

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[141] The sample involved interviews with 24 people and then group discussions with 14 people in three different parts of the UK (Camden in London, Dorset, and Bradford and nearby areas) the majority of whom were working after retirement while some were still working as they approached state pension age and 1 of whom had recently retired after working beyond state pension age.

[142] Type 2 inactivity as defined in this paper also includes looking after the family, home, not needing or wanting a job and other, but nearly all (19%) of the 21% of men aged 50-64 who were in type 2 inactivity were either retired or long term sick. For women the nearly half (13%) of the 27% who were in type 2 inactivity were retired or long term sick.

movement out of retirement into work only looks at those who are not beyond state retirement age, whereas this chapter of the thesis will look at retirees of all ages and their movement back into work.

Irving, Steels and Hall (2005) perhaps present the most useful analysis on older UK workers in terms of this chapter. In this paper the authors present findings from interviews and focus groups with 71 individuals aged 50-69 from Newcastle, Walsall and Christchurch and East Dorset, some of whom were still working and some of whom were not in work.[143] In this study Irving *et al.* look at labour market participation, leaving the labour market, staying in the labour market after state pension age, pensions and retirement and, most importantly in terms of this chapter, re-entry into the labour market. The main reasons that they found for returning to work were financial and then personal reasons. Financially those who were forced out of work through redundancy or ill health needed to return to work to afford to live and pay off debts such as mortgages. Others returned to work so as to have enough disposable income to maintain their lifestyle. There were also personal reasons for returning to work as well, such as a change in their family situation or relationship, to keep themselves physically and mentally active, and for job satisfaction or the social side of the work. Interestingly Irving *et al.* highlight that often many of those who returned to work did so for both financial and personal reasons, and also personal reasons were linked to financial ones in the decision making process of those who returned to work.

7.2.2: Important non-UK work

The paper that closest mirrors the analysis of this chapter is that of Butler, Anderson and Burkhauser (1989). However, there are also a few other past papers that also look at the movement out of retirement and back into work and these are discussed first before attention is turned to the paper by Butler *et al.*

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[143] The focus groups only involved 52 of the 71 interviewees.

Haider and Loughran (2001) examine the working conditions and reasons for working of those over retirement age in the USA using different surveys. Their analysis shows that individuals with greater education, better health and higher wealth are more likely to work after retirement age. Haider and Loughran highlight how the fraction of full time workers has increased over time for those above retirement age. This is likely to be due not only to changes in work practices and laws but also to the increasing longevity of individuals. The authors also show that workers working beyond retirement will earn a lower wage than younger workers, with those aged 74-76 earning two thirds less than those who work and are aged between 50-58. Self employment also increases with age with 30% of those employed who are aged 65 to 67 being self employed compared to around 16% of 50-52 year olds.

When estimating the effects these variables have on labour force participation, the authors find that wealth is not significant in affecting the labour force participation of those above retirement age, but that better education and health do significantly affect labour force participation. Haider and Loughran go on to examine the probability of remaining employed between 1 year and the next for those above retirement age using data from one of their surveys using basic OLS regressions. Their results highlight that health shocks are an important negative factor in whether you leave work while changes in wealth and wages do not have a significant impact on whether you are still in work at the time of survey after being in work the previous year. Education and age also play no significant part in determining whether an individual will leave work from one year to the next. The authors conclude that those working after retirement age trade wages for flexibility and that this indicates that working is seen more as a leisure activity for those above retirement age. Haider and Loughran go on to argue that all the evidence suggests that the reason behind working after retirement is non-pecuniary in nature.

Maestas (2007) uses the Health and Retirement Study for the US to examine 'unretirement' as she puts it, or the movement out of retirement and back into work. Her

descriptive analysis examines those in the survey aged 51-61 who do not report themselves as retired and are working for pay in 1992 and follows them to 2002 through interviews every two years. In the analysis unretirement is determined to be either moving from complete retirement to full time employment, moving from complete retirement to partial retirement, or part time employment, or moving from partial retirement to full time employment.[144] Maestas' analysis highlights that just over half of her sample follow the 'usual' retirement path, that is a movement into retirement from work and then they stay retired up to 5 years later. Around 13% of the sample move back into part time work after 6 years of moving into full retirement, while 6.3% of the sample move back into full time employment from full retirement after 6 years. Unretirement rates are also much higher amongst those who retired early, with over 40% of those aged 53-54 returning to some form of work after 2 years of retiring, while around a over one third will return to some form of work after 6 years. Unretirement rates are lower for older retirees, with for example just under 18% of 65-66 year olds returning to work 2 years after retirement while over 24% will have returned to work 6 years after retiring. After six years of retirement just over a fifth of women will have moved back into work while over 30% of men will have done so.

When examining the job characteristics of post-retirement work Maestas finds that the median hourly wage is $8.35 or $9.00 per hour depending if they worked part time or full time respectively compared to a median wage of $15.45 per hour in pre-retirement jobs. Pre-retirement around 18% of workers worked part time but nearly half move into part time employment when unretiring. The author also finds that there is a movement in industries as well with more post-retirement work in service industries and less after retirement employment in manufacturing industries.

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[144] As is seen in section 7.4 this choice of unretirement or moving back into work is different from the one used in this analysis. This chapter looks at self reported occupation status alone, and so a useful extension may be to change the description of moving back into work from retirement.

Maestas includes in her work an examination of whether an individual thought they would work in retirement prior to their retirement and an estimation of the probability of unretirement. In the former the author found that most individuals were overly cautious in their approach to working in retirement: just over 55% of individuals correctly anticipated whether or not they would work in retirement, around 37% thought that they would work in retirement but did not while only 7.5% of individuals in the sample thought that they would not have to work in retirement but then did. This finding suggests that the vast majority of individuals anticipate working in retirement. When looking at the latter Maestas finds that those who planned to work in retirement were 50% more likely to unretire than those who did not plan to work. A negative health shock reduces the probability of unretirement however, having an employer pension, education, and drops in capital income, net worth or stock income of more than 25% have no significant affect on the probability of unretirement. The results also show that increases in pre-retirement income significantly increased the probability of unretirement. Maestas' results give a strong indication that income and other financial factors do not play an important role in returning to work after retirement.

Butler *et al.* (1989) examine the return to work from retirement using a competing risks model. The authors use the US Retirement History Survey to get a sample of 4558 observations of workers aged 58-63 who were in the labour force in 1967 but not self employed who retired 1969 and 1977. In their estimations they allow for two possible exits from retirement, re-entry to work or death. Their results for the duration of retirement highlight that wealth, women and non-whites are less likely to move back to work from retirement, while married individuals and those who have children to support are more likely to re-enter work.

7.3: Empirical methodology

In this chapter the empirical methodology follows the econometric modelling that was presented by Jenkins (1995). In this paper he outlines how duration models can be estimated using a discrete choice framework. In other words instead of modelling the duration of months of retirement using duration modelling, instead one estimates a simple logistic specification to estimate the likelihood that someone leaves retirement to work in one specific month. This section of the chapter will analyse the hazard rate of moving back to work from retirement before outlining how the specification developed by Jenkins (1995) works, and will then look at the problems with this method of estimation.

We are interested in whether or not an individual who is retired will return to work in the next time period. This is the transition from one occurrence to another. To analyse this we use hazard modelling, or duration analysis as it is also called, which measures the duration of an occurrence from its beginning to its end. What we are then interested in is the probability that the occurrence lasts a specific length of time, or the probability that the occurrence will end in the next time period *given that the occurrence has lasted up to the previous time period.* This is the hazard rate (Greene, 2005). So for this analysis we have a number of individuals who retire at different times, but each of these times *is known.* These individuals are then examined over a period of time to see whether they remain retired or whether they go back to work. So in the data analysed in this chapter those individuals who remain retired at the time of their last interview have censored data in that they remain retired beyond our sample time scale. Those who move back into work have completed spells of retirement, but they may also then return into a new period of retirement from which they also can either remain in retirement or return to work.

