Early retirement patterns in Europe

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A Comparative Panel Study

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Early Retirement Patterns in Europe

A comparative Panel Study

Proefschrift ter verkrijging van de graad van doctor
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door

Trudie Schils

Geboren op 28 oktober 1972 te Maastricht

Promotor: Prof. Dr. Ruud J.A. Muffels
Copromotor: Dr. Didier J.A.G. Fouarge

The journey of writing a thesis

Two roads diverged in a wood, and I
I took the one less travelled by,
and that has made all the difference

(*Robert Frost (1874-1963), The road not taken*)

Writing a dissertation, to me, is much like going on a journey. The direction is somewhat unknown, although there is a plan of where to go and which places to visit. As a brave, young scientist, you start walking, still a little bit nervous whether you have packed the right gear for the road. Along your journey you meet all kinds of people. Some of them just stand aside and watch you go by, while others help you in one way or another. You meet people who point you into the wrong direction, and in certain cases this means you have to go back and travel some part anew. In most cases, however, you discover new roads that turn out to be interesting. Anyhow, even these experiences make you grow as a researcher. There are also people that travel with your for some time. Apart from keeping you company, they show you new directions and show you what to watch out for. It is all these people, that I want to thank, because they all helped me to complete my journey. Some persons, however, I want to thank in particular, as I do below.

Me taking on this journey is very much to the credit of my promotor Ruud Muffels, who hired me for this project. I am very happy that I got the opportunity to study this lively subject. He also allowed me to participate in a few of his many research programmes, and encouraged me to present my work at several conferences. He also challenged me to analyse complicated issues, and in doing all this he contributed to me maturing as a researcher. Next to Ruud, I want to thank my copromotor, Didier Fouarge. His door, actually both the one at the university and the one at the OSA, was always open. We had good discussions on topics related to my dissertation which helped to solve many problems. With his great sense of humour he was always the one who motivated me again, and other PhD's as well. In the end we shared the same room, 'het hok' and I enjoyed 'me sitting on your lap one day and you sitting on mine the other'.

The final say on this dissertation was in the hands of the defense committee. I want to thank the members of this committee, Stephen Jenkins, Wil Arts, Lieve de Lathouwer and Arie Kapteyn for taking the time to read and judge my thesis. I am particularly grateful to Stephen, who supported me through email and during the summerschool I took in Essex. Probably, he does not know how important his support was for me regaining my inspiration. It was in Essex, in the fields filled with bunnies, that I found the right motivation again to complete my dissertation. In addition to the committee members I am grateful to Kumar Jamdagni for revising my English, within a rather short time span.

When writing a dissertation, colleagues are of great importance. During the first years of my PhD time, Ronald made me feel comfortable at the department, together with Didier. He also helped me a lot with the statistical software and learned me the most important econometric tricks. Tamara en Brigitte, the other two 'Charlie's Angels', started on the same date as I did and we have grown together, both as researchers and as friends. We shared not only professional concerns, but also personal frustrations, sadness and joyful events. We had a special time together. Another pair of colleagues who became very deer to me are Dorota and Dimitris. Dorota and I spent part of our summerschool in Essex together and we talked a lot about being a perfectionist and how to live with that. Dimitris, with his endless optimism and cheerfulness made me smile every time we met. Especially in the final months he had to put up with my changing moods, but he never seemed to be really bothered by it and kept on helping me in every way possible.

Naturally, other colleagues too, among which are John, Wilfred, Christian, Minna, Antonia, Joris, Erik and Anne, helped me along the way, not only by commenting on my research, but also by making me feel relaxed at the department. I am also grateful to Ton Heynen who, being the PhD consultant, mainly heard the bad stories about being a PhD student. He made sure that problems were solved and that financial issues were taken care of, something which is very useful for a PhD student.

Outside the university are the victims, the people that suffered the most from my asocial behaviour during my PhD time. Although I turned down some invitations, Robert, Ton and Bonny never stopped inviting me for great 2cv trips, or just for a drink. This helped me to relax, so I could write again with a fresh mind. With Karien I spent many hours running or walking in the woods. These 'therapeutical sessions' as we refer to them, were very useful, because I could share many insecurities with her, since she feels the same on a whole lot of issues. Marjan showed me with her spiritual mind that work is not always the most important thing in life, but that living is. I am also thankful for the 'beauty day' we had after I handed in my manuscript. Elke and I go back for about thirty years now and although this dissertation really got in the way of us meeting physically, mentally we kept in touch. She remained very patient, even when I was cancelling our appointments, and she kept on telling me that she was proud at me for undertaking this project.

My parents, although a little surprised when I told them I was going to become a researcher, always gave me the opportunity to follow my heart. With their love and good advice, especially on how to cope with setbacks, they also contributed to the completion of this dissertation. Finally, I thank Maus, who never stopped believing in me, and who never stopped supporting me, but who also felt the greatest pain of this dissertation. He really had to put up with a lot, but in a way it strengthened our relationship.

Contents

Chapter 1

Introduction

Economic research to date has contributed to our understanding of the early retirement behaviour of older workers. The aim of this dissertation is to study early retirement behaviour from the theoretical, empirical and comparative perspectives. This approach supplements the early retirement literature in four ways. First, we use the job search theoretical framework as our starting point for examining early retirement behaviour in a comparative perspective that has up till now not been pursued. This was decided upon after reviewing the existing theoretical and empirical literature. The review itself helped us to gain a better insight into the literature on the modelling of early retirement behaviour by providing a detailed overview of the main economic models used and recent developments in these models, but also by allowing us to gain further insight into their contributions as well as their shortcomings. We show that in order to analyse early retirement behaviour, an economic model is needed that allows for the inclusion of multiple early retirement pathways (e.g. disability, unemployment, retirement) and different institutional settings. Second, by examining various early retirement systems across Europe, we add to the stream of research papers on the role of pension systems in general and that of early retirement systems in particular. Most studies in this field focus only on the old-age pension (i.e. retirement at the official age, without considering early retirement) or discuss only the public early retirement schemes, without considering the occupational and private schemes or the early retirement pathways embedded in social security arrangements. We specifically take into account early exit via these various routes.

Third, in addition to a macro economic comparison of early retirement systems, we analyse observed differences in early retirement behaviour at the microeconomic level. The comparative approach allows the investigation of the extent to which the various early retirement systems affect early retirement behaviour and herewith provide us further insight into the role of institutions in explaining the early retirement decision. This might be helpful for politicians engaged in or being held responsible for the reform or reshaping process of the welfare state that is taking place in most European counties, as we explain later. Most empirical studies on the determinants of early retirement behaviour are

applied to a single-country context, with some notable exceptions in which a comparison is made between a small group of countries. Fourth, rather than using cross-sectional data, as do a large number of existing empirical studies, we use panel or longitudinal data. Such data specifically allow for a dynamic causal analysis of retirement decisions over time. In addition, the use of panel data allows us to correct for unobserved characteristics of individuals that remain stable over time and that might affect early retirement behaviour. Together with the use of panel data, we use advanced micro econometric techniques to follow the most recent developments in the applied literature. When discussing the research questions below, we explain these points in more detail, but we first explain the need to study early retirement in a comparative perspective.

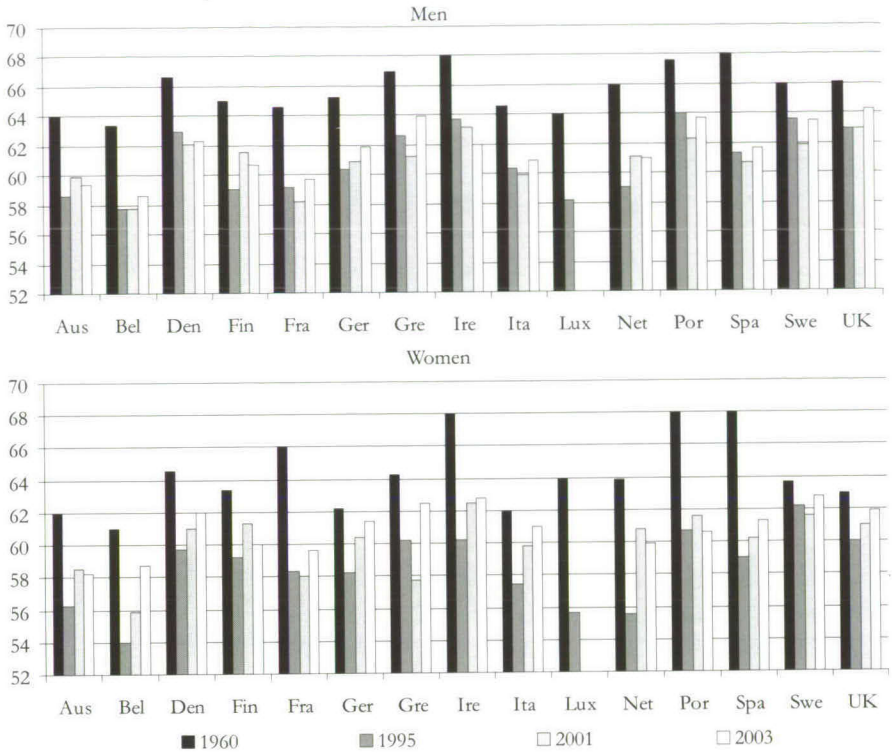
Why study early retirement in a comparative perspective?

Early retirement has become common practice in a large number of European countries. Most early retirement schemes were set up in the 1970s, mainly to reduce youth unemployment and to increase job flows on the internal labour market (e.g. increasing promotion opportunities for younger workers facilitated by the early retirement of older workers). As can be seen in Figure 1.1, in the 1990s the average exit age from the labour force dropped below the level of this average age in 1960, although in most recent years average exit ages have been increasing in most European countries, mainly in response to labour market policies that encourage the labour force participation of the elderly. Nevertheless, in the majority of the European countries the average exit age for men is below 62, in a quarter of the countries it is even below 60 (e.g. Austria, Belgium and France). For women, we observe a similar pattern, though the increase in the average exit age in recent years has been more pronounced for women. This is likely to be due to increasing female participation rates in most European countries. In any case, the average exit age in Europe is clearly below the official retirement age, which is set at 65 in most countries.[1]

Another way of studying the early retirement trend is by looking at the employment rates for older workers, presented in Figure 1.2. We find that employment rates of men aged between 50 and 54 are still above 80 percent, whereas for men aged between 60 and 64, employment rates are less than 20 percent in some countries (e.g. Austria, France, the Netherlands). This is below the European average employment rate of men aged between 60 and 64, which is 35 percent. For women, we find that employment rates have even dropped below ten percent in some countries (e.g. Austria, Belgium, France, Germany and Italy). On average, only about 15 percent of women aged between 60 and 64 are employed in Europe. The highest employment rates for older males are generally found in Denmark, Ireland and Portugal and for older females in Denmark, Finland, Portugal and

[1]The official retirement age refers to the age at which a full public pension can be drawn. In some countries, receipt of a public pension is not even possible before this age, in others only at the expense of a reduction of the benefits, as we explain in Chapter 4.

Figure 1.1: The average retirement age in Europe, by country and year (1960-2003)

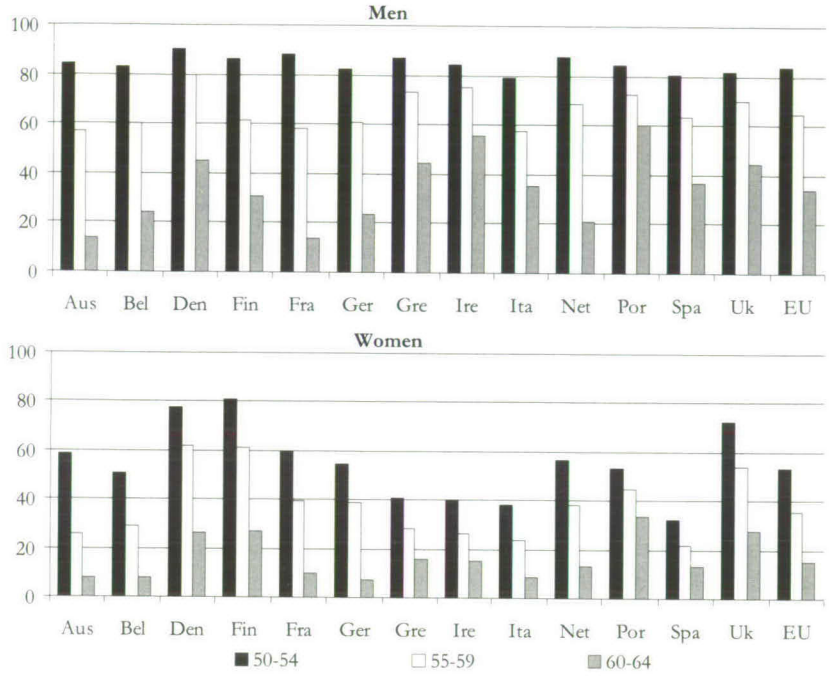


Source: Eurostat (2004)

the United Kingdom. These differences in employment rates across European countries are likely to reflect differences in overall labour market behaviour. For example, the lowest female employment rates are found in the southern European countries (except Portugal) and Ireland. This is likely to reflect traditional, bread-winner patterns of labour market participation in which women tend to remain at home, and take care of the children or household chores. At the opposite end of the scale, in countries with more modern attitudes, such as the Scandinavian countries, we find the highest female employment rates. The purpose of this study is to examine, amongst other things, to what extent such differences in labour market participation lead to differences in early retirement behaviour across countries.

In recent decades, most European governments have voiced their concern about the early retirement trend, especially in light of the ageing population. As a result of the baby boom in the early post-war period, the fall in fertility rates since the 1960s, and increasing life expectancy, the number of older people in the total population is growing, as can be concluded from Figure 1.3. In all European countries, the proportion of elderly has

Figure 1.2: Employment rates of older workers in Europe, by country and age group (2000)

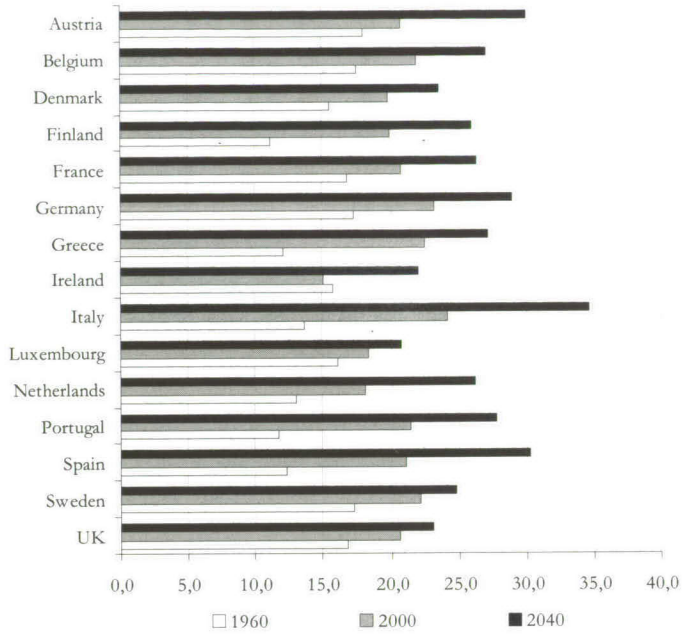


Source: Eurostat (2004)

increased between 1960 and 2000. The largest increases are found in Finland and in the southern European countries (mainly as a result of increasing life expectancies in these latter countries) while minor increases are found in Ireland, Luxembourg and Austria. Kinsella and Velkoff (2001) showed that in 2000, 13 of the 15 European countries (except Ireland and the Netherlands) were among the 25 oldest countries in the world. However, Europe has not reached the peak of the ageing process. The largest increase is expected to take place in the years to come, between 2000 and 2040. For the majority of European countries projections indicate that about one quarter of the population will be aged over 65 by 2040 (United Nations, 1999). Exceptions are Denmark, Ireland, Luxembourg and the United Kingdom where about one-fifth of the population is expected to be aged over 65 in 2040.

The main concern for politicians regarding the observed early retirement practices in Europe parallel to the ageing population, as it is put forward by many European governments, is a declining share of people of a working age, i.e. people aged between 16 and 64. According to EU projections, this population will decline heavily in the next 20 years. Some trends, however, might compensate this decline. First, female participation rates are increasing in most European countries. Women are, for example, having their

Figure 1.3: Percentage of people aged 65+ in total population, by country and year (1960-2040)



Source: United Nations (2005)

first child at a later age also because they want to concentrate in the early stages of their adulthood on their education and, consequently, on their career building. They also increasingly continue to work after having their first child. Moreover, fewer women are having children and those who do are increasingly trying to combine work with their child care duties. These trends raised the commitment and linkage of women to the labour market. In Figure 1.1. we have already noticed that the average exit ages for women have been increasing more strongly than those for men, which is partly due to the increasing female participation. Second, Europe is faced with large immigration flows increasing the share of the working age population. Whereas a large part of the influx of immigrants consists of low-skilled labour that is not warmly welcomed by European governments due to the negative impact on the long-term unemployment rates in the country, some countries have announced policy reforms to attract the high-skilled immigrant worker (e.g. Germany and the United Kingdom) (European Commission, 2005). Third, the declining share of the working age population should not be a problem in cases where the productivity of the remaining labour force would rises further, e.g. as a result of technological developments.

However, it is believed that these trends cannot compensate the expected declining share of the working age population and that this will result in a reduction of the GDP

growth rates as well as a decline in tax revenues and social contributions, which might force governments to lower the public expenditures on social security. In addition, the demand for social security is expected to rise further, due to increased demand for old-age pensions and health care services. OECD estimates show that the worker-pensioner ratio was about five to one in 1960, about three to one in 2000 and that it is expected to drop even further to about two to one by 2050 (Visco, 2000). In other words, while social revenues are expected to decline, social expenditures are expected to increase. This might increase the labour costs and reduce Europe's competitiveness. It also puts pressure on the funding of the social security expenditures in general and on the pension expenditures in particular. Because of this, many governments have recently engaged in social security or pension reforms.

The majority of these proposals are targeted at raising both the early and the official retirement age, and lowering the access to the existing early retirement schemes. For example, in Italy, reforms are targeted at the so-called seniority pensions that allow workers to retire at the age of 57 after 35 years of working. This age threshold will be increased to 60 in 2008. In the Netherlands, reforms have a more general nature with the introduction of a new concept called 'life course savings scheme' (levensloopregeling). This arrangement allows workers to choose more freely how they spend a given amount of 'accumulated leave', either to use it for early retirement, a sabbatical or parental leave. The Dutch government has simultaneously increased the early retirement age to 62.5. In the meantime, the government has started to consider an increase in the official retirement age from 65 up to 67, as has already been proposed by governments in Austria, Belgium, Germany and the United Kingdom proposed. However, political consensus about the new official retirement ages has not yet been reached. Apart from these proposals to increase the retirement age, European governments are strongly pursuing a shift in the responsibility for the provision of a pension from the state to the private sphere by encouraging the development of occupational and private pension schemes. This relieves the budgetary pressure on the public budget. It also changes the balance in responsibility between the state and the individual for (early) retirement provision. Currently, private pensions play an important role only in Belgium, Denmark, Ireland, the Netherlands and the United Kingdom European Commission (2003a). Several other European countries, though, have put the development of second and third pension provision high on the political agenda. Finally, the government is encouraging gradual or partial retirement, a trend that is growing in Europe. By increasing the flexibility of gradual retirement schemes, workers are encouraged to remain in the labour market for some hours a week rather than retiring full time. This is expected to increase the labour force participation of older workers and to increase the contribution base for the social security system.

The observed differences in the average exit age, the employment rate of older workers, the ageing of the population and the proposed reforms to the pension system show that

there is a great variety in Europe regarding early retirement institutions and practices. Research into these differences as well as into the similarities between European systems supports the understanding of early retirement behaviour and might help to formulate new labour market policies to encourage older workers' integration into the labour force or to reform the classical welfare states into more modern ones without jeopardizing their sustainability in the long run.

Research questions

The research questions dealt with in this study fall into three groups. A first set of research questions centres around the modelling and theoretical expectations of early retirement patterns:

1. *Which economic models can be used to analyse an individual's early retirement decision? Which predictions about the determinants of early retirement behaviour can be derived from mainstream economic theory?*

We answer these research questions by exploring a number of existing economic models used to analyse individual retirement decisions. The main theory used to explain such patterns is the neo-classical life-cycle model in which retirement is the optimal decision to an individual's trade-off between years of consumption (or work) and years of leisure. In addition to presenting a detailed explanation of how the models work, we also outline the development of both static and dynamic life-cycle models. Furthermore, we investigate an alternative way of analysing individual labour market transitions in a context governed by uncertainty and rapid changes, by using job search theory. Like the life-cycle models, job search theory is also founded on neo-classical principles, and labour market transitions are also treated in a context of uncertainty with the retirement choice varying with age. We translate the concepts from both the life-cycle and job search models into a formal economic model of retirement behaviour. To our knowledge there are no other recent examples of the use of the job search model for modelling the retirement decision. By doing so, we add to the literature on search models in general and retirement models in particular.

From the retirement models it follows that the early retirement decision is the result of an optimal match between the individual's preferences about income from work and years of leisure on the one hand and his[2] constraints on this behaviour on the other hand. Preferences about work and leisure vary between individuals and consequently the same applies to early retirement behaviour. Differences in preferences largely depend on the individual's background characteristics (e.g. age, gender, health), human capital level (e.g. education level, training, tenure), family status (marital status, children, spousal

[2]Where he or his is written, she or her is also understood.

characteristics) and his employment status (hours worked, type of job, sector of employment, wage, unemployment history). The constraints mainly arise from the individual's background characteristics and the institutional context. Using job search theory as well as human capital theory, we derive predicted effects of these factors on the individual's early retirement probability. Since one of the main objectives of this study is to investigate early retirement behaviour across different institutional settings, we focus more intensively on this set of constraints.

When investigating the incentive effect of the various institutional arrangements on the individual retirement decision, two issues are considered to be of major importance: the level of flexibility and the level of generosity. Flexibility mainly refers to the free choice involved in choosing the age at one retires or the conditions under which one retires, or in general to the entitlement conditions of the exit pathways. Generosity refers to the level and duration of the replacement income, which is the retirement income as a percentage of the previous wage income. The majority of empirical studies on this theme are targeted at the generosity aspect only, without focusing on the flexibility component. As already mentioned, most studies are single-country studies which leads to the individual variation in flexibility being rather small since the level of flexibility largely depends on institutional factors. By including a great variety of European countries in our analysis, we can assess the impact of the level of flexibility of the arrangements on early retirement behaviour as well. First, we derive some general expected effects of both flexibility and generosity on individual early retirement behaviour, using the theoretical retirement model we have developed. Then, we investigate how European countries differ with respect to their early retirement institutions. This gives rise to the second set of research questions:

> 2. *To what extent are European countries different in their early retirement systems in general and their level of flexibility and generosity in particular? Can we cluster early retirement systems in some way, using the level of flexibility and generosity as the main dimensions?*

We answer these questions by examining, both empirically and theoretically, particular features of the countries' pension systems, including the funding principles, the type of benefits and the reference earnings, the retirement age, the tax treatment of contributions and pension benefits, as well as the replacement income level of the pension benefits. We explain these features from a theoretical point of view and explore macro economic evidence on European pension systems. An important contribution of our study is that we not only focus on public pensions (or 'first pillar'), but also include the occupational and private pensions ('second and third pillar'). The public-private mix of pension provision might reveal important characteristics of a country's welfare state and differences in this public-private mix might explain differences in observed early retirement behaviour. As for the early retirement schemes, we investigate schemes within the public pension system,

those within the occupational and private pension systems, as well as those embedded in other social security arrangements, such as in disability or unemployment. These latter pathways might provide a substitute for early retirement schemes in some countries. Preventing workers from taking up early retirement schemes might increase the number of older workers moving into social security pathways (i.e. increased unemployment among older workers), notwithstanding the lower freedom of choice with respect to such pathways. We therefore include them in our discussion on early retirement systems, and observe in which countries these are more relevant patterns (i.e. likely substitutes). We investigate the minimum early retirement age, the entitlement conditions, and the generosity (i.e. replacement income, level and duration of early retirement benefits) of the various early retirement schemes. By investigating differences in pension systems and early retirement schemes in such a broad context, we hope to contribute to the existing literature on the role of pension systems in Europe.