There are many different ways in which the hazard rate, in the case of this chapter the likelihood that an individual moves back into work from retirement given that they have been retired for at least time t, can be estimated. However, Jenkins (1995) provides a methodological approach which allows one to estimate a duration model using probit or logistic estimation. The methodological approach suggested by Jenkins does not alter the results, indeed the results of estimating a probit model or a duration model are equivalent in this situation, the method just reduces the amount of estimation that is needed. So to address this we will begin by outlining the duration analysis of Narendranathan and Stewart (1993) in terms of moving out of retirement, before discussing the model proposed by Jenkins. Let us start by looking at the probability that someone will leave retirement and enter employment. Simplified this will be conditional on an individual being offered a job and accepting it. So the hazard probability of leaving retirement in some space of time (t, t + Δ) would be:

$$\lambda_i dt = q_t \int_{\delta_t}^{\infty} f(w) dw dt \qquad (7.1)$$

Where λ_i is the hazard probability that individual i will leave retirement and go back to work, $f(w)$ is the distribution of wages that are available given the vacancies in the labour market, and δ_t is individual i's reservation wage.[145] The probability q_t is a function of variables that affect an individual finding a job and then being offered the

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[145] We are assuming here that a retired individual would not have their pension or benefit entitlements affected by a wage above their reservation wage. One way this could be explained is that the individual who is retired will only work for a wage whereby the loss in their pension or benefit entitlements is recouped from the wage they earn. However, it is much more likely that certain individuals will in effect have a 'grey area' of wages where they would not accept the wage as it would result in a overall loss of income, and so they will in effect have two reservation wage levels. Of course another explanation may well be that a retiree is quite happy to lose some income by working because it is the job itself which they enjoy rather than the income earned from it.

job, so personal traits would be included here, the area in which they live and so on. So the continuous time hazard can be written as:

$$\theta_i(t) = \lambda(t)\exp(x_i(t)'\beta) \tag{7.2}$$

Where $\lambda(t)$ is the baseline hazard at time t, and x_i is a vector of individual i's explanatory variables which can be both time dependent and independent.[146]

However, with the dataset being used in this study, there is only information available as to an individual's retirement or work status on a month by month basis. So we must consider the discrete time case. It is important to note that this means that we are now assuming that a month is the natural measurement of a movement from retirement back into work. This would seem to be fairly realistic since even while the decision to move back to work from retirement could be made on a single day, it will usually require some time to find the right job. Even those who set up their own business would need some time to prepare their business. Therefore a month would seem to be an adequate measure of time in this instance.

So now time t is measured in months and any durations that are observed are in completed months, and a duration of t months in discrete time means that there was a duration in continuous time of between common t and t+1 months. The probability of an individual moving from a spell of retirement back to work by month t+1 given that they were still retired in month t, which is the discrete hazard, is shown as:

$$h_i(t) = P\left[T_i < t+1 \middle| t \le T_i\right] \tag{7.3}$$

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[146] The baseline hazard is universal across all individuals while their individual hazards will proportionately differ depending on their observed covariates $x_i(t)'\beta$. (Wooldridge, 2002)

$$= 1 - \exp \left\{ - \int_{t}^{t+1} \theta_i(u) du \right\} \qquad (7.4)$$

$$= 1 - \exp \left[- \int_{t}^{t+1} \lambda(u) \exp \left\{ x_i(u)' \beta \right\} du \right] \qquad (7.5)$$

Where T_t is a discrete random variable that represents the time at which the spell in retirement ends with a move back to employment. If we then assume that $x_i(u)$ is constant over $t \leq u < t+1$, that is all the explanatory variables are constant within a month but can change from month to month, then the discrete time hazard can be written as:

$$h_i(t) = 1 - \exp \left[- \exp \left\{ x_i(t)' \beta + \vartheta(t) \right\} \right] \qquad (7.6)$$

where

$$\vartheta(t) = \ln \left\{ \int_{t}^{t+1} \lambda(u) du \right\}$$

This hazard then goes into the corresponding likelihood function. The hazard above is a complementary log-log function, but Jenkins (1995) showed that by changing the likelihood function to examine the month of the spell instead of the individual you can then estimate using a simple binary variable. This can be looked at in this way since for each spell month one of two occurrences can occur, either the individual moves out of retirement and back into work or the individual remains in retirement. So each individual

in the sample provides however many months of observations that they have at risk of leaving retirement which go into an expanded likelihood function. The dependent variable is a dummy variable, y_{it}, which takes the value of 1 if an individual leaves retirement for work in month t and takes the value of zero otherwise. The non-proportional hazard can be written as:

$$P(y_{it} = 1) = \frac{\exp[\beta' x_{it} + \alpha' D_{it}]}{1 + \exp[\beta' x_{it} + \alpha' D_{it}]} \qquad (7.7)$$

This gives the probability that an individual will end their spell of retirement and return to work in time t given that they had remained in retirement to time t-1. D_{it} is the baseline hazard. Equation (7.7) is estimated using logistic estimation of the probability of the retirement spell month at risk of exit being the month of exit into employment.

However, there are problems with this sort of estimation. Firstly we are assuming that the repeated observations are independent of one another. This is unlikely to be true since each individual will have x number of months at risk of exiting retirement all of which are likely in some way to be related to one another. This possible heterogeneity could be solved by estimating a fixed effects model which uses an individual intercept to control for the similarities in observations between individuals. In doing this using panel data one would have to look at the change variables and would thus remove some of the parameters of interest for this chapter which do not change over time, such as gender, and at the age we are looking at, educational qualifications. (Bachan, Reilly and Witt, 2005)

Another problem that arises using the model described is that there is only one possible exit from retirement, namely moving back into work. However, this is unlikely to be very realistic since there is also going to be those that die while in retirement, and so this is another exit possibility. Butler *et al.* (1989) use a competing risks model to allow for two

possible exits from retirement, death or going back to work.[147] Their discussions point out that leaving those who die out of the sample creates an overly healthy non-random sample, while leaving those that die in the sample could lead to simultaneous equations bias so long as death is not random. For this chapter the data includes retirees who remain in the sample until their death, and thus it is inherently assumed that death is random.

There are also concerns when using panel data to examine labour market behaviour that arise from heterogeneity. This can come about in many different ways: from the initial sample selection, known as the initial conditions; from the attrition rate of individuals who drop out of the sample from one wave to the next; and from non-response to certain variables that are required for the estimation process, either through non-response if the individual is in the panel and has the attribute for which the information required is dependent on, or through non-response because they do not have the attribute.[148] In each of these cases if the sample that arises from the process may not be random and as such heterogeneity can occur.

So the initial conditions for this sample are that the individuals are retired in year t, and it is assumed that this initial retirement state is exogenous with no correlation between unobservables. However, if there is correlation between some unobservables then this will generate a sample selection bias due to the conditioning of being retired at time t. Thus it may well be the case that the individuals that make up this group of retirees may not be a random sample of the population. The attrition rate, or panel drop-out, may also result in heterogeneity and a non-random sample. This will apply to this sample of retirees if there are some individuals who fall out of the panel and then proceed to retire after they have left the panel. Heterogeneity due to a non-random sample can also arise if

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[147] The results of their estimations are discussed in chapter 7.2.2.
[148] This latter non-response is also a major problem of the work analysed in chapter 4 of this thesis. This is because those individuals who are not in employment do not have any wage information, resulting in a non-random sample.

individuals in the panel who have a certain attribute do not know or refuse to answer certain questions for specific information based on that specific attribute. Finally a non-random sample can be drawn because an individual does not have a specific attribute and so cannot have the required information on that attribute. The classic example would here would be that those who are not employed will not have any wage data.[149]

So all of the above problems with this estimation process must be taken into account when discussing the findings of this model. It is very likely given the heterogeneity that is present that the marginal effects of the conditional probability of returning to work from retirement will be overstated.[150] However, the results will still present some interesting findings and give a first look at what it is that affects the return to work of retirees. As such future empirical work in this area would need to take into account at least some of the problems discussed in this section.

7.4: Dataset and descriptive statistics

The following section of the chapter begins by looking at the dataset and how it was constructed. Since we are interested in the movement out of retirement and back into work, the paper uses a specially constructed episode dataset of individual's labour market spells taken from the British Household Panel Study. So this is first outlined and discussed before attention is turned to the actual construction of the dataset for this analysis. Following this discussion, the variables of interest that are included in the analysis are outlined and how they are measured in the dataset examined. Finally, descriptive statistics of the final sample are presented and discussed.

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[149] For a greater discussion of these issues see for example Cappellari and Jenkins (2004) and Stewart and Swaffield (1999) and the references therein.
[150] See Stewart and Swaffield (op cit.).

7.4.1: Initial dataset

The British Household Panel Study (BHPS) is a nationally representative survey of randomly selected households.[151] Information that the BHPS includes on employment is vast, and the information on work status for any respondent that is available is their work status at the time of interview of each wave, their employment from the previous 1st September to the date of interview and also a retrospective look at all employment since the respondent first left full time education. On top of this the retrospective data was collected in two different parts, the first looking at employment status and the second looking at occupational information.[152] Up to now this thesis has solely been concerned with current employment status, but for this part of the thesis it is necessary to also look at their past occupational status and the length of each of the statuses. Therefore it is necessary for this empirical analysis to use the available Episode file of the BHPS which puts together the duration of each period of job status for every respondent in the first 8 waves of the BHPS. Other variables of interest that are required from the main BHPS panel are then merged into this dataset. (Taylor, 2001; Halpin, 1997)

In more detail, what the episode dataset of the BHPS does is to join together a respondent's current occupational status with their inter-wave occupational status which creates a continuous record of a respondent's occupational status from September 1990 to September 1998. The episode dataset also includes a respondents life time employment status, that is information not only on their employment but also on their non-employment spells, and their life time occupational history, which gives details as to their type of employment during the duration of their employment, and so creates an employment and occupational history for a respondent that goes from their leaving full time education up to wave 8 of the BHPS. (Halpin, 1997)

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[151] For a more detailed description on the BHPS and how the original sample is constructed see chapter 1.5 of this thesis.