The national pension system is an integral and significant part of a country's welfare state. European welfare states differ markedly since they represent differences in public opinions about state interventions as well as differences in economic, historical and political conditions. Apart from observed differences in welfare or pension systems, we also find some similarities. In the social sciences, this has given rise to the idea that countries cluster in one way or another in a limited set of welfare or pension regimes. Reviewing the literature on regime typologies, we find that the focus has been primarily on the development of the social security system per se, see for example Esping-Andersen (1990). Since the pension system is only one part among many of which the entire welfare state system comprises, the picture of the whole might blur the picture of the underlying part. Therefore, we focus on retirement or pension systems in particular. This might mean that the 'grand' typologies are 'still very useful' or 'not very useful'. We will show that a large number of the existing welfare state and pension regime typologies use rather outdated data. In recent decades, however, especially the public-private mix of pension provision on which a large number of typologies have been built has developed substantially. An update of the typologies with recent macro economic evidence is required to examine whether the clustering of countries is still valid today. In addition, and perhaps most important, the existing pension regime typologies all focus on old-age pension benefits and do not pay attention to early retirement practices. In other words, they exclude particular pathways, especially the occupational and private pension schemes, and those pathways embedded in other social security arrangements (e.g. in disability or unemployment). We investigate whether the existing typologies can still be used to cluster the countries based on the similarities in the development of the countries' early retirement systems in recent decades or whether another typology must be developed that accounts for all this.

Finally, after having set out the theoretical framework with our discussion on early retirement modelling, the economic predictions resulting from it, and the presumed role

of early retirement institutions, we investigate whether these theoretical predictions are empirically supported by our data. Consequently, the final set of research questions is:

> 3. *To what extent are predicted effects of background characteristics, human capital indicators, family status and employment status on early retirement behaviour supported empirically by our comparative data? To what extent do the flexibility and generosity characteristics of the various early retirement schemes affect the exit behaviour of various groups of the working population in a similar or different way?.*

These research questions are dealt with in the empirical part of this study. The use of different data sets and different modelling techniques allows us to examine whether the results depend on the data or the econometric model used, or whether they are stable. From the theoretical model it follows that the empirical model for our analyses needs to account for the existence of multiple retirement pathways, for specific time- or age-dependence of the early retirement decision, as well as for a wide variety of background and institutional characteristics. In addition, as already mentioned, we use longitudinal or panel data to account for the dynamic character of the retirement process. Both the features of the empirical model and the use of different panel data sets leave us with various empirical specifications we can use for the analysis of individual retirement patterns, including panel regression models and duration models.

For the analysis we use the European Community Household Panel survey (ECHP) as well as the national panel surveys from Britain (BHPS), Germany (GSOEP) and the Netherlands (SEP). The main advantage of using the ECHP data set is that we are able to include a large number of countries in our analysis and to test the theoretical predictions about the effect of the individual's characteristics and of institutions formally. Due to the size of the ECHP data set and the lack of retrospective information on the respondent's labour market history, however, we are limited in the choice of modelling techniques which are available and we can control only for observed heterogeneity in explaining differences in early retirement behaviour. By using the longer running national surveys, which also include retrospective information on the individual's work histories, we are able to use more advanced econometric techniques that exploit the longitudinal nature of the data, such as duration models, and to correct for unobserved heterogeneity. We examine whether the correction for unobserved heterogeneity as well as the use of another econometric technique affect the results. Finally, in addition to studying the determinants of early retirement behaviour in these countries we briefly analyse the consequences of early retirement upon income. A large number of the predicted differences between the countries or between groups of individuals rely on differences in generosity of the early retirement schemes.

Finally, from the theoretical framework it follows that the declining participation in training of older workers is one of the predictors for early retirement. To distinguish this, we start with an analysis of the participation in formal training of older workers and compare this with the participation in training of younger workers. Human capital theory predicts that human capital investments (i.e. participation in training) are lower for older people compared to younger cohorts, the main reason for this being the higher transaction costs associated with the training older workers. These lower human capital investments, then, increase the job to non-job mobility of older workers. Again, for both the participation in training programmes and the effect of training on early exit, country differences are relevant. For example, in countries where early retirement is both generous and flexible, the difference between older and younger workers' in the participation in training is expected to be stronger compared to countries where early retirement is least generous and least flexible. However, these predictions have hardly been tested empirically and it is the aim of this research project to add to the literature in this field. When modelling the effect of training on early retirement, however, we need to take account of possible problems of endogeneity bias. We have reason to believe that older workers who are engaged in formal on-the-job training are a non-random (self-selected) group in that unobserved characteristics affecting the decision to participate in training are correlated with those affecting the retirement decision. We test to what extent such an endogeneity bias is present in European countries and we discuss what models can be used to correct for this.

Brief outline

This study consists of a theoretical part (chapters 2-4) and an empirical part (chapters 5-7). It has to be noted that some overlap between the chapters might exist, however, we have tried to reduce this to a minimum.

In Chapters 2 and 3, we deal with the first set of research questions. Chapter 2 serves as a literature review on economic retirement models and presents the theoretical job search model used for the analyses in this dissertation. In Chapter 3, we derive the main theoretical predictions about early retirement behaviour that are tested in the empirical part of this dissertation. We also present the empirical model and the data used for our analyses. In Chapter 4, we deal with the second set of research questions. We discuss the main elements of national early retirement systems and we elaborate an early retirement index along the flexibility and generosity dimension.

The third and final set of research questions is mainly dealt with in Chapters 5 to 7. In Chapter 5, we use the European-wide data set (ECHP) to test the main hypotheses about the determinants of early retirement behaviour and the effects of the institutional context. In Chapter 6, we repeat the same analysis, using the longer running national

panel surveys and more advanced econometric techniques (i.e. discrete time competing risks model with correction for unobserved heterogeneity). In Chapter 7, we test whether the predictions on the reduced participation in training of older workers are supported empirically and whether training reduces early retirement.

In Chapter 8, we summarise our main findings by answering the research questions set out in this chapter. We also discuss the scientific and social relevance of these findings.

Chapter 2

Modelling retirement

2.1 Introduction

Our goal in this first theoretical chapter is to answer the following research question: *What economic models can be used to analyse an individual's early retirement behaviour?* In particular, we explain the most important issues in modelling early retirement behaviour and we develop an economic model for retirement that can be used for the empirical analyses in the second part of this dissertation. To achieve this goal we explore a number of existing economic models used to analyse individual retirement patterns. Upon reviewing the literature, it can be concluded that the majority of retirement models build on the neo-classical theory of consumption-leisure choice. The earliest retirement models are mainly applications of the utilitarian single-period labour supply models. Although useful, such a single-period consumption-leisure model does not seem adequate for the analysis of retirement behaviour since it is a static model and completely ignores the dynamic nature of early retirement behaviour. It is not difficult to imagine that consumption-leisure decisions today affect consumption-leisure decisions in the future. Consequently, for modelling retirement behaviour, a life-cycle consumption-leisure model seems more appropriate. Apart from sketching the development of such modern dynamic life-cycle models, we present a detailed explanation of how the models work in Section 2.2. We argue that such an overview of the existing literature on life-cycle models of retirement is necessary since the life-cycle model is part of the theoretical model of retirement behaviour we develop in the final section of this chapter.

An alternative way of analysing individual labour market transitions in a context of uncertainty and dynamics is to use search theory as developed by McCall (1970) and Mortensen (1970). Like the life-cycle models, search theory is founded on neo-classical roots, and labour market transitions (i.e. retirement) are treated in an uncertain context with the retirement choice being different at each age. Within the field of labour market economics, search theory has been widely used to analyse the effect of unemployment

insurance on the incentives to find a job. In this chapter we show that the search model can also be used to analyse the effect of early retirement institutions on the incentives to retire. Although original search theory was developed to analyse the search behaviour of the unemployed, we argue that a rational older worker also searches for the optimal timing and routing of retirement. As is explained in great detail in Chapter 4, there is a great degree of freedom with respect to the age of early retirement in many countries. In addition, multiple pathways are available as early retirement schemes, including specially designed early retirement schemes and early retirement pathways embedded in social security arrangements (e.g. disability and unemployment) (Kohli et al., 1991). Naturally, the freedom to choose certain pathways is limited in the latter cases, but might be virtually unlimited in other cases (e.g. private early retirement schemes). In Section 2.3, after giving a brief summary of the general development and the structure of the basic search model, we discus relevant extensions of the model used in most modern search models (e.g. finite/infinite time horizon, non-constant reservation utility, multiple search offers). We apply these extensions to the retirement choice problem in particular.

Finally, we translate the concepts from both the life-cycle model and the search model into a formal economic model of retirement behaviour in the final section of this chapter. To our knowledge we are the first to extend the job search model into a retirement choice model and in doing so we hope to add to the literature on search models in general and on retirement models in particular. We show that our model is very flexible which not only allows us to include multiple retirement pathways, changing eligibility criteria of such pathways and uncertainty in the model but also allows us to analyse the retirement decision in a comparative perspective.

2.2 The life-cycle approach

During the 1970s, economic models to examine retirement behaviour were developed, mainly as a response to the declining male labour participation in the United States. Before this date, retirement was merely treated as an involuntary decision either as the result of dismissal by the employer or because of poor health. The increase in the number of retirees, which was not accompanied by a corresponding decrease in the health status of older workers, raised the idea that retirement might be a voluntary choice on the part of the employee (Leonesio, 1996). The early neo-classical models of retirement are mainly applications of the single-period labour supply model in which the individual decides upon the hours of work he supplies and henceforth is characterised as 'retired' when not supplying any hours of labour at a given age. In these rather primitive models each year is treated independently so that the retirement decision is only considered to influence one year at the time (Lazear, 1986). Rather than taking the future value of pension benefits into account, the individual focuses only on current period income when considering his

retirement decision. These early models were mainly used to analyse the effects of changes in social security benefits, largely as a response to the increasing number of social security beneficiaries in the 1970s in the United States (i.e. old-age pensions). Changes in social security lead to changes in the restrictions of the labour supply decision and are likely to change the individual's participation decision (Feldstein, 1974; Quinn, 1977; Boskin & Hurd, 1978; Gordon & Blinder, 1980; Parsons, 1980).

As mentioned, this single-period consumption-leisure model does not seem adequate for the analysis of retirement behaviour since it completely ignores the dynamics involved in the retirement decision. Such dynamics are found at several points and neither earnings nor pension benefits are independent of the retirement age (Fields & Mitchell, 1984). Current employment has future consequences on several factors, including productivity, wages, and pensions, all affecting the retirement decision. Productivity is assumed to increase with employment duration, which is reflected in higher wages, as we will see in more detail in Chapter 3. Additionally, wages rise because of seniority arrangements. Furthermore, during employment, contributions are paid to pension funds, thereby changing future pension wealth. Burkhauser (1979) was among the first researchers to implement a more dynamic life-cycle model of work and leisure. He mainly emphasised the asset nature of the retirement decision and showed that a rational worker should calculate the expected present value of the future pension scheme rather than yearly payments when deciding on the timing of retirement. As a consequence, for the modelling of retirement behaviour, dynamic or intertemporal life-cycle work-leisure models were developed during the early 1980s by Burtless and Moffit (1984), Fields and Mitchell (1984) and Gustman and Steinmeier (1984). An intertemporal life-cycle model has two major ingredients, discussed separately below: an intertemporal utility function (the individual's preferences) and an intertemporal budget constraint (the individual's possibilities and constraints).

2.2.1 The intertemporal utility function

Every period t, the individual chooses the optimal combination of hours of work that yield consumption (C_t) and hours of leisure (L_t). Basically, the individual has a set of alternative combinations and every period he has to reveal his preferences concerning this set of alternatives. For example, supposing that in each period the individual has to divide X hours between consumption (C) and leisure (L), he has several alternatives to do so, including: (a) (C^a, L^a), which refers to working $0.3X$ hours and spending $0.7X$ hours on leisure activities or; (b) (C^b, L^b), which refers to working $0.5X$ hours and spending $0.5X$ hours on leisure activities, etc. The individual's preference relation now determines whether he prefers option (a) or option (b). If $U(C^a, L^a) > U(C^b, L^b)$ we say that bundle (a) is strictly preferred over bundle (b). If $U(C^a, L^a) = U(C^b, L^b)$ we say that the individual is indifferent between the two bundles and both bundles yield the same utility.

Within a life-cycle context, the individual has to decide on such optimal combinations of consumption and leisure for all available periods of time. In this way his total preferred lifetime consumption (i.e. years of work) and years of leisure can be derived. Such individual preferences about consumption and leisure are represented by the intertemporal utility function (U_t), which shows the amount of satisfaction to the individual provided by the two goods at t: consumption C_t and leisure L_t during the remaining lifespan (T), both positively valued by the individual. Assuming discrete time periods t ($t = 0, \ldots, T$), the utility function can be written as follows

$$U_t = \sum_{t=0}^{T} \frac{1}{1+\delta_t} U(C_t, L_t) \tag{2.1}$$
$$\frac{\partial U(C,L)}{\partial C} > 0, \frac{\partial U(C,L)}{\partial L} > 0$$

where δ_t is the subjective discount rate including the subjective rate of time preference (ρ) and the interest rate (r). The subjective rate of time preference (ρ) represents the substitution rate of a current-period bundle of consumption and leisure with a future-period bundle of consumption and leisure, or,

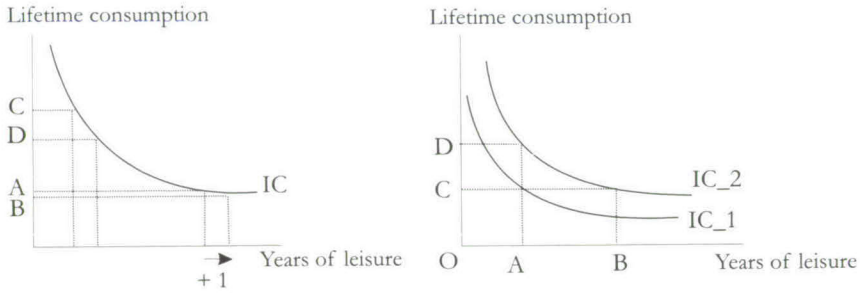
$$\begin{aligned}
&\rho = 0 \quad U(C^a, L^a)_t = U(C^a, L^a)_{t+\Delta t} \quad \text{neutral time preference} \\
&\rho > 0 \quad U(C^a, L^a)_t > U(C^a, L^a)_{t+\Delta t} \quad \text{positive time preference} \\
&\rho < 0 \quad U(C^a, L^a)_t < U(C^a, L^a)_{t+\Delta t} \quad \text{negative time preference}
\end{aligned}$$

When the subjective rate of time preference is equal to zero, the individual is indifferent between time periods and trades a future bundle against a current bundle at a rate of one to one. With a positive subjective rate of time preference, the individual has a stronger preference for a bundle of consumption and leisure now rather than in the future. Although a negative time preference might exist in individual cases, by far the majority of individuals has a positive time preference. A possible reason for this is that "current consumption opportunities confront people's senses directly whereas future ones can only be imagined" (Frank, 1997, p.166-167). With regard to the interest rate, this specifically determines the future value of current income in the following way

$$\begin{aligned}
&r = 0 \quad Y_t = Y_{t+\Delta t} \quad \text{neutral interest rate} \\
&r > 0 \quad Y_t > Y_{t+\Delta t} \quad \text{positive interest rate} \\
&r < 0 \quad Y_t < Y_{t+\Delta t} \quad \text{negative interest rate}
\end{aligned}$$

When the interest rate is equal to zero, income saved today is the same in future periods, ceteris paribus. When the interest rate is positive, which is common practice, income that is saved today is worth more in the future. A negative interest rate implies that income saved today is worth less in the future, i.e. devaluation of your savings. Although this is

Figure 2.1: Convex indifference curves



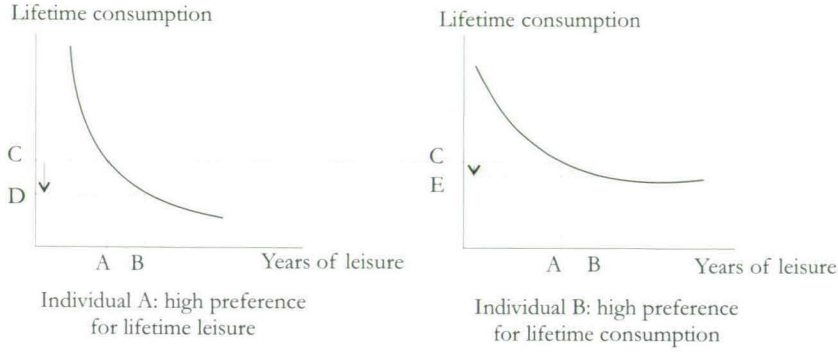
possible, we assume a positive interest rate in our models.

Indifference curves are used to represent the individual's utility function. Along an indifference curve, the individual is indifferent between the various combinations of lifetime consumption and leisure, implying constant utility. An indifference curve is characterised by the marginal rate of substitution: the rate at which an individual is willing to exchange units of lifetime consumption to gain one additional unit of leisure, holding utility at a constant level. One can distinguish between three types of indifference curves:

1. A linear indifference curve has a constant marginal rate of substitution, i.e. both goods are treated as perfect substitutes.
2. A concave indifference curve has an increasing marginal rate of substitution, which implies the opposite: someone with a low level of lifetime consumption would be willing to sacrifice more units of consumption to gain an extra year of leisure than someone who has a high level of lifetime consumption. Concave indifference curves are found with addictive goods.
3. A convex indifference curve has a diminishing marginal rate of substitution, as shown in Figure 2.1a: someone with a low level of lifetime consumption (level A in the figure) is willing to sacrifice less units of consumption to gain one extra year of leisure than someone who has a high level of lifetime consumption (AB $<$ CD). Normal goods are characterised by convex indifference curves.

The higher the indifference curve, the higher the utility as shown in Figure 2.1b. At any given level of lifetime consumption, the individual obtains more years of leisure at the higher indifference curve (OA $<$ OB), yielding a higher utility. Or at any given retirement age (i.e. any given number of retirement years), the individual obtains a higher level of lifetime consumption at the higher indifference curve (OC $<$ OD). The concept of utility maximisation now states that a rational individual tries to attain the highest level of utility possible, i.e. he strives for the highest indifference curve. We will soon see what restrictions the individual faces in this.

Figure 2.2: Different shapes of indifference curves



A steeper indifference curve points to a higher preference for lifetime consumption (or work) than for lifetime leisure (or retirement) as can be seen in Figure 2.2. To gain the same increase in lifetime leisure (AB) at a given level of consumption (C), individual A is willing to give up more units of lifetime consumption compared to individual B ($CD > CE$). Individual A attaches a higher value to lifetime leisure (i.e. retirement) compared to individual B who has a stronger preference for lifetime consumption (i.e. work). Indifference curves can differ between individuals because of differences in preferences depending on background characteristics (e.g. age, gender, health, education level), family status (e.g. marital status, children, spousal characteristics), employment status (e.g. hours worked, type of job, sector of employment, wage, labour market history) and institutional setting (e.g. old-age pension system, early retirement opportunities).[1] In addition, preferences might change over time. Gustman and Steinmeier (1984) extended the life-cycle model of retirement to allow preferences to shift towards leisure as individuals age, in other words, indifference curves become steeper over time.

It has to be noted that the concept of indifference curves is entirely theoretical. Empirically, preferences are derived either from actual choices made by individuals (i.e. revealed preferences) or from statements of the individuals about what they would choose in different hypothetical situations (i.e. stated preferences). Both methods have their advantages and their disadvantages. The use of a hypothetical situation in the stated preference case might lead to biased results simply because it is not a real life situation. People might have the intention of behaving in a certain way, but might choose to behave differently in real life. For example, the researcher constructs an experiment in which the individual is forced to choose between various early retirement opportunities that are different with respect to the eligibility conditions (i.e. age) and financial consequences (i.e. replacement income). The individual might state that he would choose to retire at specific ages using certain pathways but when faced in real life with a similar situation he might behave dif-

[1]The way in which these characteristics affect the individual's utility is explained in greater detail in Chapter 3.

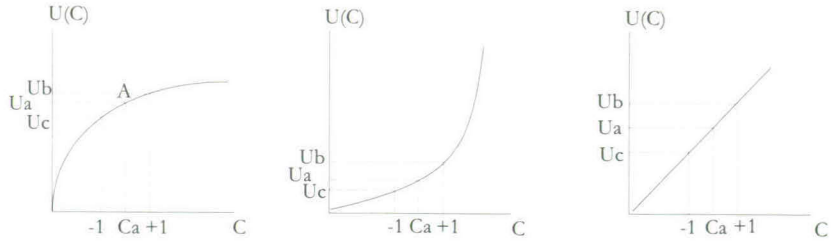
ferently because of additional factors that come into play not foreseen in the experimental situation (e.g. household dynamics). In the experimental situation the analyst cannot control for all possible factors in the individual's life that affect the retirement decision. When using revealed preferences this problem does not arise, yet with revealed preferences measurement error and unobserved correlation might exist between the observed explanatory variables. Another problem with revealed preferences is that the constraints under which the choices are made might differ between people. This problem can be minimised by including as many background variables as possible. When using stated preferences, one can make sure that all people face the same constraints. The analyst should take these advantages and disadvantages into consideration when using any of the methods.

Uncertainty and the utility function

Until now we implicitly assumed that the individual chooses his current and future levels of consumption and leisure given that all necessary information (e.g. known current and future wage, known retirement income) is available. Some uncertainty about the future is already included in the rate of time preference, where individuals have to form expectations about their life expectancy in order to value current and future periods. In addition, the individual has to deal with uncertainty with respect to future income streams. Although he might have some knowledge about the future value of his wage and pension income, it will not be possible to predict it with certainty. In a study on the predictability of pensions, Thompson (1998) distinguishes between five different sources of uncertainty: (1) demographic uncertainty such as unexpected changes in birth or mortality rates that might change the contribution-benefit relation promised in public pension systems. For example, as a result of the ageing population, current public old-age systems in the majority of European countries are threatened and people of a younger generation do not know with certainty whether the system will still exist in the current set-up when they reach the pensionable age; (2) economic uncertainty such as an unexpected change in economic growth, wages, prices or the rate of return of financial products that might change the contribution rate or the height of benefits needed to maintain the promised living standard; (3) political uncertainty including changes in the government composition that might lead to previous retirement systems being changed. For example, with the introduction of a new government at the beginning of this century, in the Netherlands the whole early retirement system was revised. Whereas workers had always expected to be able to retire at an early age, this has become uncertain now; (4) institutional uncertainty such as a failure to keep promises made with respect to future retirement income as a result of bad management, inadequate administration, etc; (5) individual uncertainty including the above-mentioned uncertainty with respect to the life expectancy, working career, future health, future household composition and so on.

Stigler (1961) already recognised that not all information may be available to every

Figure 2.3: Utility functions of people with different risk attitudes



a: risk averse person b: risk seeking person c: risk neutral person

agent operating in a market, i.e. there is incomplete and asymmetric information. Incomplete information refers to the fact that agents do not know everything with respect to their retirement possibilities and asymmetric information refers to the fact that some agents have more information than other agents in the same part of the market. For example, information asymmetry might exist between the employer and the older worker. The worker is not aware of the employer's future plans, most importantly with respect to his future wage development or the likelihood of dismissal. On the other hand, an older worker thinking of future early retirement may not wish to tell his employer yet about these plans, because an employer knowing this might treat him differently.

Because of this incomplete and asymmetric information, uncertainty arises that has consequences for the decision-making process of individual agents. The formal economic theory of choice under uncertainty was developed by John von Neumann and Oscar Morgenstern in 1944. Their general statement was that people choose the alternative that has the highest *expected* utility, and the utility function (Equation 2.1) is then written as follows

$$E(U_t) = \sum_{t=0}^{T} \frac{1}{1+\delta_t} E\{U_t(C_t, L_t)\} \tag{2.2}$$

They argued that economic decision-making under uncertainty is essentially the same as gambling. The expected utility of a gamble is the expected value of utility over all possible outcomes (Frank, 1997, p.193). With respect to the risks involved with gambling, three different risk attitudes can be distinguished. A risk-averse person has a concave utility function: an additional unit of consumption is valued less by the individual when he already has a high level of consumption compared to the case in which he has a low initial level of consumption, as shown in Figure 2.3a. Assume that the individual initially consumes A units of consumption yielding the expected utility U_a. Suppose he might consider a job change and assume he does not know exactly how much he would be able to earn in this new job. Assume for explanatory reasons that the probability that he can earn a higher wage is 50 percent (and yielding an increase in consumption) but that the probability that he will receive a lower wage is also 50 percent (and yielding a decline in consumption). In Figure 2.3a we can see that for a risk-averse person the increase in

his utility $(U_a - U_b)$ associated with a one unit increase in consumption is smaller than the decrease in his utility $(U_a - U_c)$ resulting from a one unit decrease in consumption. Consequently, a risk-averse person will not take the risk of moving to another job. A risk-seeking person, on the other hand, has a convex utility function: an additional unit of consumption is valued more by the individual when he already has a high level of consumption compared to the case in which he has a low initial level of consumption. This person will take the risk of moving to another job. Finally, in Figure 2.3c it can be seen that a risk-neutral person, who has a linear utility function, is indifferent between taking a risk or not. The increase in utility of one extra unit of consumption is the same as the decrease in utility of one unit of consumption less. Economic theory does not provide an answer to the question of whether this individual will take the risk of moving to another job or not.

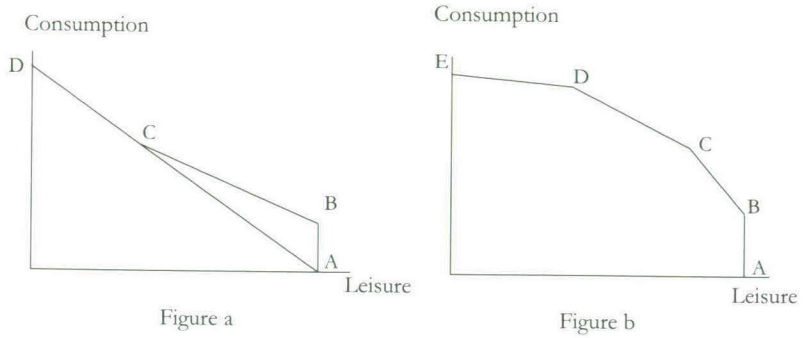
Whether people are risk averse, risk seeking or risk neutral is essentially an empirical question, but throughout this dissertation we will assume that individuals are risk averse with respect to consumption and leisure. This implies that the utility function given in Equation (2.1) is assumed to be concave in both arguments (i.e. consumption and leisure). Intuitively this means that the increase in utility of an extra unit of leisure for someone who already has a large amount of leisure is smaller compared to somebody who has a small amount of leisure.

2.2.2 The budget constraint

To complete the utility maximisation problem, the individual has to match his preferences (i.e. what he wants) with his constraints (i.e. what he can afford). Rather than reflecting the *preferred* combinations of lifetime consumption and leisure, the budget constraint summarises his *possible* combinations of lifetime consumption and leisure. Wage income as well as non-wage income such as social security and taxes are included in the individual's budget constraint. For explanatory reasons, we start by describing a single-period budget constraint. Rather than being a straight line, there are several reasons why an individual's budget constraint is kinked (i.e. non-linear). A first reason is the social security system, shown in Figure 2.4a.[2] Without social security benefits (or private savings), the budget constraint would be equal to AD, with the slope being equal to the net wage rate. However, with social security benefits the budget constraint might, for example, be equal to ABCD. When not working at all, the individual receives social security benefits AB (i.e. minimum social welfare). When starting to work some hours, the individual continues to receive social security benefits, but these are monotonically decreasing (i.e. earnings tested) between B and C until he only receives wage income between C and D.

[2]In this figure, a situation is shown in which working always pays off. In reality, however, the budget constraint can be such that being unemployed for a certain amount of hours yields a higher utility. However, this goes beyond the scope of this study.

Figure 2.4: Budget constraint for consumption and leisure



Another reason for a kinked budget constraint is the tax system, as shown in Figure 2.4b. AB again reflects the social minimum to prevent people from falling into poverty. Suppose the individual is faced with a progressive tax system implying that the tax increases with the level of income, with three tax brackets (BC, CD, DE). At each level of income, the tax is higher implying that for each extra hour worked the increase in consumption is smaller. In the most extreme case the curve would end horizontally with a tax rate of a hundred percent. Naturally, in reality the budget constraint is a mix of both curves shown here.

The intertemporal budget constraint differs from the single-period one in that it now represents streams of income, in other words the present discounted value of the expected future income streams. Future income streams must be discounted with the subjective discount factor δ_t representing the subjective rate of time preference ρ and interest rate r explained earlier. The discounted value of the expected future income stream is

$$EPV_t^Y = \int_{T=0}^{t=R} \frac{1}{1+\delta_t} Y_t^w dt + \int_{t=R}^{t=T} \frac{1}{1+\delta_t} (Y_t^{ss} + Y_t^{op} + Y_t^{pp}) dt \tag{2.3}$$

The first term on the right-hand side represents the discounted present value of wage income during the remaining working life from $t = 0$ to $t = R$ (i.e. age of withdrawal from the labour market). The second term represents the discounted present value of the income during retirement until death T (Fields & Mitchell, 1984).[3] Retirement income consists of net social security income Y_t^{ss} plus public old-age pensions Y_t^{pup} plus any occupational and private pensions $Y_t^{op} + Y_t^{prp}$. Social security income usually depends on the type of benefit received (e.g. pension, disability, unemployment or social assistance benefits), age, previous earnings, employment history, and household characteristics. Occupational and private pension income usually depend on the contributions paid into the funds, the interest rates associated with the investments, tenure, and the age of retirement and might differ according to employment status or sector of industry. Occupational pensions here

[3] In section 2.3.2. it is explained what difference it makes to assume T is 'known' or unknown. In other words, whether it makes a difference to assume a finite or infinite time horizon.

refer to pensions accumulated under a collective agreement with the employer, the so-called second pillar pensions, and private pensions here refer to all other forms of private savings (for more details on this, see Chapter 4). More formally, it can be argued that

$$Y_t^{op} = (1 + r_t^{op})(Y_0^{op} + s_t^{op}) \tag{2.4}$$

$$Y_t^{prp} = (1 + r_t^{prp})(Y_0^{prp} + s_t^{prp}) \tag{2.5}$$

in which the income at t (Y_t^{op}, Y_t^{prp}) depend on the initial values of such pension funds (Y_0^{op}, Y_0^{prp}) plus the savings into the fund at time t (s_t^{op}, s_t^{prp} times the fund-specific rates of return (r_t^{op}, r_t^{prp}). These rates of return for occupational pensions might be different from those of private funds because of collective agreements or government subsidies to encourage participation in occupational pension schemes.

As in the single-period situation, kinks might also be present in the intertemporal budget constraint. To visualise this, consider the change in the expected present value of the income stream at time t when continuing to work an additional year, or

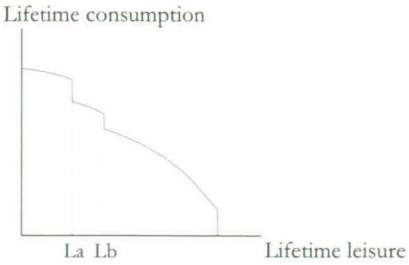
$$\frac{\partial EPV_t^Y}{\partial R} = \frac{1}{1+\delta_R} Y_R^w - \frac{1}{1+\delta_R}(Y_R^{ss} + Y_R^{op} + Y_R^{pp}) + \frac{\partial \left[\int_{t=R+1}^{t=T} \frac{1}{1+\delta_t}(Y_t^{ss} + Y_t^{op} + Y_t^{pp})dt\right]}{\partial R} \tag{2.6}$$

The first term on the right-hand side is the wage income earned by working in the *Rth* year. The second term on the right-hand side is the foregone retirement income when working in the *Rth* year, rather than being retired (Fields & Mitchell, 1984). The third term on the right-hand side is the so-called accrual rate: the rate at which future retirement income changes by working in the *Rth* year. Continuing to work another year means an additional year of contributions to the pension scheme that raise future retirement income. The accrual rate fully depends on the benefit formulae of the pension or social security scheme. As a rule, this will be positive: continuing to work another year never leads to a decrease in future retirement income (Fields & Mitchell, 1984). In the extreme case of flat-rate retirement benefits an additional year of contributions leads to a zero increase in future retirement income. In addition, in the case of pay-as-you-go pension systems (where current workers pay benefits for current beneficiaries), it is not certain to what extent the higher contributions in year R lead to a higher retirement income in the future since there is no direct relation between contributions paid and benefits received.[4]

In general, it is assumed that individuals behave in a rational and optimal way, the difference between the first term (wage income at age R) and the second term (foregone retirement income at age R) is positive. Where the foregone retirement income at age R is higher than earnings at that age, a rational individual would have decided to retire at age $R - 1$. As a consequence, the outcome of Equation (2.6) is positive: there is a

[4]A more detailed discussion of how pay-as-you-go pension systems operate and of differences in benefit formulae among retirement pathways and countries is found in Chapter 4.

Figure 2.5: Intertemporal budget constraint



positive relation between the expected present value of income and the individual's age. The rate at which the expected present value of income increases with the retirement age, however, is expected to be different at different ages. In the case of a zero relation between EPV_t^Y and R, the system is age-neutral, implying no incentive to retire at a certain age. Continuing to work as long as possible is the most rational choice in this situation. However, this is not realistic. In the majority of countries, there is a certain age from which people are entitled to full public old-age pensions (i.e. the so-called official retirement age) and as will be explained in greater detail in Chapter 4, the incentive to retire at this age is very strong. In addition, Nelissen (2001) and Blondal and Scarpetta (1999) showed that from the first age of entitlement to early retirement schemes there is an implicit tax on continued work, i.e. the increase in the expected present value of future retirement income for continued work is lower compared to that of earlier ages. Such implicit taxes, or incentives to retire early are also found in other countries (Blondal & Scarpetta, 1999). These incentives cause kinks in the budget constraint as can be seen in Figure 2.5 at L_a and L_b (Heyma, 2001). In this example, L_a refers to the incentive to retire at the official retirement age (usually around 65) and L_b refers to an early retirement incentive for this individual. While the first kink more or less exists for all individuals, the existence of additional kinks naturally depends on whether the individual is eligible for early retirement schemes.[5]

2.2.3 The optimal retirement age

In finding the optimal time or age of retirement in a life-cycle model, expected lifetime utility has to be maximised subject to the lifetime budget constraint:

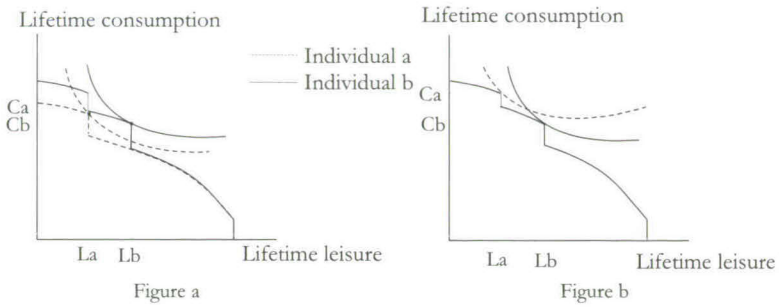
$$\text{Max } E(U_t) = \sum_{t=0}^{T} \frac{1}{1+\delta_t} E\{U_t(C_t, L_t)\} \tag{2.7}$$

$$s.t. \qquad C_t = EPV_t^Y + Y_0^{op} + Y_0^{pp} \tag{2.8}$$

$$EPV_t^Y = \int_{t=0}^{t=R} \frac{1}{1+\delta_t} Y_t^w dt + \int_{t=R}^{t=T} \frac{1}{1+\delta_t} (Y_t^{ss} + Y_t^{op} + Y_t^{pp}) dt \tag{2.9}$$

[5]How eligibility is affected by individual, household, job and country characteristics is discussed in the next chapters.

Figure 2.6: Optimal retirement age



with notation as explained before. Maximisation implies that the marginal utility of continuing to work an additional year is equal to the marginal utility of immediate retirement, or the first order condition

$$\frac{\partial U_t}{\partial C_t} * \frac{\partial C_t}{\partial R} = \frac{\partial U_t}{\partial L_t} \tag{2.10}$$

Graphically, the optimal retirement age is at the point of tangency between the budget constraint and the highest indifference curve, as can be seen in Figure 2.6. The optimal retirement ages of two individuals, a and b, are shown. In Figure 2.6a, these two individuals have identical preferences, represented by identical indifference curves. They differ, however, with respect to their budget constraints. Individual b contributes to a pension scheme (occupational or private) that allows early retirement at a certain age (represented by the kink in the budget constraint). Individual a does not contribute to such a plan and has a kink in his budget constraint only at the age at which he is entitled to the public old-age pension. We can see that the incentive resulting from individual's b early retirement scheme is large enough to allow him to retire at the earliest age possible. In his optimal situation he consumes C_b units of lifetime consumption and L_b units of lifetime leisure. Individual a, who has no early retirement opportunity, retires at the country's official retirement age, consuming C_a units of lifetime consumption and L_a units of lifetime leisure. His overall utility is lower than that of individual b, since the highest indifference curve possible for him is still below that of individual b. It is not difficult to imagine that not only different budget constraints can lead to different optimal retirement ages, but that these might also be caused by differences in preferences (i.e. different shapes of indifference curves). In Figure 2.6b, again we have shown two individuals, a and b, who face the same budget constraints, but who now have different preferences for lifetime consumption and leisure. Individual a is not affected by the early retirement incentive because he has a stronger preference for lifetime consumption or work (reflected by a flatter indifference curve). Individual b has stronger preferences for leisure and retires at the earliest age possible.

2.2.4 Recent developments in the life-cycle model of retirement

The life-cycle model of retirement as developed in the 1970s and 1980s is very useful in showing differences in the optimal retirement age for different individuals (e.g. the high-educated versus the low-educated) or in showing the effect of changes in the budget constraint on the retirement age (e.g. expected change in future income). For example, an expected increase in old-age pensions received after retirement has two effects. First, there is a positive income effect on continued work implying an increase in the present value of future income stream and leading to both an increase in leisure and consumption (i.e. an outward shift of the indifference curve yielding a higher utility). Second, there is a negative substitution effect on continued work. The opportunity costs of work are higher (i.e. a changed marginal rate of substitution between work and leisure, a shift along the indifference curve) because of higher retirement income which leads to earlier retirement and a lower level of planned lifetime consumption (i.e. a shift along the indifference curve). The total effect depends on the structure of the individual's preference (i.e. the shape of indifference curve) and his budget constraint.

The most challenging improvements to the life-cycle model were made in the 1990s when uncertainty and multiple retirement pathways were included in the models. The main theoretical model intended to take uncertainty with respect to future events into account is the stochastic dynamic programming model of retirement originally developed by Rust (1989; 1990). The general idea behind this structural model is that workers' retirement behaviour is the outcome of an 'optimal decision rule'. The sequence of work-leisure decisions taken every period under uncertainty are represented by a stochastic decision process. Workers form expectations about the uncertain state variables such as life expectancy, future income, pension benefits, future health status and future household composition. These expectations are updated every time the worker receives new information. Given his expectations, in every period the worker chooses values for his employment status (full-time work; part-time work or retirement) and the level of planned consumption. These so-called control variables are chosen in such a way that the sum of the expected discounted utilities in current and future periods is maximised. Following Rust and Phelan (1997, p.791), "Dynamic programming provides a framework that is rich enough to accurately model the dynamic structure of the social security rules and the uncertainties and sequential nature of individual decision making processes". However, a well-known problem with this approach is the so-called 'curse of dimensionality', which refers to the enormous burden in terms of time and space to solve the dynamic programming model (Spataro, 2002). A great number of theoretical state variables are unknown (e.g. expected values of future income) and much time has to be devoted to finding the best possible instrumental variables and to testing what obtained results follow from measurement errors and what results are robust (Rust, 1990, p.379). The studies of Bercovec and Stern (1991) and Blau (1994) modelled transitions between full-time work, part-time

work and full-time retirement and Heyma (2001) extended the dynamic programming model by including multiple retirement pathways (e.g. disability, unemployment and retirement). He also specifically accounts for entitlement conditions of the Dutch social insurance and pension system and allows these to vary between periods. He argued that at least in the Netherlands, social security arrangements such as disability and unemployment as well as early retirement programmes are used as retirement routes: "If eligibility conditions restrict the availability of early retirement benefits, disability programmes are used as a next best alternative. [...] Unemployment programmes only seem to serve as a financial fall back option.".

Closely related to the dynamic programming approach is the option value approach. This approach was originally used by Stock and Wise (1990) and is, arguably, simpler than the dynamic programming approach. The model has two key aspects. First, the individual compares the expected present value of retiring immediately with the expected present values of retiring at each future age (as in the life-cycle approach). Second, as the individual grows older he receives new information about the future and he updates his expectations. Therefore, during every period, the individual has to review his choice again (as in the dynamic programming approach). The option value is the maximum difference between the expected present value of immediate retirement and the expected present values of all future retirement moments. If this option value is positive, he will choose to retire at a later age, whereas if the option value is negative he will retire immediately. Thus, in the option value approach, the decision to retire is based on the maximum of expected present values, while in the dynamic programming approach the decision is based on a series of expected present values (Lumsdaine, 1999, p. 3275). Coile and Gruber (2000) noted that the option value largely depends on the individual's wage, because of the fact that wages are the main component of post-retirement income and determine for a large part the pre-retirement income. Their primary concern is that wages vary between individuals and when "these wage differences capture partly heterogeneity in tastes for work, then building wage variation into the retirement incentive measure can lead to misleading estimates of the responsiveness to financial incentives" [p.2]. In addition to this criticism, Chan and Stevens (2001) noted that if this correlation exists, occupational pension structures might also be correlated with preferences about retirement. It could be that individuals with a preference for early retirement look for an employer that offers early retirement schemes.

2.3 The search approach

The most recent extensions of the life-cycle models showed the need to incorporate uncertainty, imperfect information and dynamics into a model of individual labour market behaviour. An alternative way of analysing individual labour market transitions in an un-

certain and dynamic environment is to use search theory as developed by McCall (1970) and Mortensen (1970). Search theory is also founded on neo-classical roots, and labour market transitions (i.e. retirement) are also treated in an uncertain context with the retirement choice being different at each age. As in the modern life-cycle models, the assumption about complete information is replaced by assumptions about rational expectations of future values. At the core of the search model is an optimal stopping rule. The individual defines an acceptance set (i.e. a minimum acceptable retirement offer) and his search continues as long as offers fall short of this acceptance set and stops when an offer falls within this acceptance set. This is referred to as a reservation wage property and will be described later in more detail when the model is discussed. The original search models were developed by McCall (1970), Mortensen (1970) and Lippman and McCall (1975) to analyse the behaviour of unemployed people's search for the best job. However, the search framework can be useful in analysing all kinds of labour market transitions, including the transition from work to retirement. By recognising that an older worker can 'choose' between several early retirement pathways (including early retirement programmes and social security arrangements) it is argued that a rational individual searches for both the optimal time of, and pathway into, retirement. Of course, the freedom to 'choose' a certain retirement route varies between the pathways and this will be taken into account. Before presenting a formal model of optimal retirement search in Section 2.4, this section discusses the suitability of using the search model to analyse retirement behaviour. After a short description of the basic job search model, the underlying assumptions will be relaxed and translated into the retirement model.

2.3.1 The basic search model

We start by explaining a basic static search model of retirement, analogous to the basic model of job search as developed by McCall (1970) and Mortensen (1970). Some of the assumptions of the basic model might seem rather strong, but in the next section, most of them will be relaxed later when extending the model. For example, we already know that using a static model (where there is no time, or in other words, no age dependence) is not appropriate when analysing retirement behaviour, yet for a good explanation we deemed it necessary to start with the static model anyway. For the moment, only a two-state model of retirement search is assumed, with the individual moving from employment (state $j = E$) to retirement (state $j = R$). The retirement offers are independent drawings from a time-constant Poisson distribution, $F(Y_r)$ which is known to the individual. For the moment, it is assumed that offers are represented by an income stream, later we will extend the model to include utility in the model. In addition, the arrival rate of offers, λ, are assumed to be constant over time (i.e. not dependent on age) and initially set to one offer per period, an assumption which will also be relaxed in the extended model.

The individual is assumed to live forever implying an infinite time horizon. Following Lancaster (1990) let $y_e - c$ denote the single-period income from employment, net of search costs c. Searching for the optimal early retirement pathway is costly and time is the most important cost that must be taken into account. In most cases the older worker will look for retirement possibilities while continuing in work, thus without experiencing a loss of earnings. However, the time spent searching cannot be spent on other activities such as leisure or extra working. He is confronted with the opportunity costs of search. Other search costs one can think of are the out-of-pocket costs of retrieving information about different pathways into retirement and the application forms one has to fill in in some cases (e.g. partial retirement).

Let $\frac{1}{1-\delta}Y_j$ be the individual's expected present value of the future income stream from occupation of state j, with δ being the subjective discount rate as already explained. Assume for now that the individual's optimal strategy is to maximise his income. The value index for being employed is then (Lancaster, 1990)

$$Y_e = \frac{h}{1+\delta h}(y_e - c) + \frac{1-\lambda h}{1+\delta h}Y_e + \frac{\lambda h}{1+\delta h}\max_{k=E,R} Y_k + o(h) \tag{2.11}$$

The last term of Equation 2.6, $o(h)$, accounts for the returns to search in the event of more than one retirement offer within time interval h, which can be neglected because it is assumed that only one offer arrives within a time interval. The first term on the right-hand side represents the discounted present value of the single-period income (net of search costs) in time interval h in the present job, the origin state. The offers are assumed to arrive at the end of time interval h, implying that the current period income from employment accrues anyway to the individual. The second term on the right-hand side is the probability of not receiving a retirement offer $(1 - \lambda)$ during time interval h times the discounted present value of optimal search in the future while being employed and receiving income stream Y_e. The third term on the right-hand side is the probability of receiving a retirement offer λ during time interval h, times the discounted present value of the future income stream from the chosen state following the optimal search strategy. The individual either accepts the retirement offer and receives income stream Y_r for his remaining lifetime, or declines the offer and receives income stream Y_e following optimal search in the future.

The acceptance strategy is based on an optimal stopping policy adopted by the individual. Basically, the individual can behave in two ways: according to the fixed sample size decision rule or the sequential decision rule. The *fixed sample size decision rule* used by Stigler (1961) states that a decision maker, faced with imperfect information, must decide on the optimal sample size (i.e. the optimal number of retirement offers to investigate) before the search process starts. He argues that maximum expected returns are a function of the number of investigated possibilities. Returns are measured as the

expected increase in maximum return to search: the more possibilities are investigated, the higher the probability of finding the one with the highest maximum return. But the more possibilities are investigated, the smaller is the relative increase in the expected maximum return, i.e. diminishing returns to search. Additionally, the costs of search must also be taken into account, as explained before. The optimal amount of retirement offers to investigate is where marginal returns to search are equal to marginal costs of search. Once the individual has determined this optimal amount, he researches them and chooses the one that offers the highest returns. One might question whether the behaviour of the fixed sample decision rule, that a searcher first investigates all possibilities before making a choice, is applicable to the retirement decision. Is it logical that an older worker first collects all his retirement offers before making a decision about which offer to use? Especially when extending the model to include age-dependence, this does not seem logical, since an offer to retire at a certain age cannot be 'saved' and reconsidered at a later age. When looking at the retirement process, it seems most natural that an older worker will stop the search process when he finds a sufficiently attractive retirement possibility to retire at a certain age (Sapsford & Tzannatos, 1993). This is central in the second decision rule, *the sequential decision rule*. According to this decision rule, the searcher decides on the minimum acceptable return he wants to get out of his search process, rather than the number of possibilities to investigate. Before the search process starts, the individual decides upon this minimum acceptable return, or a reservation income at which he is indifferent between accepting or refusing an offer. The reservation income is largely determined by current earnings. In general, the higher his current earnings, the higher are the opportunity costs of not working and the higher the reservation income will be (Mortensen, 1970).

The optimal reservation income equates marginal costs of continued optimal search (foregone offered retirement income) and marginal benefits of continued optimal search expected returns (current earnings), or following Lancaster (1990),

$$Y^* = (y_e - c) + \frac{\lambda}{1+\delta}\int_{Y^*}^{\infty}(Y_r - Y^*)dF(Y_r) \tag{2.12}$$

The individual rejects all offers that fall short of the reservation income and accepts the first one that is at least equal to the reservation income, or

$$\begin{aligned} \text{accept offer if} \quad & Y_r \geq Y^* \\ \text{decline offer and continue search if} \quad & Y_r < Y^* \end{aligned}$$

McKenna (1985) showed that the expected return to search resulting from the fixed sample size decision rule is smaller than the expected return resulting from the sequential decision rule. This advantage, however, varies with the costs of search. It is only for moderate costs that the sequential decision rule is clearly dominant. Nevertheless, under the assumptions

of the basic search model, McKenna showed that the sequential decision rule is favoured and we have already discussed that the fixed sample size does not seem logical when analysing a dynamic retirement decision. Consequently, the sequential decision rule is taken as the basic decision rule for the formal model developed here.

2.3.2 Extensions of the basic model

In this section, we discuss some important extensions of the basic search model that are considered to be useful for the theoretical model of retirement behaviour developed in the next section. The extensions are taken from the literature on job search of the unemployed but we specifically discuss them within the framework of the retirement issue.