[152] With each interview for every wave a respondent's current status and their status from the 1st September to the date of interview is also recorded. The employment status history was collected in wave 2 and the job history was collected in wave 3. (Halpin, 1997)

7.4.2: Final dataset

Retirees are first identified in the episode dataset, where any left censored spells are dropped, that is any employment spells that took place and had ended before September 1990 were dropped. Any individual that did not have a current spell of retirement at any stage during the 8 year period are then dropped from the dataset. Now all that remain are individuals who are retired at some stage, but this includes all their different episodes from September 1990 to September 1998. Spells of retirement that are of length less than 1 month are checked and sorted. Some episodes are dropped altogether, which results in some individuals being dropped from the dataset if that is their only period of retirement. Other individuals have very short retirement spells occurring immediately before or after another longer retirement spell, and these two spells are then treated as one.[153] All non-retirement spells are then removed from the dataset, with the information regarding an individual's next spell remaining. From this information a dummy variable indicating whether or not the individual moved back into employment is created, the dummy variable taking a value of 1 if this is true, and taking a value of zero if they remain in retirement.[154] The final dataset thus consists of 645 retirees who in total have 748 spells in retirement over the period September 1990 to September 1998. When the dataset is extended using the methodology outlined in section 6.3 there are 25101 months where an individual is at risk of leaving retirement.

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[153] In data of this nature recall error and 'seam effects' are problems that occur often. The further in time a person is asked to recollect something the less likely they are to recall it correctly, while the 'seam effect' is where transitions from one state to another occur more often between waves. See Jäckle and Lynn (2004) for a discussion of recall error and seam effects and the effects on these problems that occur from a change in interview techniques.

[154] Some of the final dataset move from a retirement spell to other non-employment spells. 27 move into 'unemployment', 1 moves into a spell of 'family care' and 1 moves into a spell of 'something else'. With regards those moving into unemployment, all are under the statutory pension age and so it may indicate a movement to reconsidering work.

7.4.3 Variables of interest

As outlined in the introduction to this chapter, the main motivation for this empirical investigation is to analyse whether pecuniary variables have an impact on the decisions of retirees to move back into work. A secondary issue is to see if there are non-pecuniary variables which affect the decision making process. So firstly we will look at the pecuniary variables to be included in this analysis, before moving on to look at the non-pecuniary variables that are of interest. In each case the variable will be discussed in terms of its expected outcome, before any issues regarding its capture in the dataset are reviewed.

The first pecuniary variable included in the analysis is the replacement rate. This is the ratio of a retiree's pension income compared to their income when they were in employment. *A priori* it would be expected that the higher is the replacement rate of a retiree the less need they will have to return to work, *ceteris paribus*. Obviously there are going to be issues when using a dataset to try and work out an individual's replacement rate. For the purposes of this investigation we look at the household replacement rate, since it will be the income of the whole household which is likely to affect the decision of whether to return to work or not after retirement rather than an individual income. Therefore the replacement rate is calculated as the monthly household income when they are retired divided by the monthly income of the household as stated in their last interview for the survey before they retired. Ordinarily the replacement rate should be a ratio between 0 and 1. However, using this measure of the replacement rate results in replacement rates greater than 1. This arises mainly because more and more retirees are moving to part time work or to less stressful jobs before they retire and so are not earning as much in the year before retirement as they were for most of their careers. So to allow

for this, sensitivity analysis and sample criteria for values of the replacement rates are used throughout the analysis.[155]

The next pecuniary variable included in the analysis is pension membership. Ordinarily we would expect those with a pension to be less likely to move out of retirement than those without a pension, *ceteris paribus*. A problem that would seemingly arise at this point concerns whether pension membership and the replacement rate are going to be linked, that is are they going to capture the same effect in each case? As will be outlined shortly, it is worth noting that pension membership is a personal measure, while the replacement rate is at the household level. Hence any significant effect of pension membership rather than the replacement rate would suggest that the decision of whether to move back into work or not from retirement is a personal decision. Nonetheless, other problems in the measurement of pension membership remain. The variable takes the value of 1 if an individual was not a member of their occupational pension scheme in the year prior to their retirement and 0 if they were a member of their occupational pension scheme in any year prior to retirement whilst in work and whilst they were being interviewed in the BHPS. This gives two potential problems: First, that the measure does not indicate membership of a personal pension scheme. Second, the same issue arises as for the replacement rate in that many individuals will have moved to different jobs or part time work as they head towards retirement. So an individual may have been a member of their occupational pension scheme in their main occupation but not in the occupation they are currently in so close to retirement. Both these problems must be taken into account when analysing this variable.

Housing status is also likely to be important in the decision making process of a retiree as they decide whether to move back into work. Those who own their house outright have less financial worries than those that are still paying a mortgage or are paying out

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[155] In the estimation of the results the replacement rate is restricted to less than 1, less than 3 and less than 5 respectively.

rent each month for their property, and therefore it would be expected that those owning a house will be less likely to move back into work from retirement. A dummy variable taking the value of 1 is included in the analysis if the individual lives in a property which they rent or are still paying a mortgage on, while the variable takes the value of 0 if the individual lives in a property which they (or their partner or together) own outright.

Turning to the non-pecuniary variable included in the estimation, the variables included are more straightforward to capture in the dataset and are age, gender, region, wave, health, marriage status, education, and industry and occupational dummy variables. Age may be a factor in returning to work, since it may be easier for someone who retires early at 57 to return to work than someone who is 66. This could be because an individual's main occupation of their career is a job that requires workers to be of a certain age because for example of physical requirements. However, it may also be because of age discrimination. This should be less likely in recent years with the prevention of age discrimination in employment, but in the years this sample took place there may well have been age discrimination in the workplace. So *a priori* it would be expected that the older you are the less likely you are to return to employment. Also included is age squared to see if there is any quadratic relationship between moving back to work from retirement and age.

Will men or women be more likely to return to work from retirement? Will the region you live in or the year affect your decision? No obvious answer springs out to this and so dummy variables are included in the analysis for gender, your region of residence and the year in which you are interviewed.

An individual's health is likely to be extremely important in any decision on whether to go back to work or not. If someone is extremely fit then they are more likely to return to work than someone who is very ill, *ceteris paribus*. Therefore a dummy variable is included in the analysis taking the value of 1 if the individual reported their health as

being good or excellent and takes the value of 0 if the individual reported their health as very poor, poor or fair.

It could also be argued that marriage status and education will have economic effects on the decision to move back into work from retirement. However, it is likely that the economic effect of education, higher earnings, will be likely reflected in the household replacement rate, while those who are married are also likely to have a higher household replacement rate than those who are not married, *ceteris paribus*. So in this analysis education is included to see whether certain individuals need to remain active in their retirement and choose to move back into work, while marriage status is included since those who are married or living with their partner should not feel so left out and lonely in their retirement as those who live alone. Therefore an individual's highest educational qualification is included in the analysis and a dummy variable taking the value of 1 if the individual is widowed, divorced or has never been married and 0 if the individual is married or living with their partner is also included.

The final non-pecuniary variables included in the analysis are occupational and industry dummy variables. These are dummy variables indicating the individuals' last area of employment before they moved into retirement. It may be that those who work in some industries or occupations are more likely to be asked back on a consultancy basis than in others, and so some will be more likely to go back to work than others. Again it must be noted that some individuals will move either occupation or industry (or both) in the run up to their retirement as they wind down their careers.[156]

Other variables are also included in the analysis. The first is whether or not the individual has had a previous spell in retirement and is intended to capture if working in retirement becomes a habit. So are individuals who have already had a spell of work after retirement more likely to do so again? It must be noted that this variable may also capture

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[156] For an analysis of bridge employment or 'partial retirement' see Ruhm (1990) and Gustman and Steinmeier (1984).

other unobserved aspects of individuals which influence their decision on whether to return to work. Also included are some interaction variables between economic and non-economic variables. As highlighted by Irving *et al.* (2005), it is often the case that people return to work for both personal and financial reasons, and often personal reasons will be linked to financial ones. So for example an individual may return to work because they have recently been divorced and want to have more contact with people, but this may also be linked to a financial need to return to work. A dummy variable is included and takes the value of 1 if the individual is both female and was not a pension member in the year prior to their retirement and 0 otherwise. A second dummy variable is included taking the value of 1 if the individual is not married and is either renting or paying a mortgage on the property they live in and 0 otherwise. In this way it can be seen if there are interactions between economic and non-economic variables. The first interaction variable is used because female non-pension members may be more likely to return to work than female pension members and men since women statistically live longer and because those without an occupational pension may not have as much income in retirement as those that do. The second interaction variable is used since it may be the case that an individual who is not married and still needs to cover monthly rent or mortgage payments will be more likely to return to work than someone who is married who needs to cover similar payments but who has a spouse who may bring to the household an extra pensions income or income from working.

Table 7.1 provides an overview of all the variables used in the estimation processes in this chapter that have been discussed above.

Variable Name	Description	Notes
Independent Variables		
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Months at risk of leaving retirement	Binary variable indicating whether the respondent left retirement and returned to work in a given month.	0 – No 1 – Yes
Non-pecuniary variables		
Age	Age of respondent on 1st December of wave year.	
Age squared	The square of Age	
Female	Binary variable indicating whether the respondent is male or female	0 – Male 1 – Female
Not Married	Binary variable indicating whether the respondent is married or not.	0 – Married/Living with partner 1 – Not married
Mortgage/Rent	Binary variable indicating whether the respondent was living in a house that was rented or under a mortgage	0 – No 1 – Yes
Health Good/Excellent	Binary variable indicating if the respondent reported their health as good or excellent.	0 – No 1 – Yes
Education	Variable indicating the highest qualification level of the respondent	0-4 (None, Other, GCSE, A-level, Degree)
Industry	Variable indicating 1-digit standard industrial classification of the respondent in their last job before retirement	0-9
Occupation	Variable indicating the 1-digit standard occupational classification of the respondent in their last job before retirement	1-9
Wave	The year of the respondent's interview.	1-12
Region	The standard region of the respondent	1-11
Pecuniary variables		
Replacement Rate	Monthly income of household in retirement divided by the monthly income of the household before the retirement of the respondent	
Mortgage/Rent	Binary variable indicating if the respondent lives in a house where they have to pay a rent or a mortgage.	0 – No 1 – Yes
Not Pension Member	Binary variable indicating whether or not the respondent was a member of their employers occupational pension scheme in their employment before retirement	0 – Yes 1 – No
Joint interaction variables		
Female x Not pension member	Binary variable indicating if the respondent is female AND was not a member of their employer's occupational pension scheme in their job prior to retirement.	0 – No 1 – Yes
Not married x Mortgage/Rent	Binary variable indicating if the respondent was not married AND was living in a house where that was rented or under mortgage.	0 – No 1 – Yes

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7.4.4: Descriptive Statistics

Table 7.2 below presents the descriptive statistics for the final sample of retirees taken from the first 8 waves of the BHPS. Of the 748 spells of retirement that are in the sample, 122 ended with a move into employment. As would be expected the mean length of duration of retirement spells is much lower for those who move back into employment. The descriptive statistics highlight that there is little difference between the average age, sex, number of spells of retirement, pension membership in their previous job in the year before retirement and house ownership between those whose retirement spells end with them going back to work and those who remain retired.

The initial statistics do highlight however how there are differences in marriage status as well as in both health status and educational qualifications between those whom end their retirement spell by going back to employment and those who remain retired. A higher percentage of those who moved back into work are married or living with a partner than those who remain retired. This would suggest a monetary aspect to going back to work after retirement, since retirement should be a time where couples have more time to spend with one another. For educational qualifications the descriptive statistics suggest that the more qualified you are the more likely you are to return to work. This is in line with previous descriptive analysis by Smeaton and McKay (2003) and Campbell (1999) who showed that the more qualified you are the more likely you are to continue working past state retirement age and the more likely you are to still be in employment at an older age respectively. Over 47% of those who go back to work have A-levels or a degree or other higher qualification, while only around 32% of those who remain retired are similarly qualified. At the opposite end of the qualifications scale 40% of those who go back to work have no qualifications or 'other' qualifications while nearly 56% of those who remain retired have 'other' or no qualifications.

Table 7.2: Descriptive statistics of the final sample

Group:	Moved to Work	Retired	Total
Number of observations	122	626	748
Duration of retirement spell (mean months)	14.6	37.3***	33.6
Age (mean)	59.3	60.1	59.9
Female (%)	46.7	46.2	46.3
Married (%)	82.8*	74.8	76.1
Pension member (%)	39.3	40.6	40.4
Own house	48.4	47.9	48.0
Education			
No qualifications (%)	35.3	44.3*	42.8
Other (%)	4.9	11.2**	10.2
GCSE (%)	12.3	12.9	12.8
A-level (%)	8.2	5.4	5.9
Degree (%)	39.3***	26.2	28.3
Health status good/excellent	84.4***	70.0	72.3
Replacement rate	0.97	1.25	1.20
Replacement rate (excluding >1)	0.66	0.68	0.67
Replacement rate (excluding >3)	0.94	1.01	0.99
Replacement rate (excluding >5)	0.97	1.08*	1.06
Multiple spells of retirement (%)	13.1	13.9	13.8
Female*Non pension member (%)	36.1	30.4	31.3
Not Married*Mortgage/Rent (%)	10.7	13.6	13.1
New job type			
Self-Employed (%)	22.1		
Part Time (%)	54.9		
Full Time (%)	23.0		

Notes: Total percentages for the two groups may not sum to 100 because of rounding. Health status good/excellent is a dummy variable taking the value of 1 if the individual reported their health as being good or excellent, while taking a value of 0 otherwise, in which case the individual reported their health as either very poor, poor or fair. Spearman correlation tests on the difference in percentage of an individual having a certain trait depending on whether or not they returned to work were performed, as were t-tests testing the difference in the means of the other variables between those that returned to work and those who retired. *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively for the respective tests, and are included in the column which had the significantly greater proportion (or mean) having a certain trait.

The descriptive statistics on education suggest that either the more educated need to keep themselves busy once they are retired or that they are needed more by employers because of their experience and knowledge. They also give an early indication that a need for extra income may not be a major reason for going back into employment as those with the higher qualifications, that is those who you would assume have earned more in their career because of higher qualifications, are those that go back into work rather than

those with few or no qualifications, who are not as likely to have earned as much in their career. On the other hand it may be an indication that those who have a higher income pre-retirement may have a greater percentage fall in their income once they have retired and find they need to supplement their pensions.[157] It could also possibly link to the fact that those with greater qualifications want to maintain their lifestyle they had before retirement as much as possible once they have moved into retirement and so they will probably require more money to do so than someone who did not have qualifications and whose lifestyle cost less before retirement.

In terms of health status, over 84% of those who return to work describe their own health status as good or excellent, while 70% of those who remain retired describe their own health status in the same way. This would be what one would expect *a priori* as those who see themselves as having poor health are not as likely to want to move back into employment.

Three different levels of replacement rates are reported in table 7.1 according to what rate is to be used for sample criteria. When looking at all replacement rates without any sample criteria, the replacement rate of those who return to work is lower than those that remain retired, which is as would be expected. However, when the replacement rate is restricted to below 1, 3 or 5 (when outliers are removed), the rate is very similar between those who move into work and those who remain in retirement.

Looking at the 122 spells which ended with a move to work, the majority of individuals who go back to employment will do so in a part time job, while the rest are fairly evenly spread between self-employment and full-time employment.[158,159]

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[157] This can corroborated to some extent in chapter 6.5.1 and 6.5.2 which show that those with a greater pre-retirement household income have a larger percentage fall in income once they retire. This is true of the fall in household income pre- and post-retirement between males and females and between pension members and non-pension members (do note here however that there is little difference in pension member status in this sample).

[158] Part time work is measured from the self reported job type that an individual states in their interview, although it is assumed throughout this thesis that part time work is less than 30 hours a week. Also see the references in footnote 156.

Of the interaction variables between economic and non-economic variables, almost 6% more women who were not pension members in the year before their retirement move back into work, while perhaps a little surprisingly nearly 3% fewer individuals who are not married and do not own their own house move back into work.

Table 7.3 reports the cumulative failure rates by different explanatory variables at different duration points, while figure 7.1 highlights the survival function for the sample as a whole. Not all educational qualification groups are shown in the table for brevity. Again it must be taken into account that individuals remain in this sample until death or until the sample ends, and so these failure rates could be indicative of both movement into work or death from retirement, and censoring of the data.

Figure 7.1 shows that within 10 months around 16% of retirees have moved out of retirement, over half have left their spell of retirement within 30 months, while only 19% of the sample remains retired after 60 months. Table 7.3 shows that men and women have very similar movements out of retirement in the first 10 months of retirement, with nearly 17% of men and women having moved out of retirement in that time, and after 10 months men have a 4% higher cumulative movement out of retirement up to 50 months in retirement as by 60 months of retirement around 80% of men and women have moved out of retirement.

Married and unmarried retirees have similar levels of movement out of retirement, while there are major differences in movement out of retirement between those with no

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[159] There is some discrepancy in the measure of their job type and the number of hours that were attempted to be captured through forward casting. Only 69 of the 122 spells that ended in a move back to employment had an associated hours of work variable for the next year in the main panel, with the average hours of work being 21.0 hours. The missing observations on job hours can be attributed to the unbalanced nature of the sample panel selected, and some to the fact that the panel was only created for 8 waves and so cannot look at the future waves when they may have been employed. However, of these 69 observations 4 of those who are reported as moving into a full time job from retirement work less than 30 hours, while 8 of those who are reported as moving into part time employment work more than 30 hours. If the missing observations followed the same pattern of misreporting in terms of differences between job type described and hours of work then the percentage in full time work would be 28.7% and 49.2% in part time work. There are a lot of assumptions in these two figures, and we are also assuming that the status of self employment is also correctly given. However, there is only a fair difference in the figures above and those in table 7.3 and the discrepancy between job type and number of hours of work in their new job is not important in terms of the empirical analysis and so is just noted here so as to give the reader all the available information.

qualifications and those whose highest qualification is a degree or equivalent. Almost 20% of those with a degree have moved out of retirement within 10 months of being retired compared with just over 15% of those with no qualifications, and within 20 months the figures are 45% and 38% respectively. This is as would be expected with those with higher qualifications moving out of retirement and back into work more easily