Age-dependence of parameters

A first extension is the inclusion of time or age-dependence. In the basic model no reference to time (t) is made, yet it has already been explained that the retirement decision might differ from year to year. We will see how the main parameters in the search model change when including time dependence. First, it was already explained that the subjective discount rate δ might be different at different ages (δ_t). As people grow older, they are likely to place a higher value on current periods rather than future periods (i.e. increasing δ_j over time), merely because the number of future periods becomes more uncertain at higher ages. Second, the current-period income from work y_e is likely to depend on age because of seniority-wage agreements or experience-rating in wages (y_{et}). Third, search costs might vary over time (c_t), because of several reasons: (a) the minimum age condition that exists in several early retirement schemes might lead to an increasing number of retirement possibilities with age implying increasing search costs (more options to investigate); (b) by contrast, as the individual approaches the official retirement age, he might put less effort in searching for an early retirement possibility since he knows he is going to retire within a few years anyway (i.e. at the official retirement age). This might decrease his search costs with age; and (c) the fact that he has searched for several years already might reduce his search costs, since the individual has more information and hence becomes more efficient in searching. Fourth, the offers' arrival rate is expected to depend on time as well (λ_t). For example, in most early retirement schemes a minimum age is required, implying a zero arrival rate before that minimum age and a positive arrival rate afterwards. Finally, the future income stream associated with a retirement offer is expected to be different at different ages, as explained above in Equation 2.6.

Utility maximisation

A second important extension of the basic search model is our focus on a larger concept of utility rather than utility being represented by income. In the basic search model, the focus was on the maximisation of income rather than utility, but from the life-cycle

model we learned that when considering retirement, the individual focuses not only on the future income stream associated with a certain choice, but also on the amount of leisure associated with that choice. Leisure time explicitly enters the individual's maximisation problem and for that reason we include utility rather than income in the individual's maximisation strategy. As before, in Equation 2.2, because of uncertainty with respect to future values, the individual is expected to maximise expected utility. Let $U_{rt} = \frac{1}{1+\delta_t} U(Y_{rt}, L_{rt})$ be the individual's discounted expected present value of the future utility stream from retirement at time t. Utility again depends positively on the expected stream of future income Y_{rt} and expected amount of leisure time L_{rt} during his remaining lifetime. Analogous to Equation 2.11, accounting for time-dependence and using utility rather than income, the value index for being employed at time t now becomes

$$U_{et} = \frac{h}{1+\delta h}(u_{et} - c_t) + \frac{1-\lambda_t h}{1+\delta_t h} U_{et} + \frac{\lambda_t h}{1+\delta_t h} \max_{k=E,R} U_{kt} + o(h) \tag{2.13}$$

Burdett (1979) already showed that when the individual maximises his expected lifetime utility rather than his lifetime income, he has to determine both the optimal reservation income and the optimal amount of leisure time. In other words, the individual has to decide on his reservation utility level rather than the reservation income. Using the above notation, the reservation utility $U_t^* = U(Y_t^*, L_t^*)$ at time t is then defined as

$$U_t^* = (u_{et} - c_t) + \frac{\lambda_t}{1+\delta_t} \int_{U_t^*}^{\infty} (U_{rt} - U_t^*) dF(U_{rt}) \tag{2.14}$$

An interesting question now is whether the reservation utility increases or decreases with age (time). First, the single-period utility from employment, u_{et} depends on the single-period income from employment and leisure time. As argued above, seniority-wage and experience-rating agreements result in an increasing wage income and hence increasing utility over time (income effect). On the other hand, as indicated by Gustman and Steinmeier (1984) the weight an older worker places on leisure time is likely to increase with age, resulting in a declining utility from work over time (substitution effect). The total effect of time on u_{et} is ambiguous. The same is true for search costs, as explained before. As a consequence, the effect of the marginal benefits of continued search ($u_{et} - c_t$) on the individuals reservation utility is indefinite. Looking at the marginal costs of continued search (the second right-hand part of Equation 2.14), both the arrival rate and the subjective discount rate were shown to be positively related to age. The expected present value of the utility flow from retirement offers is expected to increase with age. In Equation 2.6 it was already shown that future retirement income is an increasing function of age, though at a diminishing rate. In addition, the increasing preference for leisure with age implies an increasing utility from retirement. Hence, marginal costs from continued optimal search are expected to increase over time. As a consequence, an older

worker's reservation utility might increase or decrease over time, mainly depending on his preference with respect to leisure time. For example, where preferences strongly shift towards leisure time with age, the reservation wage is likely to decline over time and the individual is more likely to accept retirement offers as he grows older.

Time horizon

In the basic model, an infinite time horizon is assumed, which implies that the individual hopes to live as long as possible, which is treated as 'forever'. An important consequence of assuming an infinite time horizon is that the possible number of searches is infinite (McKenna, 1985). Theoretically, this means that a worker could work forever and hence search for the optimal retirement offer until eternity. Using mortgage tables, however, an individual's expected time of death can be estimated, implying a finite time horizon. Although not knowing it with certainty, people might form expectations about their timing of death rather than expecting to live forever. Assuming such a finite time horizon implies a declining reservation wage over time (McKenna, 1985). In the last decision period ($T-1$, the year before expected time of death), the utility of continued search (U_et)is zero (i.e. no period left to enjoy the utility). In the second to last decision period, ($T-2$), the utility of continued search is limited since there is only one period to enjoy the utility. Intuitively this is explained as follows: as the decision-making period draws to a close, the individual reduces his preferences for the optimal retirement age (i.e. selectivity declines) as time goes by because there is an increasing likelihood that he will end up not retiring at all.

In reality we are faced with an additional 'time problem', namely the existence of an official retirement age at which people are entitled to public old-age pensions. This also limits the individual's search activities. Could one consider this as the final date of search then, implying a finite time horizon ending at the country's official retirement age? We argue that this is not correct, for several reasons. First, although search might formally end at the official retirement age, the utility streams of all remaining years after retirement until death should be included in the decision-making process of the optimal retirement age. This time span cannot be neglected. Early retirement decisions affect income flows after the official retirement age as well (for more details on this see Chapter 4). Second, how would a model in which the time span ends at the official retirement age deal with re-entry into the labour market after retirement? Or with continued work after the official retirement age? In a great number of countries, retirement at the official retirement age is not mandatory. In the Netherlands, for example, the public old-age pension is not means-tested and retirement from employment is not required. Though limited in number, some individuals continue to work or re-enter employment after the official retirement age. With a declining labour supply and an ageing population, this might even become more common in the near future. Third and perhaps most important,

assuming that the time horizon of the individual closes at the official retirement age would imply a decreasing reservation utility from any time t until the official retirement age, as explained above. This is not very likely though. Why would an individual lower his reservation utility, knowing he is retiring at the official retirement age anyway? Time is not running out as in the case of death, so there is no need to reduce the reservation utility.

We argue that these time constraints following from the country's official retirement age are incorporated into the model through the offered utility from retirement. When we discussed the intertemporal budget constraint before, we explained that there is a kink in the budget constraint at the official retirement age. This implies that the offered utility from retirement is expected to be high, inducing retirement. We further expect it to be higher than the individual's reservation utility, thereby inducing retirement at the official retirement age. In this way the model also allows for continued employment (or re-entry into employment) after the official retirement age for people who still have higher reservation utilities for retirement or for countries where generosity of old-age pensions at the official retirement is relatively low.

Search intensity

Burdett (1979) already argued that individuals are capable of increasing the probability of receiving offers by sacrificing leisure time and increasing search intensity. Therefore, the arrival rate of offers depends on time in general (on age) as well as on the amount of time an individual spends searching for possibilities. This implies the following: during each period, the worker decides how much time to spend on search such that the marginal utility of leisure equals the marginal expected utility of search time, and the expected payoff of accepting an offer with a utility maximising return in period t is equal to the maximum expected payoff of remaining in the current state for at least one more period. The individual in the basic model is assumed to be risk-neutral, implying he has a linear utility function. Earlier it was already shown that a risk-averse individual has a concave utility function. A risk-averse person is likely to decide at an early stage to accept the possibility to retire, because of uncertainty with respect to the expected present value of future offers. This implies that, ceteris paribus, he has a shorter duration of search (i.e. shorter employment duration and earlier retirement age) compared to a risk-neutral person (Lippman & McCall, 1976).

Multiple destination states

Like the original job search model for the unemployed, the basic search model is a two-state model with the focus on a transition from employment to non-employment, regardless of the benefits received. Retirement is most generally defined as not participating in the labour market. In practice, as mentioned before, social security arrangements such as disability or unemployment schemes are used as a transitional phase in between full-

time employment and fulltime retirement. They might act as substitute pathways to specially designed early retirement schemes (Kohli et al., 1991). It is recognised, however, that the senior worker's degree of freedom in deciding whether or not to make a particular transition differs substantially between the alternatives. Apart from budget constraints in all cases, for the transition to inactivity, virtually no other restrictions are present, and for the transition to early retirement the worker is only limited by age restrictions or minimum years of service. With respect to these two alternatives the worker has a great deal of free choice. For transitions into unemployment or disability, however, several factors limit the extent to which these are the result of the workers free choice. Unemployment is in many cases an involuntary exit with a dominant role played by the employer, yet it is recognised that moderate unemployment conditions lead to unemployment being the result of an implicit agreement between the worker and the employer (Lazear (1979), for more details see next chapter). Disability is mostly an involuntary exit driven by the workers declining health status.

Not all individuals face the same set of retirement pathways, that is, the offers' arrival rates are different for different individuals. Arrival rates λ_{jt} not only differ with age, but also vary between the early retirement pathways, mostly because of different entitlement conditions. As will be explained in Chapter 4 in greater detail, entitlement criteria for most early retirement schemes are based on minimum years of contribution to the pension scheme and/or minimum age. For older workers with discontinuous working careers, (e.g. women or those with an unemployment history) or for workers below a certain age, these schemes might not be open, implying a zero arrival rate. Some job characteristics such as branch of industry and type of job may influence the arrival rate. For example, in some countries special early retirement schemes exist for workers in heavy, dangerous or unhealthy work or for civil servants (e.g. Greece). Naturally, the main eligibility condition for the disability pathway is the worker's health status, shown by means of medical check ups. Since health is known to decline with age, the likelihood that a disability offer will be made to the senior workers increases with age. The individual's work or contribution history might be important, at least for determining the duration of disability benefits, i.e. the extent to which disability serves as a substitute for early retirement schemes. Employment status matters too. For example, the self-employed might have a zero arrival rate of disability offers compared to employees. Yet, in many European countries the self-employed are either voluntarily insured within the national scheme or have special disability schemes. In the case of unemployment it is often necessary to prove that one has been fired by the employer (either involuntarily or as part of an implicit contract between the employer and the worker). This implies that the employer has a rather large say in the retirement decision. In some countries (e.g. Belgium, Luxembourg), special early retirement schemes exist to lay off redundant older workers. Moreover, a country's economic situation also plays an important role. During a recession, the probability of

being laid off is higher for all workers, yet for older workers this probability might be particularly high (Samorodov, 1999).

In the next chapter, we formally derive hypotheses on the relation between individual characteristics and the set of retirement pathways. For now it is important to recognise that the two-state model of retirement and work is not adequate to explain early retirement patterns. We need to develop a multi-state model as adopted by Lancaster (1990) and by Muffels (1993), which is done in the next section.

2.4 A search-theoretical model of retirement

2.4.1 Assumptions

The starting point of our analysis is an older worker aged 50 and over in employment. It is recognised that in other studies on retirement, the age of 55 or even 58 is taken as a lower age-limit for the older workers' group (Gustman & Steinmeier, 1984; Rust, 1990; Bercovec & Stern, 1991; Antolin & Scarpetta, 1998). However, there is ample evidence that workers start planning their retirement from the age of 50 and Figure 1.1 (in the previous chapter) already showed a decline in employment rates as from this age in some countries. Preliminary decision-making for early retirement might start at an even earlier age, such as the decision to participate in private pension schemes, or even the decision to work in a sector or firm that allows early retirement (i.e. selection into early retirement jobs). We, however, assume that the individual engages in a real search process for the optimal timing and routing of retirement from the age of 50. We further assume discrete time periods (equal to the ages of the individual) ranging from $t = 0$ (or age is 50) to T (time of death). It is assumed that people adopt a finite time horizon, that is, that a rational individual is expected to form expectations about his expected time of death. We have already shown that adopting a finite time horizon rather than assuming that individuals live forever will not form a problem in our model. We further argue that the search for the optimal retirement opportunity is a sequential process without recall: at the age of 50, workers start their search process and each year they review a retirement offer (or multiple offers coming from different pathways) until they find their 'match'. This match is the first offer that exceeds the minimum acceptable utility from retirement that the individual has decided upon before he starts his search process (i.e. optimal stopping decision rule with reservation wage property). Once an offer is rejected, it cannot be recalled. Intuitively this implies the following: a retirement offer at the age of 55 that is rejected cannot be recalled at a later age, let's say 56. By continued employment in between these two ages, the income flow associated with retirement has changed, the offer is gone and only a new offer at the age of 56 can be reviewed.

With regard to the retirement offers, we already explained that the individual might

use different retirement pathways, notwithstanding some differences in choice freedom.[6] The set of retirement pathways J is defined as follows:

R	Retirement	Not in employment and receiving pension benefits
S	Social security	Not in employment and receiving disability benefits
U	Unemployment	Not in employment and receiving unemployment benefits
I	Inactivity	Not in employment and not receiving any of the above benefits

Whether the arrival rate of a given pathway is one or zero depends on whether the individual meets the entitlement conditions of the specific retirement pathway (i.e. this is exogenously determined and not depending on his search effort),

$$\lambda_{jt} = \begin{cases} 1 & : \text{ if the worker is entitled to early withdrawal pathway } j \\ 0 & : \text{ otherwise} \end{cases} \tag{2.15}$$

We assume that the worker receives at the most one offer of each retirement pathway a year, that is, at the most one retirement offer or one disability offer, and so on. Accordingly, at each age t the individual receives maximally four different retirement offers: an early retirement offer (Y_{rt}), a disability offer (Y_{dt}), an unemployment offer (Y_{ut}) or an inactivity offer (Y_{it}). We argue that the probability that no single retirement offer is made to the individual is equal to zero since the worker always has the possibility to quit working without applying for any benefits and move into inactivity $\lambda_{it} > 0$.

We assume that each retirement pathway is characterised by an expected future utility flow. This expected utility flow is determined by both the income (or consumption) and leisure associated with the retirement offer, as explained earlier. In Section 2.2.1 on uncertainty we explained that the individual is not able to predict his future utility with full certainty due to the existence of various kinds of risks (e.g. demographic, economic, political, institutional and individual risks). As well as he can, the individual forms expectations about his future utility and therefore we assume that he maximises expected utility. With regard to his future utility, the expected future income stream, this might consist of a number of components. For example, consider an individual becoming disabled at the age of 58 and receiving disability benefits from this age. In most countries, disability or unemployment benefits are converted into old-age pension benefits at the country's official retirement age. In addition, occupational old-age supplementary pensions might also be received from this age, and during the whole period of retirement, the individual might have private pension income. In sum, the expected present value of his future income stream from disability in this example is calculated as follows, with the country's official retirement age set at 65 and Y being the expected income stream,

$$Y_{d,58} = \frac{1}{1+\delta_{58}} \left\{ \sum_{58}^{65} Y^{db} + \sum_{65}^{T} Y^{pup} + \sum_{65}^{T} Y^{op} + \sum_{58}^{T} Y^{prp} \right\}$$

[6] The difference in choice freedom is formalised here through the arrival rates. These reflect the extent to which certain offers are open for the individual.

with Y^{db} referring to disability benefits and other notation as described earlier. Therefore, the expected present value of the future income stream from disability here condenses into

$$Y_{d,58} = \frac{1}{1+\delta_{58}} \left\{ \sum_{58}^{T} Y^{db} + \sum_{58}^{T} Y^{pup} + \sum_{65}^{T} Y^{op} + \sum_{58}^{T} Y^{prp} \right\} \tag{2.16}$$

The retirement offers are independent drawings from a known probability distribution of potential offers $F(U_{jt})$ and the arrival rate is governed by a Poisson process. It is assumed that the retirement offers are independent over time and between each other. We further assume that the individual decides to accept or decline retirement offers when they arrive. Once an offer is accepted, it leads to permanent retirement at the expected income stream associated with the chosen retirement pathway. This might seem a strong assumption, in Chapter 4, however, we show that welfare state institutions discourage re-entry into employment after early retirement. Additionally, age discrimination in job hiring makes it extremely difficult for older unemployed workers to find employment again. Therefore, we assume that the early retirement pathways act as absorbing states and empirical evidence given in the second part of this dissertation shows that this assumption seems valid.[7]

Finally, we assume that retirement search entails search costs c_t that might change over time, according to the individual's search intensity (i.e. the costs of search increase as the search intensity increases) or the number of retirement possibilities to investigate (i.e. the costs of search increase with the number of retirement possibilities). On the one hand, in the case of mandatory retirement at the official retirement age, we expect both search intensity and search costs to decrease over time because the worker knows he is retiring anyway within a short period of time. On the other hand, the number of retirement offers is expected to increase over time, increasing search costs c_t, since more offers have to be investigated.

2.4.2 Search strategy and solution

Having set out the model's assumptions, we can describe the worker's search strategy for the optimal retirement age and retirement pathway. Consider an older worker receiving the net single-period utility $u_{et} - c_t$ from employment at time t. Given this utility, during each period he decides between continued work or retirement. In doing so, he maximises his expected lifetime utility subject to a lifetime budget constraint as in the life-cycle model

[7] Notwithstanding differences between countries, on average about 96 percent of the early retirees remain out of the labour market in European countries. In the case of re-entry after the initial retirement decision being allowed, however, a Markov-chain version of the search model has to be used. This model then allows for a revision of an accepted offer and make the individual decide to move back to employment, and hence renewed the search for retirement.

$$\text{Max } U_t = \sum_{t=0}^{T} \frac{1}{1+\delta_t} U(C_t, L_t) \tag{2.17}$$

$$s.t. \qquad C_t = EPV_t^Y + Y_0^{op} + Y_0^{prp} \tag{2.18}$$

$$EPV^Y = \sum_t^{t=R} \frac{1}{1+\delta_t} Y_t^w dt + \sum_{t=R}^{t=T} \frac{1}{1+\delta_t} (Y_t^{ss} + Y_t^{pup} + Y_t^{op} + Y_t^{prp}) dt \tag{2.19}$$

where δ_t is the subjective rate of time preference, Y_0^{op} is the individual's initial occupational pension wealth, Y_0^{prp} is the individual's initial private pension wealth, Y_t^{ss} is the individual's expected social security income (e.g. disability, unemployment benefits), Y_t^{pup} is the individual's expected public old-age pension income, Y_t^{op} is the individual's expected occupational pension income, Y_t^{pp} is the individual's expected private pension income, R is the individual's retirement age and T is expected timing of death (i.e. calculated using mortgage tables).

The utility index for being employed at time t and moving optimally between states in the future (as a consequence of an optimal search strategy) can then be written as follows (Devine & Kiefer, 1991),

$$\begin{aligned} U_{et} &= \frac{1}{1+\delta_t}(u_{et} - c_t) + \frac{1-\lambda_t}{1+\delta_t} U_{et} + \frac{\lambda_t}{1+\delta_t} \max\,(U_{et}, U_{jt}) + o(t) \\ &= \frac{1}{1+\delta_t}(u_{et} - c_t) + \frac{\lambda_t}{1+\delta_t} \max\,(U_{et}, U_{jt}) \end{aligned} \tag{2.20}$$

where $\lambda_t = \sum_j \lambda_{jt}$ (i.e. the sum of the above defined destination-specific arrival rates) and other notation as before. The first term on the right-hand side represents the discounted present value of the single-period utility (net of search costs) at time t in the present job, the origin state. When the individual decides to move out of employment, he is assumed to do so from the next time interval $t+1$. This implies that the current period utility from employment accrues to the individual anyway. The second term on the right-hand side is the probability of not receiving any retirement offer $(1-\lambda_t)$ at time t times the discounted present value of optimal search in the future while being employed and receiving utility U_{et}. This term is only positive in the case where none of the various exit offers is received: $\lambda_t = \sum_j \lambda_{jt} = 0$. We assumed that the possibility of this happening is zero, since the individual always has the opportunity to quit working and move into inactivity, $\lambda_{it} = 1$. The fact that the expected utility flow from this exit state (U_{it}) might be too low to finally make the transition is another story and is captured by the optimal decision strategy.

The third term on the right-hand side is the probability of receiving exit offers λ_t at time t, times the discounted present value of the future utility stream associated with the chosen state following the optimal search strategy. The final term $o(t)$ accounts for the returns to search in the event of more than one offer of a given retirement pathway at time t (e.g. two disability offers at the same time), which can be neglected because it is assumed that only one offer of a given type arrives within a time interval (i.e. only one disability offer). Note, however, that it is possible that the individual receives multiple

retirement offers at the same time, yet for different destinations. For example, it might be possible that the individual is eligible for both retirement and social security at a certain age, implying that $\lambda_{rt} = 1$ and $\lambda_{st} = 1$. The individual has to decide upon accepting one or none of the two offers. How to deal with this is captured by the optimal search strategy.

The optimal strategy is characterised by the reservation wage property: the individual will only accept the offer if the expected present value of utility from the offered state is at least as great as some minimum acceptable value, the reservation utility. Because of the existence of multiple destinations, the individual decides upon multiple destination-specific reservation utilities. For example, say that the disability and retirement pathway yield exactly the same future utility flow, as if they were equivalent pathways. The individual might have different reservation utilities based on additional preferences. One might expect that the reservation utility for social security pathways is higher because of the stigmatic effects of being on social security in some countries. The destination-specific reservation utilities equate marginal costs of continued optimal search with marginal benefits of continued optimal search, or following Lancaster (1990)

$$U^*_{jt} = u_{et} + \frac{\lambda_{jt}}{\delta_t} \int_{U^*_{jt}}^{\infty} (U_{jt} - U^*_{jt}) dF_j(U_{jt}) \tag{2.21}$$

The destination-specific reservation utilities are a function of current utility from employment (net of search costs), the offered utility flow, the subjective rate of time preference, and the destination-specific arrival rate. This, however, is only part of the optimal strategy. Because the individual can choose between multiple destinations, for making a transition into state j this state must be preferred over the alternatives (Devine & Kiefer, 1991). For example, when both a retirement offer r and a social security offer s are received at time t, the individual compares the utility flows from both exit states ($U_{rt} \Leftrightarrow U_{st}$), given that these exceed their reservation utilities ($U_{rt} \geq U^*_{rt}, U_{st} \geq U^*_{st}$). His optimal strategy is then defined as follows

$$\begin{array}{rll} \text{accept offer } j & \text{if} & U_{jt} \geq U^*_{jt} \wedge U_{jt} \geq U_{st} \text{ with } j \neq s \\ \text{decline offer and continue search} & \text{if} & \text{otherwise} \end{array}$$

In other words, the theoretical probability that an individual will accept exit offer j at time t is

$$\pi_{jt} = P(U_{jt} \geq U^*_{jt} \wedge U_{jt} \geq U_{st}, \forall s \neq j) \tag{2.22}$$

Relating this back to Equation 2.21, which showed the utility index from employment when following the optimal strategy, we can write

$$\begin{aligned} U_{et} &= \frac{1}{1+\delta_t}(u_{et} - c_t) + \frac{\lambda_t}{1+\delta_t} \max\left(U_{et}, U_{jt} \mid U^*_{jt}\right) \\ &= \frac{1}{1+\delta_t}(u_{et} - c_t) + \frac{\lambda_t}{1+\delta_t} \pi_{jt} \end{aligned} \tag{2.23}$$

The individual's optimal transition behaviour can be summarised as follows. At t the individual is in employment receiving the single-period utility from employment $(u_{et} - c_t)$ and the individual receives exit offers $\lambda_t = \sum_j^H \lambda_{jt} > 0$. The individual decides whether to accept or decline the exit offers. There are two possible outcomes:

1. The individual accepts offer j and receives utility flow $U_{jt} = \sum_{t+1}^T U_{jt}$ till death. The probability that this happens is equal to $\pi_{jt} = P(U_{jt} \geq U_{jt}^* \wedge U_{jt} \geq U_{st}, \forall s \neq j)$

2. The individual declines all offers and remains employed, receiving utility U_{et} and deciding optimally again at $t+1$. The probability that this outcome occurs is equal to $1 - \sum_j^J \pi_{jt}$, with π_{jt} defined above.

2.5 Concluding remarks

As we have shown in this chapter, the retirement decision is most frequently studied within the neo-classical life-cycle framework. In this model the retirement decision is treated as an intertemporal labour supply decision in which the individual has to decide on the optimal years of work (i.e. lifetime consumption) and on the optimal years of retirement (i.e. lifetime leisure), or better, on the optimal retirement age. In doing so, he maximises lifetime utility restricted by his lifetime budget constraint. This neo-classical approach to retirement behaviour was developed during the 1970s, and the most frequent application was to show how changes in the old-age pension system, or in the general social security system, affected the individual's retirement age. In the decades to follow, the models really matured, when uncertainty and dynamics were added to the model. Uncertainty and dynamics are extremely important when studying retirement behaviour. Many aspects of the retirement decision, such as post-retirement income, future health, and household status are uncertain. In addition, recent empirical studies revealed that a variety of pathways are being used to facilitate early retirement. Not only have occupational and private early retirement schemes grown in number and coverage, social security arrangements such as disability and unemployment have proven to be likely substitutes for early retirement schemes. These various pathways an individual can take into retirement are reflected through this budget constraint, by the different income flows after the retirement age. Although some authors have incorporated the multitude of retirement routes into the life-cycle models, we argue that an alternative way of analysing early retirement in this setting, is by using search theory.

Like the life-cycle models, search theory is based on the conceptual framework of neo-classical economic theory, and age-dependence of the retirement decision is the main ingredient of the model. The search model was originally designed for the analysis of the job search behaviour of the unemployed. Each period, the unemployed individual receives job offers and at the core of the search model is the individual's optimal strategy

in choosing whether to accept or decline these offers. The individual will only accept an offer if it is at least as high as a minimum acceptable utility level, known as the reservation utility. We argue that the same reasoning can be applied to retirement behaviour. Rather than deciding beforehand at what age he wants to retire, we argue that the individual is constantly faced with retirement offers he has to evaluate. By using the search model we recognise the fact that the older workers might receive spontaneous, whether or not voluntary, retirement offers. At some ages, he might receive more offers than at other ages, which is reflected in the arrival rate of the retirement offers. In addition, specific attention is paid to the different early retirement pathways at different ages, which is more implicitly available in the life-cycle models (accounted for in the intertemporal budget constraint). The various pathways result in multiple arrival rates, which are determined by the entitlement conditions of the retirement pathways. It is shown that in this case, the individual's optimal strategy is characterised by two properties: the offer's expected utility flow has to be at least as great as the individual's reservation utility and the offer has to be preferred over its alternatives. The individual has to compare the utility flow from the various retirement offers to make his decision.

The theoretical retirement search model we have developed is characterised by a high degree of flexibility. First, the model allows us to analyse the effect of a great deal of background characteristics of the individual. We can see how the retirement offers' arrival rates, the expected utility flow from the offers, the destination-specific reservation utilities, as well as the current utility from employment are different for individuals with different characteristics. In addition, and most importantly for the research in this dissertation, we can analyse retirement patterns in a comparative perspective. Because the entitlement conditions of the various schemes as well as the expected utility flows from the various retirement offers explicitly enter the model, the search model is appropriate to analyse retirement behaviour in countries with different institutional settings. In this respect it can be seen to what extent such institutional differences affect the individual's early retirement decision. We argue that the search model is a valid alternative to the life cycle model of retirement and with this novel approach we hope to contribute to both the retirement literature and the search literature. We show that the search theory can be widely applied in the domain of labour economics.

In the next chapter, we will use the search model to derive the predicted effects of both the individual's background characteristics and the institutional framework in which the early retirement decision is made. Additionally, we specify the empirical model.

Chapter 3

The empirical model and predictions derived from theory

3.1 Introduction

In this chapter we build on the theoretical model explained in the previous chapter. Before continuing, however, we first need to define what we mean by early retirement. There are several ways to define early retirement. First, one could rely on statistics on the receipt of pension benefits. However, the decision to stop working does not inevitably mean the receipt pension benefits. A retiree might receive other public non-pension benefits, but he might also live on private wealth. Second, one could rely on the self-reported status. However, especially with part-time retirees, i.e. older workers who reduced their number of working hours as a first step into full retirement, it seems that subjective feelings of retirement can be very different (Takala, 1999). Some part-time retirees reported they were still employed, but others reported being retired. A third aspect of retirement is related to this, and concerns the number of working hours. Does retirement imply zero working hours, or does it mean a substantial reduction of working hours of, say, 50 percent? The retiree might still be on a contract for some hours, for example, to do some advisory work for the firm or to train new, young employees.

In any case, one should define clearly what is meant by early retirement. For this study, the following definition of retirement is used. First, it involves retirement at an age before the official retirement age in a country. With this latter age we refer to the age at which the retiree is entitled to a full public pension, as is explained in Chapter 4. Second, we rely on statistics on benefit receipt and include receipt of pension benefits, whether public or private, and other social security benefits into the definition. In addition, to account for the fact that some older workers make a transition out of employment without receipt of any of these benefits, a separate category, the inactive, is created. As for the number of hours, employment refers to working at least 15 hours a week, and non-employment

consequently refers to working less than 15 hours a week. It is argued that a job of less than 15 hours a week cannot provide sufficient income to live from and additional income sources are needed. In Chapter 5 we also explain the more practical reason for choosing this threshold of 15 hours a week.

From the theoretical model it follows that the probability for making a transition into either of the early retirement states j ($j \in$ Retirement, Social security, Inactivity) depends on the probability of arrival of such exit offers (λ_{jt}) and the likelihood of accepting them, based on the reservation utility property (π_{jt}). We showed that an offer j with associated utility flow U_{jt} is considered to be acceptable only when the present value of the utility flow from state j is as least as great as (a) the individual's reservation utility U^*_{jt} for that specific state ($U_{jt} \geq U^*_{jt}$); and (b) the expected present value of the utility flow from the other possible destination states ($U_{jt} \geq U_{st}, j \neq s$). The reservation utility level therefore acts as the main theoretical variable to explain the individual's retirement decision. The decision to withdraw and retire is therefore primarily determined by the arrival rate of the various offers, the subjective discount rate to value future gains, the current and expected future utility gains obtained from staying in employment, the search costs, and the present value of the expected utility flows from the various retirement offers.

The decision itself is further affected by the background characteristics of the individual or household to which the individual belongs, such as demographic indicators (e.g. age, gender, health), human capital indicators (e.g. education level, work experience, training, wage level), household characteristics (e.g. marital status, presence of children, spousal characteristics with respect to employment and health) and job characteristics (e.g. sector of industry, type of employment, occupation, number of weekly hours worked). This chapter aims to derive predictions about the effects of these factors on the model's dependent variable and consequently on the individual's transition probabilities into retirement and social security. We first derive such predictions from 'job search' theories, which constitute the main framework of our empirical model. Since the theoretical model is not solely 'job search' like, e.g. its focus on institutional differences across countries, we also include variables which are derived from other theories that will be explained later.

As well as explaining the determinants of the retirement decision, this chapter also focuses on explaining the observed country differences and the role of institutional dissimilarities in that respect (e.g. differences in the level of flexibility and generosity of the various retirement schemes) which are likely to affect the individual's retirement behaviour. We will find that accounting for institutional differences across countries leads to differences in the predicted effects of the other factors on early retirement behaviour. We will only discuss such effects at the country level, i.e. without specifying what particular type of institutions exist. For example, we show how the generosity of early retirement schemes might affect the individual's decision to retire early, without examining in detail how the countries perform in terms of the generosity of their schemes. This will be dealt

with in the next chapter.

Before we derive all these predictions, we first specify the empirical model. From the discussion in Chapter 2 we can conclude that the empirical model in this study needs to account for: (a) the existence of multiple retirement pathways; (b) specific time- or age-dependence of the retirement decision; and (c) a wide variety of background and institutional characteristics. In addition, we use longitudinal or panel data to account for the longitudinal character of the retirement process. The availability of such data has grown in recent decades and for European analyses several data sets exist that are discussed in this chapter. Both the features of the empirical model and the use of panel data provide us with various alternative empirical specifications that might be used for the analysis of individual retirement patterns. We have decided to use both the multinomial logit model and a competing-risks duration model, which fit our data and our research purposes best. The reasons for opting for these models as well as for the further specification of the models will be discussed in the first section of this chapter.

3.2 The empirical model

3.2.1 Structural versus reduced form approach

For the specification of the empirical model, there are two (rather different) approaches in econometrics: the structural approach and the reduced-form approach. In a structural model the observed retirement patterns are modelled as part of a solution of the utility theoretical model, whereas the reduced-form model estimates structural parameters from this theoretical model without relying on the causal processes behind it (Arroyo & Zang, 1996). In practice this means that in a structural model, all channels or processes through which the explanatory variables affect the early retirement patterns, are captured. A reduced-form approach, on the other hand, looks at the direct relation between the explanatory variables and the early retirement probability, leaving the processes through which this effect works unexplained. In other words, causation is not necessarily proven, since the channels through which a part of the effects might take place are not taken into consideration. For example, the effect of age on the retirement probability might be modelled as follows:

Structural model:	Age $\Rightarrow$ Human capital endowments $\Rightarrow$ Productivity $\Rightarrow$ Retirement
Reduced form model:	Age $\Rightarrow$ Retirement

Because of this, structural models are often said to be better predictors of the effect of the explanatory variables on the dependent variable. However, the informative nature of these predictions rely fully on proper specification of the structural model and knowledge about the causation process. Structural models require complete knowledge of a very detailed information set (Jarrow & Protter, 2004). It is not difficult to imagine that the

channels or processes through which the explanatory variables affect the early retirement probability might be quite large in number, rather complex, and subject to change over time. A structural model usually imposes a large number of restrictions on the data and this makes specification as well as computation extremely difficult, yet not impossible. The reduced form model is less complex but still allows the modelling of complex interaction effects between the exogenous variables. Returning to the example above, it is possible to include interaction effects between age and human capital to see whether the effect of human capital indicators is different at different ages. In addition, the reduced-form model still allows the analysis of time- or age-dependence of retirement behaviour, which is crucial for understanding the retirement process. Following Gustman and Steinmeier (2001), using a reduced-form approach is a very useful analytical tool to describe and explain the retirement process without constraining the analysis at a very early stage.

For the empirical analyses in this dissertation, we have decided to estimate the retirement decision using reduced-form models, even though it loosens the immediate relation between the empirical model and the theoretical model, of which the latter has been formulated based on a structural perspective. We believe that our approach still renders some highly relevant and valuable results which would otherwise have proven difficult to obtain or which would otherwise constrain the analysis too much by the need to impose a multitude of restrictions on the empirical model. It also permits us to discover various kinds of determinants of individual retirement patterns. Formally, the reduced-form equation for the transition utility out of employment, based on the structural relation explained in Equation 2.23, is given by

$$U_{et} = f(u_e, -c_t, \delta_t, \lambda_{jt}, U_{et}(Y_{et}, L_{et}), U_{jt}(Y_{jt}, L_{jt}), U^*_{jt}) \tag{3.1}$$

with u_e being the single-period utility from employment, $-c_t$ being the search costs, δ_t being the subjective discount rate, λ_{jt} being the arrival rate of the stream of offers j, U_{et} being the expected present value of the utility flow from continued employment, U_{jt} being the expected present value of the utility flow from retirement through exit route j, and U^*_{jt} being the reservation utility for a transition to exit route j. Following the theoretical model developed in the previous chapter, we aim to derive the very detailed hypotheses about the expected effects of all explanatory variables of interest on early retirement behaviour, thereby providing further knowledge about the causal processes behind the retirement decision. Before we do this, however, we first need to explain the empirical model and to give a short introduction to the type of data we use for the analyses.

3.2.2 Using panel data

Due to the wider availability of longitudinal data, the use of this kind of data in the economic literature has grown markedly during the past few decades. In this thesis,

we also use panel data for the analyses of early retirement behaviour. Panel data are different from other data because of the repeated measurements of information from the same individual.[1] In Europe, the most known panel data sets are the European Community Household Panel (ECHP), the British Household Panel Study (BHPS), the German Socio-Economic Panel (GSOEP) and the Dutch Socio-Economic Panel (SEP). All these panels are designed to survey the income and living situation of individuals and households over time. The surveys collect information on individual characteristics (e.g. age, sex, marital status), household composition (e.g. relation to household head, household size, number and age of dependents), human capital endowments (e.g. highest education level attained, training on-the-job, tenure), labour market status (e.g. type of job, sector of industry), and income (e.g. labour income, social security benefits and private wealth accumulation). Whereas the BHPS, GSOEP and SEP are country-specific panel studies, the ECHP is a harmonised cross-national longitudinal survey. The ECHP survey was initiated in 1994 and the final wave concerns 2002. The ECHP started with a sample of about 60,500 households (i.e. approximately 130,000 adults aged 16 years and over) across twelve member states of the European Union (Belgium, Britain, Denmark, Germany, Greece, Spain, France, Italy, Ireland, Luxembourg, the Netherlands, Portugal). Austria was included in 1995, Finland in 1996 and Sweden finally joined in 1997. The Swedish data set, however, is not longitudinal but a repeated cross-section. Both the SEP and the GSOEP started in 1984. The Dutch SEP, however, stopped as a survey in 2002 though it continued as an administrative data source from then on. The GSOEP runs from 1984, the latest wave currently available being 2003. The BHPS is running since 1991, the latest wave currently available being 2002. More specifications on the data are presented in the empirical chapters.[2]

3.2.3 Empirical models - a short note

Equation 3.1 shows the reduced-form equation for the transition out of employment, into one of the various exit states. For estimation purposes, we have elaborated an empirical model in which the dependent variable is an indicator variable for whether the worker is observed to make a transition from employment to non-employment from t to $t+1$, or more formally

$$Y_{ijt} = \begin{cases} 1 & \text{if a transition from employment to state } j \text{ is observed for individual } i \\ & \text{at time } t \\ 0 & \text{otherwise, i.e. no transition out of employment is observed} \end{cases}$$

[1] The most important advantages and disadvantages of panel data over using cross-sectional data are presented in the Appendix to this chapter.

[2] A detailed description of the ECHP data is given in the Appendix of Chapter 5 and a detailed description of BHPS, GSOEP and SEP is given in the Appendix of Chapter 6.

From the theoretical model we learned that the probability that a transition from employment to any of the exit states is observed (i.e. the probability that $Y_{ijt} = 1$), is the product of the offer's arrival rate (λ_{jt}) and its acceptance probability (π_{jt}), or

$$\begin{aligned} P(Y_{ijt} = 1) &= \lambda_{jt} P(U_{ijt} \geq U^*_{ijt} \wedge U_{ijt} \geq U_{ist}, \forall s \neq j) \\ &= \lambda_{jt} \pi_{jt} \end{aligned}$$

Such a reduced-form model with multiple destination states, can empirically be estimated with multinomial logit or probit models, or with a competing risks duration model. We start with the first type of models: the multinomial logit or probit models.

A basic difference between a probit and a logit model is the underlying distribution of the error term: the probit model assumes a normal distribution, whereas the logit model assumes a logistic distribution. Estimation results of the two models are usually more or less similar, with some differences found in the extreme tails of the distribution (Greene, 2000, ch.18). A practical problem with the multinomial probit model is that with three or more alternatives, there is no closed form for the integral, and numerical integration is computationally complex if not infeasible (Maddala, 1987, p.62). This is the main reason why many empirical applications use the multinomial logit model. However, in this model, an important assumption is made: the independence of irrelevant alternatives assumption (IIA). This assumption implies that the odds ratio of one retirement pathway chosen over the other pathway, does not depend on what other alternatives are available. Removing any of the irrelevant additional retirement pathways should not change the parameter estimates systematically, which provides a way to test the relevance of the assumption (Hausman & McFadden, 1984). When the assumption proves not to hold, an alternative model would be the nested logit model. In this model, it is assumed that the individual first decides whether to stop working or not, and when he decides to stop working, he makes the decision which pathway to use. Correlation of the unobserved factors between the different retirement pathways is allowed in the nested model, which relaxes the IIA assumption. The nested models, however, mainly because of the two-step estimation procedures might be difficult to implement and might yield unstable results (Hakola, 2002a). Another way to relax the IIA assumption might be to include additional explanatory variables into the model, variables that are related to the availability of possible substitution retirement pathways (Hakola, 2002b).

When using panel data, the most logical model to use would be a panel multinomial logit model that accounts for unobserved individual heterogeneity by including random or fixed individual-specific effects (α_i). In many cases, it turns out that the individual's preferences are not completely measured by the observed factors but that they are hidden in unobserved individual effects. An advantage of panel data is that, due to the existence of repeated information with the same person over time, we could be able to control for

this.[3] The specification for a panel multinomial logit model is as follows

$$Y_{ijt} = X_{it}\beta_t + \varepsilon_{it} + \alpha_i \tag{3.2}$$

$$P(Y_{ijt} = 1 \mid X_{it}, \alpha_i) = \frac{e^{\alpha_i + X_{it}\beta_t}}{1 + \sum_{j=1}^{J-1} e^{\alpha_i + X_{it}\beta_t}} \tag{3.3}$$

for the logistic distribution. However, with a large data set such as the ECHP, i.e. when pooling all countries and all years into one file as we want to do, it appears to be very laborious to estimate the model. This because of the integration of the multi-dimensional integral, which makes the estimation time extremely long, not to mention the computational limitations we face in this, with respect to time and space (e.g. the computer just cannot cope with the procedure). One of the existing alternatives is to model the probability to move to state j at $t+1$ using the explanatory variables and the original state of employment as lagged variables measured at t, i.e. a transition model without taking account of the individual-specific effects, or

$$P(Y_{ijt+1} = 1 \mid X_{it}, Y_{ijt}) = \frac{e^{X_{it}\beta_t}}{1 + \sum_{j=1}^{J-1} e^{X_{it}\beta_t}} \tag{3.4}$$

This boils down to the standard multinomial logit model applied to the pooled cross-sectional data. A drawback of this empirical specification is that the panel nature is not fully exploited. Only two subsequent waves are used to model the transition, and information of the individual gathered in previous waves is not used. Controlling for unobserved heterogeneity is not captured in this model, since the individual effects are excluded. This problem can be resolved, though only partially, by including a wide range of explanatory variables (both current period and lagged variables) to retrieve as much information about the individual as possible. Another potential drawback of the model we use is that the inclusion of time-varying covariates is not allowed in this model. Especially for the transition into retirement, changes in certain individual characteristics (e.g. health, income, institutions) might affect the early retirement decision. Yet, since we do have panel information, we can include changes in the explanatory variables, for example a change in the individual's health status or his spouse's working status between $t-1$ and t to see whether this affects a transition from t to $t+1$. Basically we then turn the time-varying covariate into a change-indicator dummy variable that is 1 where a change is observed and 0 otherwise.

Formally, the log-likelihood function following from this model, which is estimated by maximum likelihood estimation is (Maddala, 1987):

$$\log L = \sum_{i=1}^{N} \sum_{j=1}^{J} Y_{ijt} \log P(Y_{ijt} = 1) \tag{3.5}$$

[3] For more details see the Appendix to this chapter.

Another reduced-form approach in which we are able to control for observed and unobserved heterogeneity and to include time-varying covariates is a duration model. Two factors have contributed to the use of duration models in labour market analysis: (a) the aforementioned increased availability of longitudinal data; (b) the recognition of the key importance of the dynamic aspects and the role of expectations or uncertainty about the future in modelling labour market behaviour explained in the previous chapter. Issues related to the use of longitudinal data like unobserved heterogeneity and censoring[4] are relatively easy to deal with in duration models as will be shown in Chapter 6, where a duration model is used. Rather than modelling the transition probability at a certain time (referring to a year, let's say 1999), in a duration model, this transition probability is specifically modelled at a certain age. The t in our previous notation now directly refers to the individual's age.[5]

$$Y_{it} = \begin{cases} j & \text{if a transition from employment to state } j \text{ is observed for individual } i \\ & \text{at age } t \\ 0 & \text{otherwise} \end{cases}$$

Analogous to the multinomial logit models, we use a competing risks duration model in which multiple destination states are distinguished to which the individual can make a transition. A competing risks model is the most proper way to deal with the theoretical presumption, i.e. in the case where a transition to retirement is observed it means retirement is preferred above continued employment as well as above a transition to other exit states as determined by the individual's optimal decision strategy. Each destination state has its own destination-specific hazard rate or transition intensity. The probability of making a transition to state j at a particular age t is the product of the probability that someone has not previously made a transition (he has thus survived in employment until that age) and the conditional probability of making the transition.

For further specification of the duration model, let the random variable T represent the length of time an individual is employed in his current job after the age of 50, with expected timing of death being the maximum.[6] The use of this variable relates to the fact that observations of duration of employment are available rather than hazard rates themselves. Second, all intervals are assumed to be of unit length (a year), implying that the observed duration in the current job for each individual corresponds to the time interval $[t-1, t]$. For the analyses in this dissertation we use time as a discrete process. It

[4]Censoring means that the dependent variable, in this case the transition from the main job to one of the destination states, does not take place during the observation period. A person may make this transition before the observation period starts or after it has already ended.

[5]In the multinomial logit model an indirect age-dependence is modelled, since year and age are directly correlated.

[6]For a detailed discussion on the time horizon of the early retirement decision see Section 2.3.2.

is recognised, however, that the underlying transition process might in fact be continuous, one can 'decide' to leave employment at any moment. In other words, "the data are not intrinsically discrete, but they are grouped into intervals of unit length, in our case a year" (Jenkins, 2005, p.97). By using a discrete time duration model, this study follows recent approaches in empirical social science research. Applications using discrete time models have been on the increase during the last decade, but have not been applied much in this domain (Jenkins, 2005). A set of dummy variables η_j is defined where the dummy variable η_j is equal to 1 if exit state j is chosen and equal to 0 otherwise. Empirically this implies that completed durations are observed for those individuals who make a transition from their current job to one of the exit states after the age of 50 within the sampling period. People who are not observed to leave employment within the observation period yield censored observations (i.e. the event of interest has not occurred). The transition intensity to exit state j is then given by:

$$\lambda_{ij}(t) = P(T = t, \eta_j = 1 \mid T \geq t,) \tag{3.6}$$

The hazard rate is the probability that the individual leaves the original state of employment, regardless of where he makes a transition to, which is the sum of the transition intensities of all exit states

$$\lambda_i(t) = \sum_{j=1}^{K} \lambda_{ij}(t) \tag{3.7}$$

Formally, a competing risk model is obtained by assuming that the different exit states to which an individual can make a transition to are independent of each other, mutually exclusive and that they exhaust the possible states to which an older worker can make a transition. In a continuous duration model, the log-likelihood function can be split into the sum of the destination-specific transition intensities (Lancaster, 1990). Jenkins (2005) shows that this is not true in the interval-censored case: "with grouped survival times, more than one latent event is possible in each interval (though, of course, only one is actually observed. Put another way, when constructing the likelihood and considering the probability of observing an exit to a specific destination in a given interval, we have to take account of the fact that, not only was there an exit to that destination, but also that that exit occurred before an exit to the other potential destinations"[p.97]. The log-likelihood function is only by approximation equal to the sum of the destination-specific transition intensities and further assumptions about the 'within-interval hazard rates' are necessary. For example, one could assume that the exit out of employment only occurs at the end of the time interval, as did Narendranathan and Stewart (1993) in their analysis of exit out of unemployment. Or one could assume that the (continuous) hazard is constant

within the time intervals, and Jenkins (2005) shows that in the case of a relatively small interval hazard rate, this approach produces approximately the same estimation results as the multinomial logit approach developed by Allison (1982) for intrinsically discrete data. He assumed the following specification for the destination-specific hazard rate,

$$\lambda_{ij}(t) = \frac{exp(\beta_j' X_{it})}{1 + \sum_{j=1}^{J-1} exp(\beta_j' X_{it})} \tag{3.8}$$

with X_{it} again being the individual-specific vector containing the explanatory variables, β_j the vector of estimated parameters. He further showed that the likelihood contribution function following from this specification has the same form as the likelihood for a standard multinomial logit model applied to the data organised in a person-period format. A person-period format refers to a data formal in which the number of cases, or rows, per individual is equal to the number of time intervals (or years), the individual is at risk of experiencing the event of interest (in our case, exit out of employment). Among the vector of estimated parameters, is β_{0j}, the destination-specific baseline hazard, which can be interpreted as the age-dependence of the transition intensity. The baseline hazard function may be defined as either parametric or non-parametric. In our model the baseline hazard is expected to be larger than 1: the destination-specific transition intensities is increasing over time, implying that the probability of leaving to one of the destination states is an increasing function of age. In Chapter 6, where we empirically estimate this model, we provide more details.

The vector X_{it} in both the multinomial logit model and the duration model, contains the independent or explanatory variables. These are derived from the theoretical model developed in the previous chapter and include:

- individual characteristics: age, gender, health;
- human capital indicators: the highest education level attained, the work or labour market experience, participation in formal on-the-job training and the wage level;
- household characteristics: marital status, the presence of children, spousal characteristics such as employment or health status, the household income;
- job characteristics: the sector of industry, the type of employment, the occupation and job level, the weekly number of hours worked and the unemployment history;
- institutional characteristics: flexibility and generosity of early retirement schemes, flexibility and generosity of other social security arrangements facilitating early retirement and business cycle effects.