Figure 7.1: Survival function for the overall sample of 751 retirees.
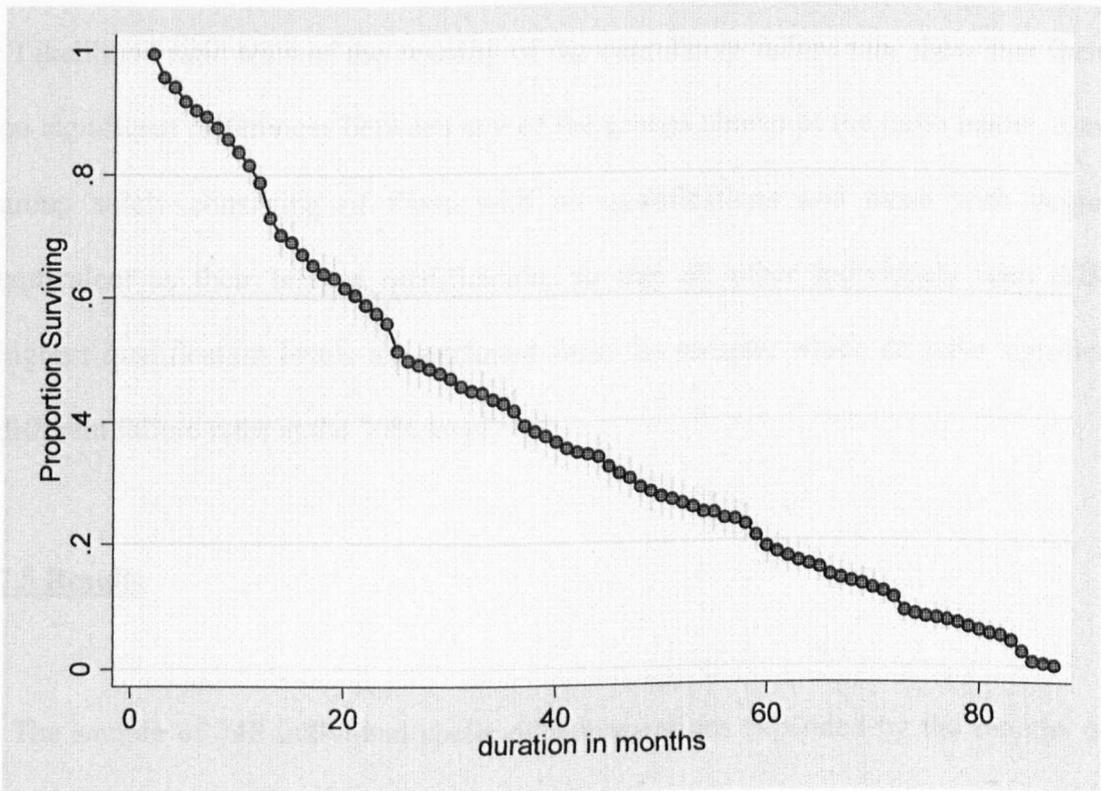
Table 7.3: Cumulative failure rate of leaving retirement by different groups

Duration (months)	10	20	30	40	50	60	70	80	90
Gender									
Men	0.164	0.401	0.550	0.654	0.741	0.811	0.891	0.963	1.000
Women	0.165	0.367	0.512	0.610	0.705	0.809	0.861	0.922	1.000
Marriage status									
Married	0.181	0.397	0.540	0.633	0.728	0.816	0.889	0.951	1.000
Not married	0.112	0.346	0.508	0.637	0.715	0.793	0.838	0.922	1.000
Highest qualification									
No qualifications	0.153	0.384	0.541	0.634	0.706	0.794	0.859	0.934	1.000
Degree or equivalent	0.193	0.453	0.590	0.698	0.802	0.863	0.915	0.962	1.000
Health Status									
Very Poor-Fair	0.193	0.391	0.541	0.643	0.749	0.816	0.874	0.952	1.000
Good/Excellent	0.153	0.383	0.529	0.630	0.715	0.808	0.878	0.941	1.000

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than those with no qualifications. The final two rows of the table show the cumulative failure rates according to the level of reported health by individuals. Here is the clearest indicator that death may well play a factor in this sample since it is those with poor or fair reported health who have the higher movement out of retirement in the first 10 months of retirement, and after this the figures are similar. It would be expected *a priori* that those in good health would move back into work at a faster rate than those in not so good health.

Likelihood ratio tests of the equality of the cumulative failure rate show that there are no significant differences between any of the groups shown in the table below, except a group solely consisting of those with no qualifications and those with degree or equivalent as their highest qualification, so that all other individuals with different highest qualification levels are excluded from the sample, which do have significantly different failure rates at the 10% level.

7.5 Results

The sample of 748 individual spells of retirement are expanded by the months of the duration of the retirement spells, where if the length is unknown because of censoring then the month of the individuals final interview is taken as the end of the duration.[160] The variables that would seem to be of importance according to the descriptive statistics are the replacement rate, education, and health status. The replacement rate should be under 1 theoretically since this is equal to pension income divided by labour income. However, as has been seen, it is calculated in this analysis as the household monthly income in retirement divided by the household income of the individual in the month

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[160] Right censoring occurs commonly in duration analysis and is where the end of the spell (in this case the end of the retirement spell) is not observed in the sample data. Left censoring is where the start of the spell is not observed in the sample data, and is more of an issue. In this sample all individuals with right censored spells have y = 0 for the t months that they are observed to be retired in the panel. Section 7.4.2 shows that the left censored spells for this sample are dropped. See also Keifer (1988) for a discussion of censoring issues in duration analysis.

before the interview in the year prior to their retirement. As would be expected this means that there are some values of the replacement rate that are greater than 1. This will be because for some individuals their labour income just prior to retirement may well have been smaller than their labour income on which their pension is based. This in itself will be because an individual will have reduced their hours in their current job, moved to another job or moved to another job and reduced the number of hours they are working. Therefore when estimating the results of the logistic estimation included are various different levels of replacement rates.

As just mentioned, various logistic regressions are estimated including various selections of the variables of interest, and the odds ratios from the logistic regression are presented in table 7.4 below. Dummy variables indicating an individual's occupation and industry in the year before their retirement were never jointly significant and so are left out of the final estimation. This suggests that which industry or occupation you retire from does not affect the likelihood of an individual returning to work. In the first three columns the replacement rate is restricted to less than three, while in column 4 the replacement rate is restricted to less than 1 and column 5 the replacement rate is restricted to less than 5. In this table no occupational or industry variables, nor life satisfaction are included. For the first three columns, three different specifications are estimated. The specification in column 1 is where only the basic variables of interest are included in the logistic regression and wave and regional dummies are left out of the estimation.

Also left out of the estimation are the two interaction variables. The specification estimated in column 2 includes wave and regional dummies, while specification 3 adds the interaction variables between pecuniary and non-pecuniary variables. Again it is noted here that caution must be taken when interpreting these results because of the issues raised in section 7.3. This chapter will examine the results and then discuss the

policy implications as if these results are completely correct, but it must be remembered that this is unlikely to be the case.

Table 7.4: Duration analysis of leaving retirement

Variable	1 Logistic regression	2 Logistic regression	3 Logistic regression	4 Logistic regression	5 Logistic regression
Age	0.827** (0.062)	0.799** (0.077)	0.759*** (0.074)	0.797* (0.102)	0.757*** (0.074)
Age Squared	1.001** (0.001)	1.002** (0.001)	1.002*** (0.001)	1.002* (0.001)	1.002*** (0.001)
Female	1.013 (0.202)	1.028 (0.219)	0.629 (0.226)	0.587 (0.278)	0.629 (0.224)
Not Married	0.719 (0.198)	0.710 (0.215)	0.422* (0.201)	0.290* (0.195)	0.409** (0.192)
Mortgage/Rent	0.959 (0.196)	1.026 (0.239)	2.208 (1.159)	2.276 (1.890)	2.160 (1.121)
Not Pension member	1.433* (0.304)	1.374 (0.300)	0.965 (0.272)	1.294 (0.472)	0.949 (0.265)
Replacement rate	0.581* (0.168)	0.601* (0.186)	0.592* (0.181)	0.385 (0.271)	0.639* (0.171)
Highest qualification:					
Other	0.399* (0.190)	0.367** (0.179)	0.386* (0.188)	0.578 (0.315)	0.377** (0.182)
GCSEs	1.000 (0.312)	1.067 (0.351)	1.120 (0.372)	1.021 (0.461)	1.092 (0.359)
A-Levels	1.514 (0.557)	1.373 (0.538)	1.370 (0.543)	1.150 (0.617)	1.359 (0.530)
Degree	1.618** (0.362)	1.639** (0.377)	1.800** (0.424)	1.883* (0.650)	1.779** (0.412)
Health: Good/Excellent	1.923** (0.502)	1.838** (0.507)	1.857** (0.514)	1.508 (0.613)	1.874** (0.516)
Multiple Spells	1.211 (0.340)	0.997 (0.312)	0.995 (0.314)	1.318 (0.500)	1.004 (0.314)
Regional Dummies	NO	YES	YES	YES	YES
Wave Dummies	NO	YES	YES	YES	YES
Female*Not Pension Member	-	-	2.099* (0.878)	2.426* (1.277)	2.139* (0.892)
Not Married* Mortgage/Rent	-	-	0.387* (0.216)	0.359 (0.302)	0.382* (0.212)
N (person-months)	23343	23343	23343	11286	23938
Pseudo R²	0.028	0.046	0.050	0.062	0.049
Wald	43.26	82.11	85.51	72.68	81.42
Pr(>Chi Sq.)	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: The numbers presented are the odds ratio of leaving retirement and moving into work given you have that trait, while the robust standard errors are in parentheses. In columns 1-3 the replacement rate is restricted to less than 3, while columns 4 and 5 repeat the regression of column 3 but with the replacement rate restricted to less than 1 and less than 5 respectively. *, **, and *** indicate significance at the 10, 5 and 1% levels respectively.