In the next section we will discuss in what way these explanatory variables can be expected to affect the individual's retirement decision.

Table 3.1: Predicted effects on exit probability derived from search model

Explaining factor	Mechanism	To retirement	To social security
Age	$u_{et} \downarrow, U_{jt} \uparrow \longrightarrow U^*_{jt} \downarrow \longrightarrow \pi_{jt} \uparrow$	$\tau_r \uparrow$	$\tau_s \uparrow$
	$\delta_t \uparrow \longrightarrow U^*_{jt} \downarrow \longrightarrow \pi_{jt} \uparrow$	$\tau_r \uparrow$	$\tau_s \uparrow$
Women	$\lambda_{rt} \downarrow$	$\tau_r \downarrow$	
Bad health	$u_{et} \downarrow, U_{et} \downarrow \longrightarrow U^*_{jt} \downarrow \longrightarrow \pi_{jt} \uparrow$	$\tau_r \uparrow$	$\tau_s \uparrow$
	$\delta_t \uparrow \longrightarrow U^*_{jt} \downarrow \longrightarrow \pi_{jt} \uparrow$	$\tau_r \uparrow$	$\tau_s \uparrow$
	$\lambda_{st} \uparrow$		$\tau_s \uparrow$
Higher human capital	$U_{et} \uparrow \longrightarrow U^*_{jt} \uparrow \longrightarrow \pi_{jt} \downarrow$	$\tau_r \downarrow$	$\tau_s \downarrow$
$\rightarrow$ higher wage	(i.e.) $U_{et} \uparrow \longrightarrow U^*_{jt} \uparrow \longrightarrow \pi_{jt} \downarrow$	$\tau_r \downarrow$	$\tau_s \downarrow$
	(s.e.) $U_{rt} \uparrow \longrightarrow \pi_{rt} \uparrow$	$\tau_r \uparrow$	
	$U_{st} \downarrow, \lambda_{st} \downarrow \longrightarrow \pi_{st} \downarrow$		$\tau_s \downarrow$
Working spouse	$U(L_{rt}) \downarrow \longrightarrow \pi_{rt} \downarrow$	$\tau_r \downarrow$	
	$U(Y_{rt}) \uparrow \longrightarrow \pi_{rt} \uparrow$	$\tau_r \uparrow$	
	$\lambda_{st} \downarrow$		$\tau_s \downarrow$
Having dependents	$\lambda_{st} \uparrow$		$\tau_s \uparrow$
+ being male	$U_{et} \uparrow \longrightarrow U^*_{jt} \uparrow \longrightarrow \pi_{jt} \downarrow$	$\tau_r \downarrow$	$\tau_s \downarrow$
+ being female	$U_{et} \downarrow \longrightarrow U^*_{jt} \downarrow \longrightarrow \pi_{jt} \uparrow$	$\tau_r \uparrow$	$\tau_s \uparrow$
Working in industry	$\lambda_{ut} \uparrow$		$\tau_s \uparrow$
Public sector employee	$U(Y_{rt}) \uparrow \longrightarrow \pi_{rt} \uparrow$	$\tau_r \uparrow$	
Being self-employed	$\lambda_{st} \downarrow, \lambda_{st} \downarrow$	$\tau_r \downarrow$	$\tau) s \downarrow$
Higher job level	$\lambda_{st} \uparrow, \lambda_{st} \downarrow$	$\tau_r \uparrow$	$\tau_s \downarrow$
$\rightarrow$ higher wage		τ_r?	$\tau_s \downarrow$
Hours worked	$\longrightarrow$ Human capital $\uparrow$	τ_r?	$\tau_s \downarrow$
$\rightarrow$ higher earnings		τ_r?	$\tau_s \downarrow$
Unemployment history	$\lambda_{rt} \downarrow, \lambda_{st} \uparrow$	$\tau_r \downarrow$	$\tau_s \uparrow$

3.3 Predictions from theory

We will first outline the predictions derived from job search theory, after which we will explain how alternative theories might be used to arrive at similar or different predictions.

3.3.1 Predictions derived from search theory

Table 3.1 summarises the theoretical predicted effects on transition probabilities derived from job search theory. Country differences are discussed separately in Section 3.3.3.

Individual characteristics and early retirement

The exit probability, regardless of the destination state, is expected to increase with age. As explained earlier, preferences are expected to shift toward leisure with age (Gustman & Steinmeier, 1984). Consequently, both current and expected future utility from employment declines (u_{et}, U_{et}) and expected utility from exit increases (U_{jt}), reducing the reservation utility (U^*_{jt}) and increasing the transition probability out of employment (τ_{jt}). The arrival rate of retirement offers (λ_{rt}) is positive as soon as people are eligible for early

retirement. In addition, as people grow older, the number of future periods decreases ('time runs out') and people tend to place a higher value on offers in current periods. This increases the subjective discount rate (δ_t), which also reduces the reservation utility and increases the exit probability.

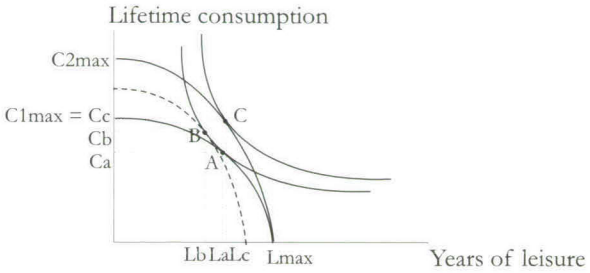
Women are expected to have a lower transition probability into retirement. The reason for this is that women are generally less likely to meet the entitlement criteria of early retirement schemes (e.g. minimum contribution period) because of disrupted working careers. This lowers the arrival rate of retirement offers (λ_{rt}) and the transition probability into retirement. From theory we further expect that a bad state of health increases the individual's exit probability. First, a bad state of health reduces the individual's productivity, which, in a competitive labour market, would reduce both current earnings (y_{et}) and expected earnings potential (Y_{et}). This reduces utility from employment, reducing the reservation utility (U_t^*) and increasing the transition probability out of employment. In addition, a bad state of health might reduce one's life expectancy, which might accelerate early retirement decisions because of an increased preference for current leisure time (Disney et al., 2003). Finally, a bad state of health is expected to increase the arrival rate of social security offers (λ_{st}), increasing the transition probability (τ_{st}). The health effects are expected to interact with age. It goes without saying that an individual's health is a declining function of age. The rate at which health declines with age depends, among other things, on the individual's life style (e.g. smoking, exercise), genetic inheritance and his employment situation (e.g. hours worked, type of work, working conditions).

Human capital and early retirement

For the effect of human capital on the individual's exit probability, an ambiguous outcome is derived from job search theory which, however, very much follows from human capital theory (Becker, 1964). On the one hand, it is argued that people with higher human capital levels have invested more time and money in building up this human capital. These higher investments increase the individual's payback time period (or his utility from employment), increasing his reservation utility for transiting into early retirement and thereby lowering his early retirement probability. On the other hand, it is argued that the main return on investment in human capital for the individual are higher earnings. Higher earnings are expected to have an ambiguous effect on the retirement probability. We explain this by showing the effects of an increase in earnings using the life-cycle consumption-leisure framework from the previous chapter, shown in Figure 3.2.[7]

[7]For illustrative reasons we use a non-kinked budget constraint, the results however are the same when allowing a kinked budget constraint.

Figure 3.1: The effect of higher earnings on retirement



Assume that the individual's preferences and constraints are structured such that initially he is in situation A, consuming L_a lifetime leisure and C_a lifetime consumption. Because of a pay-off on his investments in human capital, he experiences a wage increase resulting in a new budget constraint $LC2_{max}$. First, these higher wages increase the opportunity costs of leisure, i.e. the marginal rate of substitution has changed due to the rotated budget constraint: leisure has become more expensive compared to consumption. This is the substitution effect from A to B, with a reduced consumption of lifetime leisure and an increased consumption of lifetime consumption. Second, the higher wages increase post-retirement income as well since this is dependent on pre-retirement income. This yields an income-effect from B to C (income in both the state of employment and the state of retirement increases), increasing both the consumption of lifetime leisure and of lifetime consumption. The total effect is an increase in lifetime consumption C and an ambiguous effect on lifetime leisure L. From theory it is not clear which effect is dominant and whether higher wages induce earlier retirement or not. Note that this ambiguous effect of higher human capital (and wages) only applies to the transition into retirement. For the transition into social security, higher human capital (represented by higher wages) are expected to have a negative effect due to reduced entitlement. This is especially true for means-tested social security benefits (i.e. not available for people with earnings above a certain threshold) or benefits up to a certain amount (i.e. maximum benefits).

Consequently, using search theory, the general prediction for the effect of higher human capital levels on the exit probabilities is ambiguous for the transition into early retirement and negative for the transition into social security. In Section 3.3.2, using alternative theories, we discuss in more detail the effects of the factors that determine a person's human capital (e.g. education level, work experience and training).

Household indicators and early retirement

The exit probabilities derived from the search model are also affected by household characteristics. The expected utility from retirement is expected to depend on the existence of

a partner, and where a partner exists, on the partner's working and health status. When the individual has no partner or children to take care of, he can basically decide himself when and how to retire, given the limitations put forward earlier (e.g. budget constraint and limited freedom of choice with respect to some pathways). When the individual has a partner, however, the situation is different. First of all, we have to account for the 'added worker effect'. This refers to income spill-over effects between partners. The income earned by his partner affects the expected utility stream of the individual. For example, an individual might decide to increase his labour supply (or years of work, later retirement) when his spouse's income is reduced (e.g. because of unexpected retirement). Or an individual might decide to retire when the spouse is earning additional income (additional household income encourages early retirement then). Based on such income spill-overs, one might expect postponement of the retirement decision for individuals with non-employed spouses compared to individual's with employed spouses. However, apart from income spill-over effects, household members are likely to experience utility gains from 'joint consumption' of leisure time. Leisure time that is spent jointly with the spouse is preferred over 'personal consumption' of leisure time. In addition to this, tastes are likely to be correlated, even when controlling for economic factors, for assortative mating reasons (i.e. people tend to marry people with similar attitudes and preferences).[8] The effect on the retirement decision of having a working spouse might thus work in both directions: the income earned by the working spouse might induce earlier retirement of the individual because of the income spill-overs, while the disutility from a 'non-joint' or purely personal retirement decision might encourage the individual to continue working when his spouse is also continuing in work.

The presence of dependents in the household, either children or other relatives or a spouse in a bad state of health, also affects the retirement decision. Because of the higher income needed to cover the costs of larger households, the utility from working is higher for individuals who are (financially) responsible for such households. This effect might be smaller or even non-existent for women (or, non-heads of the household in strict terms) if the dependents also need personal care as well as financial care. Since Women are generally the ones who take care of the children or of the grandparents, this might decrease their utility of working. Additionally, other household income in general, regardless of whether it is earned by the spouse or by other people in the household, or whether it refers to household wealth (e.g. private property or savings) is expected to reduce an older workers' entitlement to social security. Means-tested social security offers

[8]The work status of the partner might even be endogenous, something which should be tested formally when estimating the models.

are not open to workers who have other household members with income sources, either from employment or private wealth.

To model such household effects, several authors adopted family life-cycle models (Clark et al., 1980; An et al., 2004; Hurd, 1990). In our search model we control for these effects by including household characteristics and by including interaction effects between the household characteristics and the other variables.

Job characteristics and early retirement

Several aspects of the older workers' employment situation are expected to affect his exit probability into early retirement or social security. First, sector of industry seems of importance. In some sectors it is much more common to retire early than in other sectors. For example, the mandatory retirement age in the Dutch banking sector is 62, three years before the age at which one can claim a public old-age pension (the so-called official retirement age is 65 in the Netherlands). The freedom of choice is limited in this respect and the employee is forced to take up early retirement or seek employment in another job outside the banking sector. The probability that this latter event takes place is very low, implying that the majority of bank employees aged 62 years retire early. In addition, in sectors where a worker's productivity declines fastest with age, older workers might be more at risk of involuntary early exit (i.e. higher arrival rate of unemployment offers or forced into early retirement scheme). One can think of sectors in which physical health conditions are an important factor (e.g. construction) or where modern technologies are introduced at a high speed, which increases the rate at which senior workers' skills and knowledge become obsolete (e.g. information technology). Furthermore, public sector employees by contrast, are known to have the most generous early retirement benefits and therefore the highest expected utility from retirement (U_{rt}) and the highest transition probability into retirement.

Second, type of job might affect the exit probabilities. For example, the self-employed are generally not eligible for social security schemes or early retirement schemes, and therefore have to rely fully on their privately organised, more costly, arrangements although participation in public schemes is in many cases possible, on a voluntary basis. Furthermore, with respect to job level, it might be expected that people in higher positions (e.g. management positions) are less threatened by the risk of unemployment compared to blue-collar workers. They are more likely to be offered specific early retirement options that allow retirement after a minimum number of contribution years (e.g. the so-called seniority or anciennity schemes). Traditionally, the higher-skilled were among the first group of workers that were allowed to retire early as a reward for long service and also

signalling their higher professional status. However, people in higher level jobs usually have higher earnings, with the earlier explained ambiguous effect of such higher earnings on early retirement.

Third, the weekly number of working hours is expected to increase total labour earnings as well as the worker's human capital (e.g. people working longer hours have more work experience and are even more likely to participate in training), with the aforementioned ambiguous effects on exit. Working more hours might be seen as an indicator for a higher preference for working or a higher need for earning labour income (this might be for various reasons such as living in a larger household). Finally, the national unemployment rate acting as an indicator for the business cycle might affect the exit probabilities of older workers. Arrival rates of early retirement and unemployment offers might be higher in periods of economic downturn, when older workers are especially vulnerable to exit because of their higher wage costs (Remery et al., 2001). In recession periods, employers generally need to rationalise their labour force to improve their economic position. Samorodov (1999), for example, showed that in periods of economic downturn indeed older workers are confronted with higher job separation rates.

3.3.2 Predicted effects derived from alternative theories

Apart from the effects of variables directly derived from the search theoretical model, some relationships between the explanatory factors and the exit patterns are more complicated to explain from the underlying theoretical perspective and need further consideration. When we start using alternative theories to explain these relationships we have to be aware that this might also lead to contradicting predictions compared to those derived from the job search framework. The focus will be on factors that will be explained empirically in later chapters of this dissertation, such as work experience or tenure, the level of wages, and the participation in formal training of older workers.

Tenure and early retirement

A worker's proficiency in working skills increases by working and performing tasks over and over again. A long tenure is therefore expected to increase one's job-specific human capital with the expected ambiguous effects on early retirement behaviour explained earlier. From theory, however, some additional effects of tenure on individual retirement patterns can be derived. Following job match theory (Jovanovic, 1979), a long tenure signals a good employer-employee match since a mismatch would manifest itself early in the employer-employee relation. From this perspective, the transition probability into unemployment is expected to be lower for people with longer tenure (i.e. a lower or even zero arrival

rate). For transitions into disability it can be argued that this fully depends on the type of work. A long tenure in a physically demanding job (e.g. industry) might raise the arrival rate of disability offers, while this effect might not be found in less physically demanding jobs. In addition, most early retirement schemes request a minimum number of working or contribution years and long tenure might encourage early retirement because the entitlement conditions of the schemes are more likely to be met.

Wages and early retirement

We have already contended that in a competitive market higher human capital translates into higher earnings. These higher earnings have an ambiguous effect on the retirement probability as explained in Figure 3.2. In addition to the effect of human capital on wages, other factors also affect an individual's wage, indirectly affecting his retirement behaviour. Of primary interest here is the existence of seniority wages and experience-rating practice in wage formation resulting in increasing wages with age or tenure. From economic theory it is expected that the older worker's declining productivity leads to lower wages. In practice, however, older workers are seldom faced with declining wage growth and according to Thurow (1975) the relation between productivity and earnings is less strong than predicted by the human capital theory. There are several economic theories that try to explain the positive correlation between wage and age, one of which is the contract theory. According to this theory, the relation between an employer and an employee is characterised by uncertainty arising from asymmetric information (Lazear, 1979). When the employer hires the employee, he is not sure whether the employee will fulfil his tasks adequately. Similarly, the employee is not sure whether the employer will do what he promised at the time he was hired. By means of a contract, the employee commits himself to attaining the company goals by working in return for a wage, which is set to assure the compliance of the contract (Muffels, 2001). Seniority wage systems seem to support the theoretical assumptions underlying contract theory. Paying a worker below his marginal productivity when he is young and above his marginal productivity when he is older results in a more positive work attitude, a stronger effort, and a better on-the-job performance. A valid argument for paying a younger, starting employee below his marginal product is that he is still receiving training (both formal training and informal learning-by-doing) which means that he is less productive in the initial training period and more productive afterwards. When this training pays off, his wage will therefore tend to rise in the future.

These higher wages paid to older workers have several consequences for the older worker's position in the firm. For the older worker, the higher wages act as an incentive to

remain with the current firm (i.e. in another firm this wage will not be received) lowering the job-to-job mobility of these categories of workers. However, for the employer there is an incentive to dismiss the older worker early since his wage exceeds his productivity which declines over time due to the obsolescence of the knowledge and skills obtained through formal education and training. Lazear (1979) therefore argues that, in the absence of mandatory retirement, an implicit contract between the employer and the employee should include an end date for their contract. In most cases this end date will be related to the country's official retirement age, yet it might also be related to an early retirement age when such schemes exist. For example, in the Netherlands, the official retirement age is 65 and from that age on people are entitled to a public old-age pension. Although retirement is not mandatory at this age (and not even needed to claim an old-age pension) in most collective agreements it is specified that the contract ends at the age of 65. When not explicitly mentioned, it is implicitly assumed that workers leave their job at the age of 65. The existence of seniority wages might also lead to 'mandatory' early retirement as in the Dutch banking sector mentioned before. It is well known that older workers in this sector earn very high wages, for which the employer in return demands early retirement at the age of 62. Finally, the existence of seniority wages in combination with final-pay early retirement schemes (i.e. retirement schemes in which pension benefits depend on the earnings in the final years of employment), might induce later retirement since pension income is increased by working longer. With average-pay early retirement schemes (i.e. retirement schemes in which pension benefits depend on the average earnings over the worker's career), the increase in pension income due to a wage increase in later life is lower compared to the increase under final-pay schemes. More details on such schemes are provided in Chapter 4.

Participation in training and early retirement

Generally speaking, trained workers are expected to be more productive and more valuable for the employer, reducing the layoff risk. Furthermore, training increases the payback time period, which motivates employees to continue working rather than retiring early. Yet, it is often contended that the participation in training of older workers is lower compared to that of younger workers. Below, we provide some further arguments.

When deciding whether to offer training or to participate in training, both employers and workers must evaluate the costs and benefits of such training. For the employer, such costs include direct costs paid for equipment and materials used as well as indirect costs due to additional wage costs after training. The main return from training for the employer is an increase in the worker's productivity. For the employee, the main costs are

related to the value placed on time and effort as well as a possible contribution to the costs of equipment and material. The main return from training for the worker is an expected wage increase in the future. Employers will only offer training, and employees will only participate in training, if the expected returns exceed the expected costs. From theory it is now expected that the participation in training is lower for older workers, mainly because expected costs are likely to exceed the benefits. Expected returns from training are lower because of the shorter payback time period for older workers (Becker, 1964). Although retirement at the official retirement age is not mandatory in most European countries, it is common practice to retire at that age (for more details see Chapter 4). In other words, the financial incentive in terms of the offered expected utility at the official retirement age is so high that it acts as an offer one cannot refuse. Additionally, one might argue that the mere existence of early retirement options reduces the expected payback period and discourages both older workers and employers from investing in training.[9] Another reason for lower expected returns for older workers' training is the lower expected productivity increase after training for older workers resulting from a general decline in productivity with age, as put forward by the 'ageing deficit' perspective. The extent of this expected productivity decline depends largely on the type of job of the older worker. For example, the productivity decline is expected to be largest in physically demanding jobs and smallest in administrative jobs. In addition to higher training costs associated with older workers, it is often heard that older workers are more difficult to train because they are less healthy, more rigid and require different training methods than younger workers (Casey & Bruche, 1981; Remery et al., 2001).

Participation in training further depends on the readiness to pay for the training costs. In this respect, Becker (1964) distinguishes between two types of training, general and specific training. It is expected that participation in general training is indeed lower for older workers, compared to younger workers. General training also raises the worker's productivity in other firms making returns to general training not firm-specific. Rational employers provide such training only if they can shift the costs to the trainees. Young workers might be willing to pay for such costs since it raises their wage over their future career, regardless of the firm they work for. Older workers are less likely to pay for such costs since their future career is much shorter and the probability of finding employment in another job after possible layoff is small. While general training does not tighten the relation between the employer and the employee, specific training does. It mainly raises the productivity in the current firm since the acquired skills are of less use to another

[9]Note that causality might run both ways here. A lack of training among older workers might induce early retirement, yet the mere existence of early retirement might reduce participation in training of older workers.

employer. The readiness to pay for such training, however, is not as clear cut as with general training. When the employer pays for the training and the worker quits the firm after a while, the employer ends up with a lower productivity because a new employee will not have the same productivity as the trained employee. However, when the worker pays for the training and he is laid off, he will receive a lower wage in his new job since the training he received in his old job is of no value to the new employer. Both parties thus face a risk when paying for the training. Arguably, if they were to behave rationally, they would share the costs (Becker, 1964).

Another reason for lower participation rates in training of older workers follows from the accumulation perspective of lifelong learning theories. Following this perspective, there is a positive relation between a worker's education level and his participation in training. People with higher education levels are more likely to accumulate skills and knowledge during their working life compared to people with lower education levels. Because of the increased access to higher education and the higher average education level over time, education levels are expected to be lower for older generations. In addition, knowledge and skills acquired through such formal education are subject to depreciation. This depreciation can be divided into two types. First, there is depreciation related to worker-attributes such as health and age. For example, the rate of depreciation is higher for workers in a bad state of health (Brunello, 2001). As mentioned, older workers, ceteris paribus, have worse health compared to younger workers implying faster depreciation of their human capital. A second type of depreciation is the one caused by obsolescence due to technological developments at the workplace. Following Brunello (2001), the rate of obsolescence depends on the initial education level. The rate is expected to be higher for people with low education levels since the knowledge they acquired is most basic and least specialised. Accordingly, older workers have lower education levels and higher depreciation of their skills acquired through this formal education, both factors making them less receptive for training - assuming that the accumulation perspective of lifelong learning theories holds.

In contrast to the accumulation perspective, however, the compensation perspective of lifelong learning theory holds that it is especially the low-educated who need to be trained to make up for depreciated or lack of skills and knowledge, i.e. higher training necessity for older workers. Training is needed to remain employable, to remain part of the learning society. This would imply a higher training probability for older workers. However, this effect is partly offset because of the increased working experience that older workers commonly have. Tenure directly raises experience and job-related skills, which reduce the need to participate in formal training. On the other hand, following the job

match theory as explained earlier, a longer tenure might decrease the exit probability and offset the expected decrease in the payback period from training.

3.3.3 Institutions and early retirement

In order to analyse differences in early retirement patterns across European countries, we need to account for institutional differences. Due to its flexibility, the search model is suitable for the comparison of individual retirement patterns across countries with different institutional settings. In this section, we first discuss some general institutional effects before showing how some of the predicted effects might differ when controlling for the institutional effects. As mentioned before, in this chapter we only discuss institutions in general, not looking at specific country details. This is done in Chapter 4.

In general, when discussing the incentive effect of exit schemes, two aspects are considered of major importance: generosity and flexibility. Generosity refers to the replacement income (i.e. post-retirement income as a percentage of pre-retirement income) offered by the exit scheme, and flexibility refers to the availability of early retirement options and the ease of using these exit schemes (e.g. entitlement conditions). With regard to generosity, the higher the replacement income, the higher the expected utility flow from leaving employment. Because of this higher utility, the acceptance probability is higher (i.e. $U_{rt} \geq U_{rt}^{*}$ is more likely to occur) and hence the transition probability is also higher. In other words, the more generous an exit scheme, the higher the transition probability to that exit destination. The majority of early retirement schemes in Europe provides non-neutral incentives in terms of pension benefits, which are held largely responsible for the low labour participation rates (Aaron, 1999). In the next chapter, we present evidence on the replacement rates of the various pathways in several European countries, but across the board, it can be concluded that replacement rates of social security are lower than those of specifically designed early retirement pathways (either public or private). Unemployment generally has the lowest replacement rate, although the employer is sometimes willing to supplement unemployment benefits to facilitate early retirement through unemployment, increasing the actual replacement rate (Knuth & Kalina, 2001).

Looking at the flexibility of the schemes, again two aspects are of relevance: entitlement and freedom of choice. With regard to the entitlement conditions, certain conditions (e.g. minimum age, minimum contribution period) generally have to be met in order to use the exit pathways. For workers who do not meet such conditions, the arrival rate of offers (λ) is lower (or zero), while it is higher for workers who meet the scheme's requirements. In other words, the higher the likelihood that entitlement conditions are met, the higher the arrival rate of a scheme and the higher the transition probability to

Table 3.2: Predicted country differences

Age $\rightarrow \tau_{rt}, \tau_{st} \uparrow$	Strongest in countries with most generous schemes ($U_{jt} \uparrow$)
	Strongest in countries with least tight entitlement ($\lambda_{jt} \uparrow$)
Female $\lambda_{rt} \downarrow \rightarrow \tau_{rt} \downarrow$	Less strong in countries with relaxed conditions for women
Bad health $\lambda_{st} \uparrow \rightarrow \tau_{st} \uparrow$	Strongest in countries with least tight medical criteria
higher wage (i.e.) $\tau_r \downarrow$	dominant in countries with least generous schemes
higher wage (s.e.) $\tau_r \uparrow$	dominant in countries with most generous schemes
Working spouse	least likely to exist in most traditional countries
Dependents $\lambda_{st} \uparrow \rightarrow \tau_{st} \uparrow$	Strongest in countries with generous child benefits
+ female $\rightarrow \tau_{rt}, \tau_{st} \uparrow$	Strongest in more traditional countries
Industry $\lambda_{ut} \uparrow \tau_s \uparrow$	Strongest in countries with special redundancy schemes
Public sector $U_{rt} \uparrow \rightarrow \tau_{rt} \uparrow$	Strongest in countries with strong corporatist tradition
White collar $U_{rt} \uparrow \rightarrow \tau_{rt} \uparrow$	Strongest in countries with strong corporatist tradition
Selfemployed $\lambda_{st} \downarrow \tau_{st} \downarrow$	Less strong in countries with social insurance for selfemployed

that specific destination. The easier it is to meet the entitlement criteria or the fewer the number of criteria, the more flexible the schemes are assumed to be. As for the freedom of choice, the decision to choose whether, when and how to retire is not entirely in the hands of the worker himself. Apart from being restricted by the above-mentioned entitlement conditions, the individual might also be forced to use certain exit pathways (e.g. unemployment or disability) or retire at an earlier/later age than planned by himself because of pressure from the employer or other external forces (e.g. economic situation, health status or household situation).

We will now examine how this translates into differences in the predicted effects derived from search theory earlier, summarised in Table 3.2. The predicted positive age effects on the exit probabilities are expected to be strongest in countries with the most generous schemes or countries where entitlement to the schemes is least tight. For example, the lower the minimum age at which workers are allowed to retire, the lower the age at which the arrival rate of such options becomes positive ($\lambda_{rt} > 0$). In countries where in addition to the minimum retirement age other criteria have to be met (e.g. minimum contribution period), arrival rates are lower compared to countries with schemes that only require a minimum age. Following the same reasoning it is argued that the age effect on the transition probability into social security is expected to be strongest for countries that have schemes with most relaxed entitlement conditions for older workers. The predicted negative effect for women on the transition probability into retirement is expected to be less strong for countries that have relaxed entitlement conditions for women. When conditions for women are relaxed, such as a reduced minimum contribution period or a lower retirement age, women are more likely to meet the criteria, thereby increasing the retirement probability for women. The predicted positive effect on the transition probability into social security for people in a bad state of health is expected to be strongest in countries with the least tight medical criteria. For example, as we will

see in the next chapter, the most important criterion for claiming disability benefits is the minimum incapacity to work. The lower this percentage, the easier the access into disability and the higher the likelihood that someone meets the criteria. Or out another way, the lower the incapacity to work, the higher the expected arrival rate of disability offers.

With regard to the predicted ambiguous effect of human capital or higher wages, it is expected that in countries with high replacement rates of early retirement schemes, the income effect is dominant. For example, when the replacement rate is 90 percent, the opportunity costs of retiring are much lower compared to a replacement rate of 50 percent (i.e. a small substitution effect). In addition, it can be argued that the existence of seniority wages is more common in countries with a more corporatist tradition. In such countries, strong ties between the firm and the worker exist that are likely to result in seniority wages. The higher wages at older ages might act as a reward for long service or tenure and it might also be expected that generous schemes exist for such workers. In sum, in countries with a strong corporatist tradition, seniority wages are likely to exist as well as generous seniority schemes that allow early retirement at early ages.

Looking at the effects of household characteristics, some ambiguous effects are derived for having a working spouse. The probability of having a working spouse at all is less likely to exist in more traditional or breadwinner-like labour markets. With more traditional, we mean labour markets in which males are commonly (full-time) employed, while women are not likely to participate in the labour market due to their caring duties or household obligations. Additionally, in countries where women participate on the labour market, they are more likely to withdraw from the labour market when there are dependents in the household to care for. In addition, the overall positive effect of having dependents is expected to be largest in countries with the most generous child or family allowances or benefits related to caring activities.

The predicted positive effects of working in sectors where productivity declines fastest with age (either because of physical decline or because of obsolescence of skills and knowledge) are expected to be strongest in countries where special redundancy schemes exist. Such schemes facilitate the exit of older workers in cases where they are redundant or where the company needs to be reorganised in order to survive in the face of strong competition. With regard to the predicted lower social security transition probabilities for the self-employed, these are least strong in countries where the self-employed are included in the social insurance system. Finally, the higher retirement probabilities for both public sector employees and white-collar workers are expected to be strongest in countries with a strong corporatist tradition. It is in these countries that segregation between workers is most likely to be observed and where the upper level workers are most likely to be rewarded with generous early retirement benefits.

In the next chapter, we will explain how European countries differ with respect to

the flexibility and generosity of early retirement schemes. We will also describe to what extent countries share the same features and what sort of clusters might be elaborated using the information on the institutional set-up with respect to early retirement.

3.4 Concluding remarks

In the first part of this chapter we specified our empirical model, using the theoretical model developed in Chapter 2. We elaborated on multinomial logit models and duration models and we argued that the 'best' way to analyse the retirement problem is to either use a panel multinomial logit model or a duration model. Both models, however, place strong requirements on the data, with regard to the size of the data set, etc. A panel multinomial logit model appears impossible with our data because of the computational complexity and limitations of the models with multiple destination states and the need to apply extended models with a large number of explanatory variables. There exists a sort of trade-off between the advantages of using advanced econometric techniques and the advantages of being able to use the comparative ECHP data set allowing us to find evidence about the role of institutional differences on the early retirement decision. Mainly because of this latter argument, we have decided to use an alternative and more static multinomial logit model to analyse the retirement patterns in Europe. In Chapter 6, however, we will use a more advanced discrete-time competing-risks model to estimate the probability of retiring through one of the available pathways. Here we will not use the ECHP but the longer running national panel studies: the GSOEP, the SEP and the BHPS. The reason for this is that the ECHP lacks retrospective information, which implies that we are not able to reconstruct employment spells for people who entered the panel at an age above 50. Without any additional information we would have to assume that these people have been continuously in employment from the age of 50, and such assumptions might lead to biased estimation results. The GSOEP, SEP and BHPS, on the other hand, allow us to reconstruct the employment histories of people more accurately, making duration analysis feasible.

In the second part of this chapter, we formulated some theoretical expectations about a great variety of variables on the exit probabilities into the various early retirement pathways. We included individual characteristics, human capital indicators, household factors, job characteristics and institutional indicators. Using search theory at first, we found that age, a bad state of health and working in the public sector increase the transition probability into early retirement, while being a woman, being self-employed and having been unemployed before reduce this probability. In addition, it appears that the theory predicts ambiguous effects for higher human capital (or higher wages), having a working spouse, and working more hours on early retirement. For the transition probability into social security, however, the theory seems to unambiguously predict negative

effects of these latter factors. In addition, when using other theories, we even found more complicated effects, especially for human capital indicators such as work experience or tenure and wages. Moreover, when taking into account institutional differences between countries, we found that some effects are stronger in countries with the most generous early retirement benefits. Viewing these rather large differences it makes sense to look at retirement patterns from such an institutional perspective. Therefore, in the next chapter we discuss in detailed the early retirement institutions in European countries which we then use as our benchmark for the subsequent empirical chapters in this dissertation.

Appendix

Advantages and disadvantages of using panel data

Baltagi (2001, p.5-7) lists a number of benefits from using panel data rather than time-series or cross-sectional data. A first advantage is the possibility to control for individual heterogeneity, both observed and unobserved. Often, the individual's preferences are not completely measured by the observables and are hidden in the unobserved effects. By using repeated observations on the same individuals over time, such unobserved effects can be controlled for. Not controlling for this could lead to biased estimation results (Moulton, 1986). In addition, panel data have the advantage that the problem of multicollinearity (i.e. correlation among the explanatory variables) is reduced, due to the variability both between individuals and between time periods. Panel data thus provide us with more informative data, increasing the degrees of freedom and the efficiency of estimation procedures. As a consequence of this increased information, we are able to test more complex behavioural models. Particularly important is the ability to analyse dynamic events more accurately, such as labour market transitions. When using time-series, labour market transitions can also be analysed, yet no individual-specific effects are allowed since time-series are pooled cross-sections.

Panel data have some limitations too (Baltagi, 2001, p.7-9). First of all, data collection might be difficult and more time-consuming. Not only are data collectors faced with the 'usual' data collecting problems such as representativeness of the sample population, non-response, frequency of interviewing, they are also faced with additional problems. One can think of tracking individuals who have moved home and the motivation of individuals to continue their participation in the survey. A problem related to this, which is also present in cross-sectional data yet with less severe consequences, is selectivity. Missing information due to non-response or attrition is more severe in panel data, since the 'information chain' for the individual is disrupted. This information loss causes identification problems and the analyst should look for procedures to correct for the non-response and attrition when applying modelling techniques. A final problem, again not specifically connected with panel data, is the problem of measurement error. This might be the result, amongst other things, ofmemory bias (the individual cannot remember things correctly), deliberate non-response (e.g. the individual might be unwilling to give certain information), or interviewer effects (e.g. interviewers too are heterogeneous, causing differences in the interviewing techniques that might result in differences in responses). Finally, it takes some time before a panel has developed into a 'mature' panel. To really benefit from the advantages of panel data, a relatively long series of time periods is needed.

Chapter 4

Retirement systems in Europe: diversity or unity?

4.1 Introduction

In Chapter 3 we found that the country's institutional setting with respect to early retirement is expected to affect the predicted effects from theory. Before we can test this empirically, we have to research the early retirement institutions in Europe and find out how the European countries differ in this respect. This is the purpose of this chapter. One of the main institutions affecting the individual's early retirement decision is the country's pension system. We start by giving a detailed overview of the pension systems in Europe, paying attention to the funding principles, the type of benefits, the retirement age, the tax treatment of contributions or pension benefits, and the generosity of pension systems. An important aspect of our approach is that we not only focus on the public first pillar pensions, but also on the second and third pillar pensions. Especially with respect to these latter pillars of the pension system we observe some interesting differences between European countries. While in some countries the second and third pillar pensions have developed rapidly, in others they still virtually non-existent. The European Commission, however, is urging all European countries to stimulate the development of such occupational and private pensions to unburden the public pension pillar which is facing problems as a result of the ageing population in all countries.

A second important aspect of our study is that we pay close attention to early retirement opportunities in European countries. A large number of studies on pension systems mention only the early retirement age, but we look more closely to the entitlement conditions of the early retirement schemes, to the existence of occupational and private schemes, as well as to the generosity of the various schemes. Additionally, rather than only focussing on the early retirement benefits, we also discuss the early retirement pathways embedded in social security arrangements and examine how European coun-

tries differ in this respect. Again, we include the entitlement conditions, and especially the relaxed conditions for older workers, as well as the generosity of the schemes. We argue that by looking at early retirement both through the pension system and through the social security system in general, we contribute to the literature on pension systems and early retirement in Europe. Our chapter gives a detailed and distinct comparison of all 15 European Member States.

With this discussion of European pension systems we show that there is substantial cross-country variation in pension systems and early retirement institutions around Europe. Yet, we also find some similarities between the countries. It is such similarities in countries' social security settings or welfare state development that have given rise to the idea that systems cluster one way or another in a limited set of welfare or pension regimes. Reviewing the literature on pension regime typologies, we find that the focus has been primarily on the social security system as a whole, with the pension system as a component. The pension system, however, has some specific features that are different from the other social security domains and must therefore be treated separately. Some studies have indeed focussed on pensions separately. In this chapter, the leading typologies will be discussed (e.g. Esping-Andersen (1990)), yet it is by no means our intention to give an exhaustive summary of all existing pension regimes classifications. When discussing these typologies we observe some interesting facts. First, a great number of the existing pension regime typologies use rather outdated data. For example, Esping-Andersen uses data from the 1980s to construct his regime typology and we argue that it is especially the public-private mix of pension provision, which plays a dominant role in his typology, that has developed distinctly since then. Consequently, by using more recent data on pension systems in Europe (taken from our discussion in the first part of this chapter), we show that the typology is not necessarily valid anymore for comparative analysis of early retirement patterns in Europe. Some countries seem to have shifted from one cluster to another mainly as a result of the extension of private pension schemes. Second, and perhaps more important, the existing pension regime typologies all focus on the receipt of old-age pension benefits as of the country's official retirement age. For an analysis of early retirement, i.e. retirement before the country's official retirement age, such typologies might not be that useful. Additionally, they lack the inclusion of early retirement pathways embedded in social security arrangements.

Therefore, we decided to construct our own 'early retirement policy index' based on the evidence presented in the first part of the chapter. Our index accounts for both the flexibility or availability of pathways of the retirement options and for the generosity of the various pathways. After having constructed this index, we compare it to the Esping-Andersen one and discuss the main differences and similarities. first, however, we start with an overview of the main elements of the countries' pension systems.

4.2 European pension systems

4.2.1 Why public pensions provision?

Basic economic welfare theory argues that in the absence of market failures (e.g. imperfect information, failure of perfect competition, external effects, public goods not supplied by the market, incomplete markets) free markets generate a Pareto efficient equilibrium. This implies that no individual can be made better off without making another individual worse off (Stiglitz, 1988, 90). Even in the case of Pareto efficiency, however, the income distribution might be viewed as socially unacceptable. Some individuals might have insufficient resources to live from and this provides a rationale for government activity. In fact, this is the main reason behind the development of public old-age pension systems. The first formal European pension system was the German system introduced by Bismarck in 1889, soon followed by Denmark (1891), Belgium (1900), the Netherlands (1901), the United Kingdom and Ireland (1908). Old-age pension provision was strictly related to disability and targeted at the prevention of poverty among the elderly. Old-age pensions belonging to such a system are typically means-tested, flat-rate, and tax funded. Gradually the aim of public old-age provision shifted from mere poverty alleviation to a system of social insurance to cover longevity risks (due to increased life expectancies) and to protect against income loss due to an incapacity to work. In many ways, social insurance works as private insurance with the individual contributing to the insurance fund (i.e. payroll taxes) and benefits based on the insured risk (i.e. earnings-related). Yet, with private insurance there is a direct relation between contributions paid, risk insured and benefits received, which does not exist with social insurance. The main reason is the redistributive aspect of social insurance, usually the fundamental rationale behind the old-age pension system as already explained.

Apart from the development of public pensions, employers too started providing some benefits to their old and sick employees as a compensation for their diminished working capacity (Fabel, 1994). The earliest occupational pension schemes mainly existed for workers in physically demanding industries (e.g. railroad workers, miners and seamen) or large industries (e.g. Hoechst or Siemens in Germany and Cadbury or Lever in the United Kingdom) (Esping-Andersen, 1990). Such early pension schemes were extremely selective, i.e. they were primarily targeted at white-collar workers and served as a reward for long service, i.e. so-called gratuity, anciennity or seniority pensions. As we show below, this occupational segregation is still present in many European occupational pension schemes. It was not until the 1950s, however, that coverage of occupational pensions started growing more rapidly. Although in many cases such pensions were provided or even initiated by the employer, the state played an important role in this type of pension provision too. The reason for this happens to be the market failures in the private insurance of income loss due to retirement (Stiglitz, 1988). First, transaction costs involved with private insurance

are higher compared to uniform insurance schemes. Private plans are more tuned to the individual's needs and administration costs of such specifically designed schemes are higher than costs of collective or uniform schemes. For this reason, occupational pension schemes are mainly found in large companies or organised at the sectoral level.

A second problem with private insurance is the problem of adverse selection. Different individuals have different life expectancies and the insurer cannot distinguish between people who are expected to live longest from those with relatively short life expectancies, even when medical statements on the individual's health are available. In other words, he cannot distinguish between the 'low' and the 'high' risks. This leads to higher premiums, which might cause the people with a low risk not to buy the insurance. The concentration of people with high-risks among the insured drives the premium even further upward. This inefficiency might even lead to a termination of the insurance (Stiglitz, 1988). A final problem is the problem of moral hazard. This refers to a change in behaviour of people who have insured themselves, i.e. individuals might reduce their efforts to avoid the insured risk from happening. With respect to retirement, this problem refers to the fact that individuals who are still in good health and perfectly capable of working, might decide to retire early. In this way the pension is not used according to its original purpose. After all, it was designed to cover the risks of not being capable of working anymore and not to facilitate early retirement for people in good health. The same holds for social security arrangements. People might argue that they have been contributing to such schemes and in return want to use them as early retirement gateways. A lack of control enables a larger group of people to use social security than the group of people for which social security was originally designed.

Because of the large costs of public pension systems, most governments stimulate participation in private or occupational plans. It is even (quasi-) mandatory in some countries as we will soon show.

As a result of this simultaneous development of both public and occupational pension provision, modern pension systems are characterised by a multi-pillar pension structure. Before we describe the main pillars of modern European pension systems, we first discuss the funding principles because they have a strong impact on the structure of pension systems.

4.2.2 Structure of pension systems

Pension funding principles

Generally speaking, we can distinguish between two funding principles: (1) the pay-as-you-go principle; and (2) the fully funded principle. A pay-as-you-go funding system means that (defined) benefits of the retired population in a certain year are paid by contributions of the working population in that year, i.e. there is strong intergenerational

redistribution (hence solidarity) from the young to the old. The main problem with a pay-as-you-go system is that it is vulnerable to population ageing. With an increasing dependency ratio (the number of retired people over the number of working people), the contribution base declines. In contrast with predictions about a declining contribution base, Bovenberg (2003) argues that the contribution base might increase with an ageing population. As a result of the declining labour force, labour becomes more scarce, which would lead to higher wages in a competitive market. These higher wages in turn increase the contribution base. Consequently, based on theory, an ambiguous total effect of ageing on the contribution base is predicted. Yet, public opinion agrees that the first effect dominates the second and contribution bases are expected to decline as a result of the ageing population in most countries. A solution would be to lower pension benefits and encourage people to set up their own private pension plans or to extend second pillar coverage of occupational pensions. As we will show later, this trend can be observed in some European countries. Another solution would be to increase contributions. This might, however, be difficult to establish, because political support for the contribution change is usually required.

Other disadvantages of the pay-as-you-go system are that such a system is affected by changes in the political system (i.e. benefit and contribution rates might depend on the political 'colour' of the government) and that contributions might be perceived as taxes that can be harmful to a country's competitiveness. Finally, a pay-as-you-go funded scheme where benefits are determined using the final pay rule (earnings of final years of employment are taken as reference, see Section 4.2.3 for more details on this) might result in 'unfair' redistribution: redistribution of income from people with flat age-earnings profiles (usually lower segment of labour market) to people with steep age-earnings profiles (upper segment of labour market) (Gillion et al., 2000).

Within a funded or capital return system, pensions are financed by funds accumulated by the retirees during their working life, i.e. individuals as a group pay for their own pension. For the individual, in both a pay-as-you-go system and a funded system, pension contributions are paid, yet in the latter case these are regarded as 'savings' for their own pension at the pensionable age, whereas in a pay-as-you-go system these are regarded as 'taxes' and used for the pensions of the current retirees. Because of this direct individual link between accumulated assets and received benefits, this system is less vulnerable to population ageing. However, benefits depend on the rate of return on the financial markets and are subject to investment risks. Apart from the existence of financial risks, a funded system is vulnerable to mismanagement and corruption (Stevens et al., 2002). Currently, most European public pension systems are funded on a pay-as-you-go basis, but governments are considering of changing it into a funded system. However, it is not possible to shift from a pay-as-you-go system to a funded system within a short period of time, because the current older generation has not been saving for their old-age income,

Table 4.1: Different definitions of multi-pillar pension systems

	European Commission	World Bank	ILO
Public non-contributory basic pensions	Pillar I	Pillar I	Pillar I
Public contributory social insurance pensions	Pillar I	Pillar I/II	Pillar II/III
Occupational employer-provided pensions	Pillar II	Pillar II/III	Pillar III
Private pensions	Pillar III	Pillar III	Pillar III

whereas they have been paying pension contributions to the pension system. Both Italy and Sweden are currently in the transformation process with partially funded systems. In addition, as is shown below in more detail, governments are increasingly trying to shift responsibility for pension provision to the private sector, including employer-provided pensions. Generally, these latter pensions are all funded systems.

Defining the pillars

With respect to the definition of the pension pillars, several approaches are found in the literature, and shown in Table 4.1. For a better understanding of the differences between these definitions, it is useful to distinguish between four types of pension schemes:

- Public non-contributory basic pension schemes meant to prevent poverty (or social assistance pensions). These refer to the most traditional type of public old-age pension and benefits are means-tested, flat-rate, and funded by taxes. Benefit entitlement is not based on a contributory record, since the pensions are tax-funded, but based on the income of the retiree.
- Public contributory social insurance pensions. These are the type of public pensions where workers pay contributions to the system and receive earnings-related benefits, usually on a pay-as-you-go basis.
- Occupational or employer-provided pensions. These refer to funded pension schemes managed by employers (or unions) on a firm or a sectoral level. They can be mandatory or voluntary as is explained below. Note that in some studies occupational pensions refer to pensions related to employment also including public social insurance pensions. However, we use the term 'occupational pensions' to refer to employer or sectoral pension agreements only, excluding public social insurance pensions.
- Private pensions. These refer to all wealth accumulation products individuals might have to insure themselves against income loss in old-age. A more detailed description of these private products is given below.

The traditional and most commonly used classification of pension systems into pillars is the one adopted by the European Commission, which defines the three pillars based on the institution responsible for the management of the pension benefits. The first pillar concerns public or state-managed pension schemes, including both the non-contributory

and the contributory pensions. The second pillar concerns schemes organised on employer or sectoral level, the occupational pensions. The third pillar refers to all private pension products. Following Willmore (2000) this classification is especially useful when comparing pension systems between countries, because it reveals the public-private mix of pension provision. For this reason, we adopt this classification in our analyses which allows us to see the differences in impact of countries with different pension systems.

However, two other classifications are worth mentioning here, nicely summarised by Yermo (2002). In 1994, the World Bank adopted a classification related to the participation of the pension scheme, rather than the management of the scheme (Bank, 1994). The first pillar refers to the publicly managed pay-as-you-go defined benefit pension schemes. The public tax-funded pensions are included here and public social insurance pensions are included in the first pillar as long as they are funded on a pay-as-you-go basis. The second pillar refers to occupational contributory pension schemes, including those publicly managed as long as they are funded rather than based on a pay-as-you-go funding, where participation is mandatory. Finally, voluntary occupational and private schemes are classified in the third pillar. A third classification, adopted by the International Labour Organisation (ILO), defines the three pillars based on the type of funding principle. The first pillar consists of the tax-funded public non-contributory basic pensions. The second pillar consists of mandatory public pay-as-you-go funded social insurance schemes, and the third pillar consist of all funded pensions, either occupational or private.

As mentioned, we have chosen to use the definition adopted by the European commission both because it enables us to make comparisons between the countries' pension systems and because most data we use is organised into these three pillars:

- Pillar I: Public pensions. Both social assistance and social insurance pensions. State-managed. Mainly tax-funded or pay-as-you-go, in some cases funded parts. Mandatory (except some groups, e.g. the self-employed, in some countries).
- Pillar II: Occupational pensions. Managed by employer or at sectoral level. Mainly funded systems. Usually voluntary or quasi-mandatory.
- Pillar III: Private pensions. Privately managed. Funded systems. Voluntary.

We will discuss the pillars separately below.