Looking first at column 1, it can be seen that gender, having more than one spell in retirement, not being married, and not owning your own house do not significantly affect the likelihood of an individual leaving retirement for work. Compared to those with no qualifications, those with GCSEs or equivalent or A-levels as their highest qualification are not significantly more likely to re-enter the labour market. However, the results suggest that compared to those with no qualifications those with other qualifications are significantly less likely to enter the labour market, by about 60%, while those with a degree or other higher qualification are over 60% more likely to re-enter the labour market.

As expected not being a pension member while an individual was in work in the years prior to their retirement increases the likelihood of you returning to work by 43%, while the higher is your replacement rate the lower is the likelihood that a retiree will return to work. The results also indicate that those who report their own health as being good or excellent are over 90% more likely to move back into work from retirement compared to those who reported their health as very poor, poor or fair. The older you are the less likely you are to go back to work after retirement, but this effect increases at a decreasing rate as the square of age is also significant. These results suggest that both economic and non-economic variables play a key role in the decision of an individual to leave retirement and go back to work.

Once all the variables of interest have been included in column 3, the results described above do change to an extent. Men and women are still just as likely as one another to go back to work, but women who were not part of an occupational pension scheme in the years before their retirement are 110% more likely to re-enter the labour market than women who were. Those who are not married are 58% less likely to go back to work after retirement than those who are married, but if the person who is not married or living with a partner does not own a house then this figure drops to almost 120% less likely. This result suggests that those who are single and own their own house are actually less

likely to go back to work than those who are single and do not own their own house. This result points to pecuniary reasons for wanting to return to work rather than non-pecuniary such as to increase social contacts or to keep mentally and physically active. Again good health compared to bad and having a degree compared to no qualifications are significantly more likely to return to work from retirement. Age, at a decreasing rate, the higher is your replacement rate and having other qualifications compared to no qualifications significantly reduce the likelihood of an individual leaving retirement and going back to work.

When the replacement rate is restricted to less than 1, as presented in column 4, then the results do change to a certain extent. Not being married or living with a partner means you are more than 70% less likely to return to work from retirement, while again women without a pension are much more likely to return to work than women with a pension. With the replacement rate restricted to less than 1 both health and the replacement rate itself do not significantly affect the likelihood of going back to work after retiring. When the replacement rate is restricted to those under 5, as in column 5, then the results are broadly in line with column 3.

Depending on the specification used in the estimation, when compared to the South East of England excluding London, those who live in East Anglia are more likely to return to work and those who live in Yorkshire and the West Midlands are less likely to return to work from retirement. In terms of year effects only in column 2 are there any significant differences and those suggest that those individuals who were retired in 1995 are much more likely to go back to work than those who were retired in 1991.

So these results suggest that age, health status, education, marriage status, and retirement income compared to pre-retirement income are important determinants of the probability of leaving retirement for work, as to are female non-pension members and in two of the three specifications not being married and not owning a house. So the results definitely point to the decision being based on both pecuniary and non-pecuniary

reasons. As discussed in section 7.4.3 education and marriage status are assumed here to capture non-pecuniary reasons for moving back into work but it could well be that they are capturing pecuniary factors. Health however is a very major factor in the possibility of returning to work and so are financial factors such as retirement income and for women whether they had an occupational pension in the year before retirement.

How strong are these effects on the probability of leaving retirement and moving back into work in terms of their marginal effect? Table 7.5 presents the marginal effects on the probability of leaving retirement and returning to work. For ease of use only those variables that were significant in the preferred specification, column 3, are included. One would not expect large effects considering that the proportional sample mean value of the dependent variable is 0.0052.[161] Given this the marginal effects at the mean values of the variables are relatively large. Having good or excellent health increases the probability of an individual moving back into work from retirement by 0.2 percentage points. If you are not married then you are less likely to move back into work by 0.3 percentage points, although those that are not married who live in mortgaged or rented accommodation are 0.03 percentage points *more* likely to return to employment from retirement. A woman who was not a member of an occupational pension scheme before their retirement has an increased probability of leaving retirement and returning to work of 0.25 percentage points.

The probability of exit from retirement is also affected by a relatively large amount by educational qualifications: those with other qualifications are less likely to return to work by 0.3 percentage points than those with no qualifications, while those with a degree are more likely to return to employment than those with no qualifications by almost 0.2 percentage points, *ceteris paribus*. It is likely that those with other qualifications may have qualifications in manual labour and so their returning to work may not be as likely

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[161] This is the number of exit-months from retirement into employment (122) divided by the number of person-months we observe (23343). This is to say that only just over 0.5% of the sample of person-months end in a movement back into employment from retirement.

because their abilities to do the work may not be as adequate as other equally well qualified younger workers.

Table 7.5: Marginal effects on the probability of exiting retirement for employment

Variable	Mean	Marginal effect
Age	60.48	-0.001
Age Squared	3701.07	0.000008
Health Good/Excellent	0.732	0.0020
Replacement Rate	1.056	-0.0018
Not Married	0.321	-0.0030
Female*Not pension member	0.141	0.0025
Not Married*Mortgage/Rent	0.141	0.0033
Highest Qualification:		
Other	0.121	-0.0032
Degree	0.251	0.0018
Region:		
East Anglia	0.132	0.0023
West Midlands	0.097	-0.0032
Yorkshire and Humberside	0.091	-0.0049

Notes: Marginal effects evaluated at the mean value.

The movement into work from retirement is also affected by where you live. The probability that a retiree will return to work from retirement is reduced by 0.3 and 0.5 percentage points if the individual lives in the West Midlands or Yorkshire respectively when compared to an individual living in the South East (excluding London). However, an individual living in East Anglia is more likely to leave retirement for employment than an individual living in the South East, *ceteris paribus*. The probability of leaving retirement for work increases by 0.2 percentage points for an individual in the former area compared to the latter.

The replacement rate of a retiree is relatively very important in its magnitude of affecting the probability of an individual returning to work from retirement. If a retiree's replacement rate increased by 10% then the probability that the retiree would return to work would be reduced by 1.8 percentage points, *ceteris paribus*. The mean replacement rate is 1.056, and so if we were to assume that monthly household income during retirement were £1056 and the monthly income before they retired was £1000, then household income per month would only have to increase by just over £105 to reduce the

probability of returning to work by nearly 2 percentage points.[162] So income in retirement is an extremely important determinant as to whether an individual will move back into work or not.

How do these results compare to past empirical papers in this area? Well in that the results of this chapter highlight that both pecuniary and non-pecuniary factors have a role to play in the decision of retirees as to whether to return to work or not this supports the evidence from recent UK literature on the subject.[163] However, these results do in some way go against the findings of Butler *et al.* (1989) for older US data. Their results indicated that wealth, women and non-whites reduced the likelihood of returning to work, while being married and having children increased the probability of returning to work. The results of this chapter indicate that women are no less likely to return to work than men, a result that suggests that sexual equality has certainly improved since the 1970s, indeed women without an occupational pension are more likely to return to work than men or women who had occupational pensions prior to retirement. The results of this chapter also point to unmarried individuals being less likely to return to work than married people. However, there is agreement with financial indicators since the replacement rate is seen as important in this analysis. This finding goes against the results of Maestas (2007) using more recent US data who found that financial variables played little part in retirees returning to work.

What do these results suggest for policy? Again there is clear evidence that income after retirement plays a large part in return to work decisions and so the changing of the UK pension system and the efforts to make individuals more aware of their pension entitlements and likely pension benefits in retirement are key policy objectives.[164] So for example individuals should know if their income in retirement is going to be lower than

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[162] See the discussion in section 7.4.3 as to why the replacement rate can be over 1.
[163] See chapter 7.2.1.
[164] See chapter 1.3 for a more detailed discussion of the UK pension system and changes by the government towards it.

they would want to that they can change or alter their retirement plans as necessary. The removal of age discrimination will also help play an important role in helping older workers keep their jobs or return to work. It is important to stress that these results do indicate that there are those who want to return to work simply to keep themselves motivated or to meet new people, so it is important for the government to be able to allow older workers to have the ability to get jobs if they so wish. The results do highlight that there may be some regional differences and so it is important that there is regional as well as national policy coordinated towards improving the availability of jobs to older workers.

Some caution must be taken however in the validity of these results and therefore their potential implications. It must be acknowledged when looking at these results that there are problems in this estimation process that were raised in section 7.3 of this chapter that could lead to bias and inefficiency. As was discussed, heterogeneity can arise from the problems of initial conditions, sample attrition and non-response. However, there is some evidence that some of the potential problems may not cause too large a discrepancy in results.[165]

7.6: Conclusion

This chapter has looked at the factors which affect an individual's decision to leave retirement and go back into work. Recent literature that focuses on the UK has looked in great detail at the movement into retirement and the postponing of retirement but little empirical work exists for the UK which has considered the reasons for why an individual would want to leave retirement and move back into work. Using the British Household Panel Survey (BHPS) a dataset of around 750 retirement spells was created, of which just

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[165] See the results of Cappellari and Jenkins (2004) and the review of previous empirical work in their discussion.

over 120 ended with a move into work. The retirement spells were then expanded by the number of months at risk of leaving retirement within the sample so as to be able to estimate a binary regression as explained and outlined by Jenkins (1995).

Logistic estimation of each month at risk of leaving retirement indicated that there are both pecuniary and non-pecuniary factors that affect an individual in their decision to go back to work. Income is a major factor in the decision to go back to work, with those who had low replacement rates more likely to leave retirement than those with higher replacement rates. Health was also a key factor in the decision process with the healthier you were the more likely you were to move back into work from retirement. Age, not being married and having other qualifications compared to no qualifications both reduced the likelihood of an individual moving out of retirement, while having a degree compared to no qualifications increased the likelihood of moving back into work from retirement. Interaction variables to highlight the link between pecuniary and non-pecuniary variables were significant which points to a conclusion that it is neither pecuniary nor non-pecuniary factors which solely decide whether an individual will return to work from retirement.

In terms of policy the results suggest that governments do need to increase awareness of retirement income and how well off individuals will be compared to before their retirement. Regional governmental policy should also be examined as results suggest that those living in certain areas are more likely to move out of retirement and into work than in other areas.

There are four areas in this investigation that would be useful to explore in future research. First is that there are relatively few exits from retirement into employment in the BHPS which can then be examined. Further research may wish to use alternative datasets; for work in this country the English Longitudinal Study of Ageing (ELSA) will

prove to be a useful dataset in the future as more waves become available as this focuses solely on older individuals.[166]

Second, it is likely that further investigation is needed into the effects of replacement rates on the probability of returning to work from retirement. In this analysis replacement rates looked at household income prior to retirement and after retirement. This led to many replacement rates being above 1, and while the results remain broadly similar when different specifications of the estimation are run using different cut off points for the maximum replacement rate, it would prove beneficial to examine the effects of income and on the probability of going back into employment from retirement using more comprehensive replacement rates. For example it may prove beneficial to examine replacement rates at an individual level as well as at a household level.

Third, there is relatively little data in the BHPS on pension incomes and types. This links to some extent with the former problem in that it would prove beneficial to have more information on where income is coming from after retirement, be it a state pension or private personal pension, and what types of saving for retirement were occurring while they were in the labour force.

Fourth, there are problems with this estimation process which must be taken into account when considering these results. Firstly it has been assumed that there is only one exit possibility from retirement for individuals, namely that the individuals can either be retired or return to work. Of course one obvious other exit possibility is that the individual dies, and therefore the results may be biased to some extent if death is not random. (Butler *et al.*, 1989) Another problem with the data is the likelihood of heterogeneity given that we are looking at repeated spell months for each individual, and so again there is likely to be some bias in the results because of this. Future research in this area should look to solve these issues, most importantly by looking at estimating

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[166] Interviews for wave 3 were completed in April 2007. See www.natcen.ac.uk/elsa/index.htm for further details on the English Longitudinal Study of Ageing.

competing risks models to remove the possible bias from not including death as a possible exit from retirement.

Conclusion to The Labour Supply and Retirement of Older Workers: An Empirical Analysis

Pensions, retirement and the labour supply of older workers have become increasingly important topics in recent years. In the UK the population is growing ever older on average, there is now a national debate on pension reform, Acts have been passed into law to reform the pension system, and there has been the removal of all forms of discrimination from the workplace, including discrimination on the grounds of age. Reforms to the pension system include the increasing of the state pension age for women from 60 to 65 which is to be phased in between 2010 and 2020, and the ability for individuals to defer their state pension and continue working. In the last ten years there has also been the introduction of the New Deal 50 Plus which aims to help get older people who want a job to find one.

Given all of the above this thesis was motivated to examine the labour supply and retirement of older workers. In particular the aims given at the beginning of the thesis were to: Examine the labour supply of older workers in the UK; compare how older workers and younger workers react to wage and income changes; examine descriptively what happens to income and happiness as individuals retire; quantitatively study the changes to income and happiness as individuals retire; and examine what the causes are of moving out of retirement and back into employment.

Following the introduction the next two chapters focussed on the theory and empirical evidence of labour supply and retirement respectively. From these the research questions were motivated further. Chapter 2 examined the theory and empirical evidence of labour supply and found that there was little work on recent data for the UK as to the labour supply of older workers and their wage elasticity and income elasticity of work hours. Indeed there was no work comparing the difference in elasticity of work hours of income and wage between older and younger workers. The chapter also outlined how there was

hardly any evidence on the reasons why an older worker will participate in the labour force. As such there was sufficient motivation to look at the labour supply of older workers.

Chapter 3 of the thesis examined the theory and empirical evidence of retirement, and highlighted that there were improvements that could be made to the literature to date on the effects of retirement. Recent literature had descriptively examined what happens to income as individuals move into retirement, but no multivariate analysis had been attempted. Also there was no literature examining what occurred to happiness as an individual moved into retirement. The chapter also highlighted how many individuals now return to work after retiring and how there has been little work in the UK that has empirically examined why an individual would return to work after retiring. Therefore there were clear reasons to estimate the effects of retirement on income and happiness as well as to look at the reasons as to why an individual returned to work after retiring.

Chapters 4, 5, 6 and 7 then went on to estimate empirical models to that were motivated in the first 3 chapters. Chapter 4 examined both the labour force participation and labour supply of older workers. Separate random effects probit models of labour force participation were estimated for men and women aged 50-70. To examine the labour supply of older workers a random effects tobit model was used to allow for the possible censoring of the observed data on hours worked that takes place at zero. The results indicated that men aged 50-70 were less likely to participate in the labour force the greater was their education, while the opposite was true for 50-70 year old women. The poorer an older person's health, women who are widowed or single as opposed to being married, having a retired spouse, the greater was your other household income and for older women the greater your predicted wage the less likely you are to be participating in the labour force.

When looking at the labour supply of older men their hours of work are not affected by the number of children they have or their level of education. Having a spouse who is

retired does not affect the number of hours an older man works once they have decided to participate in the labour force. Other household income significantly reduces the number of hours worked by older men, while the predicted wage of an older man has no effect on the number of hours they work.

For older women those with qualifications significantly increased their hours of work compared to those with no qualifications. Having a retired spouse and other household income significantly reduces the number of hours an older woman will work. Health also plays an important role in the number of hours worked for older women, with those with very poor health significantly more likely to work fewer hours. The results also suggested that the greater the predicted wage the less hours an older woman will supply.

When examining the wage elasticity of older men and women and their younger counterparts the results showed that older men and women were significantly less responsive to wage changes than their younger counterparts. A 10% wage increase would not lead to any change in an older man's labour supply while for younger men the wage increase would lead to a decrease in labour supply of 32 hours per year. For older women the fall in working hours from a 10% wage increase was 32 hours per year while for younger women the fall in working hours would be 210 hours per year. With regards to other household income elasticity of work hours all workers of any age had a negative response to any other income changes, but again older workers were less responsive in their changes than their younger counterparts. However, the results did show that the effect on work hours of changes in other household income were very small.

The chapter successfully achieved the first two aims of the thesis to examine the labour supply and labour force participation of older workers and compare the wage elasticity and other income elasticity of work hours of older workers with their younger counterparts. The chapter ended by analysing how policy could take advantage of the different responses of younger and older workers to wage changes to increase older worker's labour supply.

Chapter 5 examined the movement into retirement, looking at the movement into retirement for older workers as a whole using descriptive analysis, specifically concentrating on the economic participation rates of older individuals according to age cohort when split by wave and gender and then wave cohorts when split by age and gender. The analysis of the movement into retirement suggested that for older workers as a whole the movement into retirement was a gradual process, although there were larger movements at the ages of 60 for women and 65 for men respectively. Time trends were also found that suggested that younger cohorts were less economically active at older ages than their older counterparts. However analysis of work hours in the years prior to retirement showed that for the majority of men and there was little gradual cutting of working hours before their retirement. For a minority of men and women there was a gradual cutting of hours with a higher proportion of men and women being in part time work 1 year before retirement compared to 2 years before their retirement.

Chapter 6 of the thesis provided a descriptive analysis of changes in income and happiness as individuals moved into retirement. The analysis showed that there is a very large fall in personal income as an individual moves from work into retirement, while their happiness does increase but not significantly so. However, there was evidence that there was an improving trend in happiness between waves. When income and happiness by different personal traits are examined the results highlighted that women have a significant one off increase in general happiness as they move into retirement but the same cannot be said for men. Those who retire early also have a significant increase in general happiness as they first move into retirement, while late retirees have no change in general happiness levels. Early retirees also have a sustained significant increase in subjective wellbeing after their retirement, but their fall in both personal and household income is significantly greater than late retirees. Employer pension scheme members have a one-off significant increase in general happiness as they move into retirement while non-pension scheme members do not.

The chapter continued with a multivariate analysis of the change in happiness as individuals moved into retirement showed that those who had been their previous job longer before retirement had a significantly greater fall in happiness as they moved into retirement. When looking at the change in life satisfaction those individuals who retired late had a significant fall in life satisfaction as they moved into retirement compared to those who retired at the state pension age. The results also highlighted that the higher an individual's wage before retirement the greater was their improvement in life satisfaction as they retired.

Extensions to the research were also suggested including using an instrument variable to control for the heterogeneous decision of retirement. This chapter answered two aims of the thesis by examining both descriptively and quantitatively what happens to income and happiness as an individual retires.

Chapter 7 of the thesis examined the probability of an individual leaving retirement and returning to work. This was achieved using logistic estimation of a simple binary variable that took the value of 1 if the individual returned to work from retirement in a specific month. By looking at person-months instead of the length of the retirement spell the chapter was able to use equivalent logistic modelling rather than using duration analysis. The data used for the estimation process was a data file of individual's episodes in the labour force that used information from the 1st 8 waves of the BHPS and included all their job statuses for their whole work life.

The results found that there were some very strong effects on the likelihood of leaving retirement and returning to work. The replacement rate was found to be extremely important in reducing the likelihood of a retiree returning to work, while good health and a degree or equivalent as your highest qualification increases the likelihood of you returning to work. Not being married reduces the likelihood of going back to work from retirement unless a retiree also happens to not own their house in which case the retiree is more likely to return to work. The results also showed that living in certain regions of

Great Britain increases and decreases the likelihood of a retiree returning to work when compared with those living in the South East (excluding London).

There were some important caveats raised in the chapter however, and these issues were all put forward as areas where future research could improve on this work. Despite this the final aim of this thesis has been achieved, with the chapter analysing the reasons for moving back into employment from retirement.

What are the key findings from this thesis? 1) That older workers have different wage and other income elasticities compared to younger workers. In particular older workers are less responsive to changes in wages and other household income. 2) That there is evidence of both a gradual movement into retirement for workers as a whole and a sudden retirement process for the majority of individuals. 3) That income and happiness change significantly as individuals move into retirement and the changes depend on certain traits of the individuals. 4) That women and early retirees have a significantly greater fall in personal income as they move into retirement than their respective counterparts. 5) That life satisfaction is improved the greater is your wage before retirement and is worsened if you retire late compared to retiring at the state pension age. 6) That pension income is important in keeping a retiree retired rather than returning to work. All six of these findings link and achieved the aims of the thesis as set out in the introduction to the thesis.

What do the above findings mean for current and future policy in the UK? The conclusion will now turn to discussing the findings of this thesis and the implications they have on the policies discussed in the introduction to the thesis. The increase in state pension age for women from the age of 60 to 65 is to bring the state pension age into line for both men and women and will be phased in from 2010 until 2020. There is also scope that the state pension age for men and women will increase in the future as life expectancy increases. In that there is now going to be longer for individuals to work before they can receive the state pension it is likely that we will see a move towards a

more gradual movement into retirement for both individuals and for the overall population. This is likely since all individuals should now be able to plan for their retirement to a greater extent and therefore retire when they feel the time is right. Increasing the state pension age will also mean that it will take longer for older workers to receive the increase in other household income that would accrue from receiving the state pension which should mean that there older workers will not cut back their labour hours worked for longer, thus encouraging greater labour supply of older workers. In that the increase in state pension age may allow workers to achieve greater savings by working for longer it may well be the case that the increased state pension age will lead to smaller falls in income upon retirement, plus the increase in the state pension age for women should lead to less of a fall in personal income upon retirement, and individuals may also be happier if they are able to plan their retirement to a greater extent. Also given that the state pension age will increase it is likely that 'late' retirees will reduce in number and so should reduce the number of older individuals who have a fall in life satisfaction as they move into retirement. The Final positive outcome of this policy according to the results of this thesis is given that pension income is a very important determinant of keeping an individual retired the increase in state pension age should as already mentioned lead to improved readiness for retirement and so it may lead to a fall in those who return to work for pecuniary reasons.

However, there is one con to this policy according to the results in this thesis. Increases in the state pension age will lead to increased levels of early retirement, which will probably result in greater falls in personal income upon retirement for early retirees. The counterargument to this is the point already raised that individuals who do retire prior to the state pension age will likely be better prepared for their retirement and so may not suffer such a great fall in income than they otherwise would have.

The government policy of pension deferral is aimed at increasing old age employment and allows older individuals to receive an increased state pension by deferring it for a

number of years. This policy would again likely increase the individualism of retirement and should make it more of a gradual process as individuals would be able to decide for themselves when the time was right to retire. The policy would also be good for the labour supply of older workers, which is a main intention of the policy, as decreasing other household income in the short term will increase the labour supply of older workers, and it will also increase their labour force participation. Individuals that are able to retire when they are ready to will likely be happier and also are likely to be better off financially than they otherwise would have been. Also the pension deferral should also help enable retirees to not go back to work for pecuniary reasons and stay retired with the increased pension income they would receive. However, there is a negative point to this policy in that 'late' retirees have a fall in life satisfaction as compared to those who retire at the state pension age, and so pension deferral may lead to a fall in life satisfaction for some older individuals.

The EU issued a policy directive in 2000 removing all forms of discrimination from the workplace, and this includes the removal of ageism, and in the UK the directive's issues in terms of the removal of age discrimination came into force under the Employment Equality (Age) regulations 2006. Removing any ageism from the work place is likely to remove an added barrier to employment of older workers and thus increase the likelihood of a more gradual and individual movement into retirement rather than a sudden institutionalised stop to work at a certain age. Removing ageism will have demand impacts on older workers and so could lead to an increase in working hours for older workers. This in turn could impact on their happiness and income as they move into retirement. The removal of ageism may also improve the life satisfaction of older workers who retire after the state pension age as this fall in life satisfaction may be linked with a removal of their employment on the grounds of age.

The New Deal 50 Plus was introduced as a pilot scheme in 1999 and went Nationwide in 2000, and was aimed at helping those over 50 who wanted to work to get back into

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employment. In that the New Deal 50 plus attempts to help get older workers back into gainful employment if they want it then it should increase the economic activity of workers and improve the individual decision on when to retire. The policy, again as it is aimed to do, will also improve labour supply as improved labour market conditions should lead to a larger number of older workers employed. Getting older individuals back into work when they want to is also likely to improve their happiness as they move into retirement when they decide to and will probably improve the income fall at retirement as well with a possible reduction in early retirements.[167] Finally, improving pension incomes through allowing older individuals to earn more labour income should enable fewer retirees into returning to work because of pecuniary reasons.

Overall the policies that have been introduced in the last 10 years in the UK would seem to have a great beneficial impact for the majority of older individuals in terms of their labour supply, their movement into retirement and the likelihood that they stay retired and do not return to work. There are one or two negative points to some of the policies according to the findings of this thesis, but these are far outweighed by the positives.

Are there any other policies that may be of use for the UK in terms of the older individual, their employment, retirement and the likelihood of them leaving retirement to return to work? Firstly, it would seem to be very important from the findings of this thesis that policy continues to be aimed at making sure individuals are aware of their retirement and the issues that surround it. If they are prepared correctly for their retirement they are likely to leave the labour force when they want to, have a good income in retirement, be happier in their retirement and should not have to return to work once in retirement. Secondly, the final two empirical chapters have highlighted the importance of pensions and while this is an area where policy makers are already looking at keenly the findings certainly back up this and suggest that these discussions should

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[167] This conclusion must be tempered with the policy to increase the state pension age which will likely lead to more early retirements.

continue. Finally, evidence from the final chapter also suggested that there were regional differences in the probability of returning to work from retirement within Great Britain that should be assessed by regional policy.

Despite all of the above key findings there is still much that can be achieved in the areas that have been examined in this thesis. Research can look at increasing dataset size for the number of those moving in to retirement. Further research into the probability of a retiree returning to work can also look at using a competing risks model to allow for the possibility of death and could also use a different dataset to have more observations of individuals moving back to work from retirement. Another issue that could be addressed is to look further into the reasons why older workers are less reactive to wage and other household income changes than younger workers. Another possible extension to this thesis would be to look at each of the topics examined in the thesis from the point of view of the impact of policy. Just how has policy helped the labour supply of older workers? How has policy helped the effects of retirement on income and happiness and has policy changed the probability that an individual will return to work after retiring?

Overall this thesis has closely examined the labour supply of older workers and their movement into retirement. It has examined the labour force participation of older workers, the labour supply of older workers and their wage elasticity and other household income elasticity of work hours. What has also been achieved is to closely look at the movement into retirement by wave and gender and age, as well as examining what happens to an individual's income and happiness as they move into retirement. Finally the thesis has also looked at why an individual may leave retirement and return to work and estimated the determinants of the probability of this.

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