First pillar: public pensions

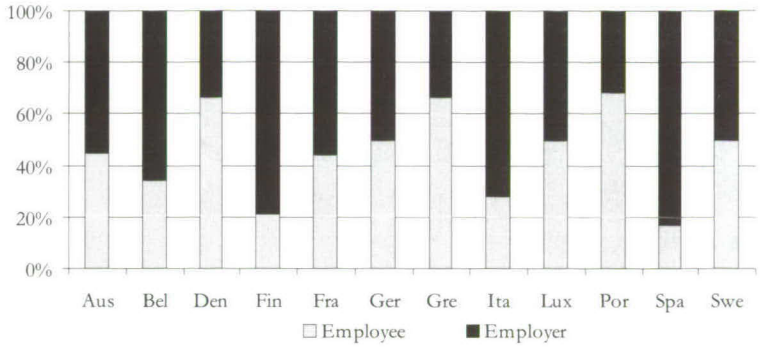
All European countries have well-developed public pensions and in general two goals can be distinguished leading to different types of pension schemes: (1) safeguarding a minimum income or preventing poverty in old-age; (2) maintaining the living standard acquired during working life. The first goal is the most traditional one and all European countries guarantee a minimum income during retirement. Generally, it is socially more acceptable to provide the elderly, usually incapable of continued employment, with a social

assistance pension. After all, in all European countries a welfare system exists that prevents people from falling into poverty. An important difference between social assistance schemes for people of working age and social assistance schemes for retirees is that in the first group, the incentive to work must not be removed. As a consequence, social assistance for the elderly is usually more generous than social assistance for people of working age (European Commission, 2003a). There are several ways in which a minimum pension income is guaranteed in Europe: non-contributory non-means-tested universal pensions for all residents (i.e. there is no distinction between the general social assistance scheme and the retirees' social assistance schemes); non-contributory means-tested minimum or social assistance pensions; contributory means-tested and/or non-means-tested basic or minimum pensions. All minimum pensions are flat-rate (i.e. not earnings-related) and in some cases (e.g. social assistance) a means-test is used. Using an earnings-test is motivated by an efficiency argument: only paying social security benefits to those individuals who are really in need of financial support, i.e. poverty-alleviating argument of pensions. Using an earnings-test, however, is distortive in the sense that workers might decide to quit working in order to receive a pension while they might otherwise have decided to continue working. The universal pensions are commonly not means-tested, in Finland and Sweden the means-test only includes other (public) pension income. As for the level of these minimum pension guarantees, the European Commission (2003a) provides some information on the amounts paid in Europe, however, it is argued that the levels are not comparable, because non-cash benefits and the provision of housing benefits have a large impact on the minimum income of the elderly. In general though, the highest levels of minimum incomes are found in Denmark, Luxembourg, the Netherlands and Sweden.

While these flat-rate minimum pensions protect the elderly against poverty, public earnings-related pensions schemes are meant to assure retired people of maintaining the living standard they acquired during working life. Public earnings-related pensions schemes are usually referred to as social insurance pensions because of the state-management and the pay-as-you-go funding.[1] Social insurance pensions are either compulsory for the whole active population including the self-employed or for salaried workers only. In the latter case, the self-employed can usually join the scheme on a voluntary basis or they have separate schemes of their own. Social insurance schemes are found in all European countries, except in Ireland and the Netherlands where these schemes are part of the second or third pillar and not (fully) state-managed. While the British public social insurance pension (SERPS) is pay-as-you-go funded and mandatory, it is sometimes classified as a second pillar pension. The reason for this is that people can contract out of SERPS, and they are encouraged to do so, when making occupational or private pension arrangements substituting the SERPS pension. For this reason, we have also chosen to

[1] In some countries funded supplementary public pensions exist within the first pillar, e.g. Scandinavian countries.

Figure 4.1: Contribution rates under social insurance pension schemes in Europe, 2000



Source: Natali (2004)

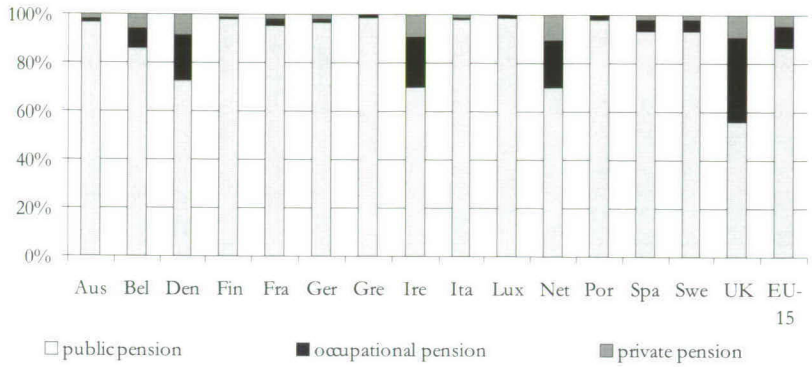
include it in the second pillar.

Social insurance pensions are funded by contributions paid by employers and employees. In some countries supplements are made by the state, either on a structural basis or only when needed. The contribution rate can vary by the sector of industry (e.g. civil servants pensions fully paid by the state in Germany), occupation (e.g. Austria), the worker's age, or the company size. In Finland, for example, employers' contributions depend on the number of workers, their age and their gender. As for the employers' and employees' share in the contribution burden, a great deal of variation is found between European countries, shown in Figure 4.1. In Denmark, Greece and Portugal, the largest share is paid by employees, whereas in countries like Belgium, Finland, Italy and Spain, the largest share is paid by the employers. In the remaining European countries employers and employees each pay about half of the pension contributions. At first sight, it might seem inefficient that employers pay pension contributions for their employees, yet Gillion et al. (2000, p.140) argue that 'An advantage of having employers and workers pay at least a part of the social security contribution is that it makes both parties aware of the costs of the scheme and creates some sense of ownership of the scheme'. It can also be reasoned that in fact employees bear the full contribution burden because of foregone wages.

To get an idea of the importance of the public pension in the total income of pensioners, we rely on the results of a cross-national public opinion survey on the opinions and attitudes about pension issues of European Union citizens in all Member States (European Commission, 2004). Retired workers were asked what their main source of income was and results are depicted in Figure 4.2.[2] Looking at the European average (EU-15), we find that public pensions account for about 80 percent of the pensioner's income. In some

[2]For Finland the results in the original source were rather confusing, with occupational pensions accounting for 80 percent of a pensioner's income. Most likely, this refers to the funded part of the first pillar pensions, and we will show next that the second pillar as we defined it, is rather undeveloped in Finland. Therefore, we adapted the Finnish results to obtain truly comparable numbers for our purposes.

Figure 4.2: Main source of pensioner's income in Europe



Source: European Commission (2004)

countries, such as Austria, Germany, Greece, Luxembourg and Portugal, public pensions account for over 90 percent of the pensioner's income, whereas in other countries, like Denmark, the Netherlands and the United Kingdom, they account for less than half of the pensioner's income. As we explain below, these are countries with well-developed occupational and private pensions systems. We return to this figure after first explaining the other pillars of a country's pension system.

Second and third pillars: occupational and private pensions

Looking at second pillar provisions, or occupational employer-provided pensions, it was already mentioned that participation in such schemes is generally voluntary, in some sometimes quasi-mandatory. Voluntary schemes are schemes that are usually established on the initiative of the employers' or employees' organisation. It is not a legal requirement for employers to provide their employees with an occupational pension scheme (Yermo, 2002). When the employer offers a pension scheme, in most countries the employee is free to choose whether to participate in the plan, although enrolment in the scheme might be specified in the labour contract or established by law (e.g. Belgium). Quasi-mandatory secondary pillar pension schemes are found in Denmark, the Netherlands, the United Kingdom and Sweden. As already mentioned, within the British system employees are either compulsorily insured under the social insurance pension schemes (SERPS), or voluntarily under occupational schemes in which case they are able to contract out of the public scheme. Either way, they are obliged to participate in any occupational pension scheme approved of by the state. In the other countries with quasi-mandatory second pillar pension provision, the compulsory participation is the result of collective bargaining between the social partners.

The first two columns of Table 4.2 show some evidence on second pillar pensions in Europe. When pensions are quasi-mandatory, we can see that coverage is almost universal,

Table 4.2: Private pension provision in Europe, around 2000

	Coverage (% workforce)	Second pillar Assets (% GDP)	Third pillar assets (% GDP)
Austria	10%	12.0	
Belgium	40%	5.9	8.8
Denmark	80%	23.9	55.5
Finland	15%	8.9	3.1
France	10%	6.6	
Germany	42%	16.3	
Greece	5%	4.7	
Ireland	50%	51.0	
Italy	10%	2.6	
Luxembourg	30%	0.2	
Netherlands	95%	111.1	54.9
Portugal	7%	7.0	
Spain	7%	5.0	
Sweden	90%	56.6	
United Kingdom[a]	70%	80.9	
Average EU-15	37.5%	29.0	

[a]Including SERPS.

Sources: (Goldbrunner, 2004); European Commission (2003a) and European Commission (2002)

with a coverage rate of over 80 percent. When participation is voluntary, the percentage of workers covered by an occupational pension is much lower. Still, in Ireland, where participation is voluntary, about half the working population is covered by an occupational pension, which can be explained by looking at the first pillar pensions. Only flat-rate minimum pensions are provided, and for supplementary pensions, Irish workers have to seek insurance in occupational or private pensions. For reasons explained earlier (e.g. higher administration costs, inefficiency) it is usually cheaper to participate in collective occupational pensions. In Germany and Belgium, coverage rates are about 40 percent, slightly above the European average of 37 percent. Both countries have a tradition of occupational selectivity on the labour market, meaning that people in higher level jobs are treated differently. In many occupations, special occupational pension schemes exist to reward high-level workers for long service. When looking at the component of the second pillar pensions in the retirees' total pension income, we find that these account for over ten percent of the retirees' pension income in Denmark, Ireland, the Netherlands and the United Kingdom. At first sight, it seems remarkable that in Sweden, where second pillar pension coverage is over 90 percent, these only account for about four percent of the retiree's total pension income. However, this is likely to be due to a definition issue. Since participation in second pillar pensions is quasi-mandatory, people might refer to it as public pensions when defining the components of their pension income.

As for the third pillar, or private pensions, according to a recent study of the European Commission (2003a) personal pension provision plays an important role only in Belgium, Denmark, Ireland, the Netherlands and the United Kingdom. Because of the

non-transparency of such private pension products, it is difficult to find reliable evidence for the size of the third pillar. Table 4.2 also shows third pillar assets as a percentage of GDP, taken from European Commission (2003a). It shows that evidence is missing for a large number of countries, either because of underdeveloped private sectors or because of unreliable statistics. Looking at Figure 4.2 again, which shows the composition of the pensioner's income, we find the largest share of private pensions in the mentioned countries, although these still account for less than ten percent of the pensioner's total pension income. In the other European countries, private pensions account for less than four percent of total pension income, below the European average.

The private sector is still very much in development, largely because of the high individual risks involved with pension investments as explained before. Still, according to European Commission (2003a), in Europe occupational and private pensions are becoming increasingly important in providing adequate retirement income. Several countries, especially the southern European countries, put the development of second and third pension provision high on the political agenda in 2000. An important reason for this shift is that the funding of public pensions is becoming more unstable due to the ageing population. In addition, flexibility has become a keyword with respect to the European labour market in general, and with respect to retirement in particular. Flexible and temporary labour contracts, flexible working hours, but also flexible retirement are becoming increasingly important. Flexible retirement not only refers to the age at which people can retire from the labour force, but also to the way in which people want to save for retirement. It is argued that such flexibility is easiest to achieve within occupational and private pensions rather than within public pensions (Stevens et al., 2002). One of the problems with second pillar pensions, however, is that the individual might lose his pension rights if he changes employer. In countries where such pensions are highly developed, legislation has been established to ensure vested rights for employees, either by remaining in the current scheme or by transferring them into a new scheme (European Commission, 2003a). This is still very much in development in most European countries though.

One way for governments to encourage the enrolment of retirees in the second and third pillar pensions is using favourable tax treatment of either contributions or pensions, i.e. tax expenditures. Another reason for using favourable tax rules with retirement savings is a more paternalistic argument that it ensures that individuals do not use their retirement savings at an earlier point in time, for example in the case of sickness or unemployment. In this respect, the tax expenditure can be said to be more costly for low-income workers who generally are at greater risk of becoming unemployed and hence in greater need of their savings (Willmore, 2000). When looking at retirement savings, three points in the pension accumulation process can be distinguished at which either taxation (T) or exemption (E) can occur: (1) pension contributions paid, either by the employer, the employee or both; (2) return on invested contributions; (3) pension benefits

paid to the individual (Willmore, 2000). Consequently, eight possible taxation schemes result with at one extreme TTT, in which case contributions, returns and pension benefits are taxed, i.e. double taxation. At the other extreme we find EEE, in which case no tax at all is paid. Both schemes seem irrelevant when looking at the European pension taxation schemes.

Most countries use the 'classical expenditure tax' scheme or the cash-flow treatment of pensions (EET) (Willmore (2000), Bovenberg (2003)): contributions as well as returns to pension investments are tax-exempt, whereas pension benefits are taxed. In some countries the tax exemption of contributions paid is limited (Austria for employees' contributions, Luxembourg for employees' contributions, Italy and Portugal). In Sweden, additional requirements have to be fulfilled for tax-exemption of contributions (pension benefit should not be paid before the age of 55). Apart from the cash-flow treatment of pensions, Germany partly uses a 'comprehensive income tax' (TTE) in which part of the contributions paid to the pension scheme (employees' part) and returns on pension investments are taxed, whereas pension benefits are exempted from income tax. According to Willmore (2000) this is the typical taxation scheme for general savings. Taxing pension benefits rather than contributions, or using the aforementioned EET schemes, implies that the tax base increases with an ageing population, and with a larger tax base higher public spending (e.g. increased health costs with an ageing population) is borne by a larger population. As a result individual tax increases are lower than in the case of tax-exempted pension benefits (Bovenberg, 2003). In addition to the tax treatment of pensions, in some countries other taxes are different at older ages. For example, property taxes are lower for older people in Denmark, and general tax deductions are higher for older people in the United Kingdom and Austria under certain conditions. These supplementary tax concessions partly protect retirees from large reductions in income after withdrawal from the labour force.

4.2.3 Pension benefits

When looking at pension benefits, several aspects are of importance: (1) the type of benefits (flat-rate, earnings-related, or contribution-related); (2) the reference earnings (e.g. average earnings, final earnings, or best earnings); (3) the generosity of benefits (replacement income). These aspects are discussed separately below.

Type of pension benefits

A first distinction to be made is that between flat-rate pensions and earnings- or contribution-related pensions. Flat-rate benefits are only found within the public basic pension schemes of the first pillar, i.e. the social assistance pensions. All other pensions are either earnings- or contributions-related. With respect to this, a second distinction can be made: defined

benefit versus defined contribution schemes. Within a defined contribution scheme, pension benefits are based on the amount of contributions paid into the scheme and the returns on the invested capital. The final pension is dependent on the interest rate and on the capital market return. The risks associated with this are fully borne by the individual. Advantages of defined contribution pension schemes are that (a) they might stimulate the development of a country's capital market; (b) they have a less distortive impact on to labour market behaviour (earnings are needed to make contributions); and (c) they are less vulnerable to political power compared to defined benefit schemes (Gillion et al., 2000). Defined benefit schemes are pension schemes where the risk for the individual is minimised and pension benefits are less strictly related to contributions paid. In most defined benefit schemes, pension benefits guarantee a certain percentage of reference earnings rather than taking contributions paid as the base for pension benefits. The risks associated with the investment of the contributions paid are now borne by the pension plan funder instead of the retiree.

The majority of first pillar pensions in Europe consist of the defined benefit scheme. This is typical for a public pension, since it is usually set up to guarantee a certain living standard (i.e. a certain percentage of previous earnings). In addition, intergenerational redistribution exists when using pay-as-you-go defined benefit schemes in funded systems. When the capital return is too low for the guaranteed benefits of the current pensioners, contributions from the current working population will be increased (when reserves are too low). Within second pillar pensions, we find more divergence. While in some countries either only defined benefit schemes (e.g. Finland, Netherlands, Germany, and Greece) or defined contribution schemes (e.g. Denmark and Belgium) are found, in the others both schemes are common. Third pillar pension provisions are usually defined contributions since these are strictly personal pension plans.

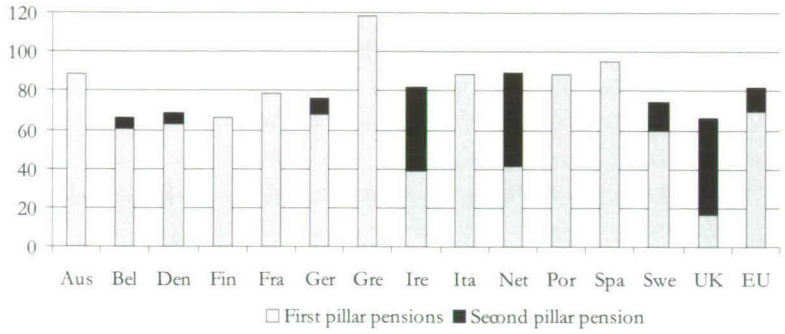
With respect to the way in which pension benefits are paid to the individual, two possibilities exist. The retiree can either receive a lump-sum payment or an annuity. A lump-sum payment refers to a one-off payment of the full pension and it is the individual's responsibility to spread this amount of money over his pension years. With annuities, the pension benefits are usually paid on a monthly basis. A lump-sum payment is taxed immediately and annuities are taxed when they are paid out. In general, the retiree is better off with annuities because with a lump-sum payment the individual's money is removed from his pension fund immediately, whereas with annuities it remains in the fund for a longer period, still generating capital return. Because of this, lump-sum payments are sometimes taxed at a lower rate than other personal income (e.g. in Belgium, Ireland, Italy, Portugal, Luxembourg and the United Kingdom). Besides the higher 'individual costs' associated with lump-sum payments, governments might have paternalistic motives for disallowing lump-sum payments of pension benefits. In their view, individuals are expected to be short-sighted and be tempted to spend their pension at once. Consequently,

they might be at risk of falling into poverty after all, something which governments try to prevent from happening. In addition, state-provided social assistance welfare for all residents might even encourage such 'rapid spending of lump-sum pensions'. Individuals who know they receive welfare benefits after having spent their pension capital might spend their lump sum pension more rapidly, being less forward-looking (Stevens et al., 2002). It is possibly for these reasons, and the costs it puts on society, that lump-sum payments of pensions are not allowed in some countries (e.g. France, the Netherlands, Norway and Sweden).

Reference earnings

With respect to the reference earnings, a distinction can be made between schemes that take earnings over the final years of employment (i.e. final pay rule), earnings over the whole employment or insurance period of the individual (i.e. average pay rule), or earnings over the best years of employment (i.e. best pay rule) as the base of pension income. Generally, the final pay rule is a quite generous calculation rule since earnings are usually the highest at the end of one's career (i.e. seniority wages and experience-rating). Yet, as explained in Chapter 3, combined with pay-as-you-go funding, the final pay rule might result in an unfair redistribution from the poor to the rich. Other disadvantages of the final-pay rule are that it disadvantages people with lower final earnings (e.g. due to sickness), and that it might encourage fraud in the sense of over-reporting final earnings (to get higher benefits). It might also lead to the under-reporting of earnings in years that are not taken into account (to pay lower social security contributions) (Gillion et al., 2000). Because of these problems, a number of countries adopted another pension calculation rule, such as the average pay rule. This rule is less generous than the former one, since the lower earnings at the beginning of one's career are also taken into account, which reduce the average value of the lifetime income. An advantage of this calculation rule is that a larger number of years of employment are taken into account, thereby reducing the incentives of fraud present under the final pay rule. A possible disadvantage of this calculation rule is that it requires an accurate record of an individual's earnings and leaves room for errors. In addition to these two calculation rules, in-between variants have been developed in some countries, including the best pay rule: a number of years in which the individual had the highest earnings are taken as a reference base for pension benefits. An advantage over the final pay rule is that the average number of years that is taken into account is relatively high (generally 15 to 25 years) to avoid fraud. An advantage of this rule over the average pay rule is that it allows for the exclusion of years with low earnings, either due to sickness or due to participation in training activities. These years are included in the average pay rule and hence reduce average earnings.

Figure 4.3: First and second pillar net replacement rates in Europe, 2002/2003



Source: Natali (2004)

Generosity

To assess the generosity of pensions and to see how this differs between countries, replacement rates can be used. Replacement rates are the ratio of post-retirement income to pre-retirement income, i.e. the percentage of earnings maintained during retirement. Apart from cross-country variations, replacement rates can vary within countries according to family status, age, the length of working or residence period, and so on. For example, in some countries pension supplements are granted in the case of a dependent spouse or the presence of children.[3] Following most recent calculations of Natali (2004), we first look at the replacement rate of first pillar pensions, i.e. only public pension income, depicted in Figure 4.3.[4] We observe relatively high public pension replacement rates (replacement rates over 80 percent) in Austria, Greece, Italy, Portugal and Spain. Except for Portugal and Italy, these are all countries with best pay or final pay schemes that have been said to be more generous compared to average pay schemes. When we compare the average replacement rate of all countries using best pay or final pay schemes (e.g. Austria, Finland, France, Greece and Spain) we get an average of 89.3 percent while for countries with average pay rules this is only 63.7 percent. Additionally, the lowest replacement rates of first pillar pensions (below 50 percent) are found in Ireland, the Netherlands and the United Kingdom. These latter countries are all countries in which the state provides only a minimum basic pension and people are encouraged or even mandated to participate in second pillar pension provisions. When accounting for such second pillar pensions, we find that replacement rates of total pension income increase above 60 percent, or even above 80 percent as is the case in Ireland and the Netherlands. Note that the coverage of second pillar pensions is only about 50 percent in Ireland, implying

[3]Throughout this dissertation our focus is on cross-national differences in generosity of pensions, summarised in terms of national averages. We realise that we neglect within-country diversities or inequalities, however, our data did not allow such an analysis. We leave this for further research.

[4]All replacement rates are net, except for the United Kingdom, where only gross replacement rates were available.

that only half of the retired population has such generous replacement rates. The other half, with public pensions only, has very poor replacement rates of about 40 percent.

4.2.4 Retirement age and early retirement

Retirement age

In all European pension systems there is a particular age at which people become eligible to a full old-age pension (if other conditions are fulfilled). This age is referred to as the official, normal or standard retirement age. The most common official retirement age in Europe is 65, as can be seen in Table A1 in the Appendix to this chapter. Exceptions are France with a lower age of 60 and Ireland and Denmark with higher ages (66 and 67 respectively). In some countries, the official retirement age for women is lower than that of men, although in most cases these are due to become uniform within a few decades. In addition to gender-differences in the official retirement age, in some countries a lower retirement age exists for government employees (Blondal & Scarpetta, 1998). As mentioned in Chapter 1, in some countries reforms have been announced to raise this official retirement age to 67 in Germany and the Netherlands or even 70 in the United Kingdom.

Although in the majority of countries retirement at the official retirement age is not mandatory, people are strongly encouraged to do so either because of means-tested pension benefits, high replacement rates or pressure from the employer as explained in Chapter 3 (i.e. an explicit or implicit contract defines official retirement age commonly as mandatory retirement age).[5] To claim a public pension at the official retirement age, additional conditions have to be fulfilled. For example, to receive a universal pension in Denmark and Sweden, a minimum residence period of three years is required. Full benefits are granted in the case of 40 years of residence in the Scandinavian countries and 50 years in the Netherlands. For people with a shorter period of residence, benefits are reduced. In the social insurance pension schemes, the additional conditions refer to the number of insurance or contribution years. Using such a minimum number of employment years might encourage people to participate in the labour market who would otherwise not participate. However, caution is needed when making the minimum employment period too long as this might be disadvantageous to people with discontinuous working careers (e.g. women). They would not be able to receive benefits, while having paid contributions to the scheme for several years (especially in pay-as-you-go funded pension schemes). In addition to a minimum insurance period, retirement is required in several countries before a full pension can be claimed.

In a number of countries it is possible to retire early, either fully or partially, either through special early retirement schemes or by using disability or unemployment schemes.

[5] In Chapter 2 we explained that the budget constraint is kinked at the official retirement age, providing strong incentives to retire, except for those with an extremely high preference for work.

Table 4.3: Age thresholds in the first pillar early retirement schemes in Europe

	Flexible scheme	Seniority scheme age M/W (yrs)	Partial retirement schemes
Austria		age 61.5/56.5 (35)	age 55/50
Belgium		age 60 (32)	age 55
Denmark		age 60 (25[a])	age 60
Finland	age 60		age 56
France		age 56 (42)	age 55
Germany		age 63/60 (35/10)	age 58
Greece		age 58 (35)	
Ireland			
Italy	37.5 yrs	age 57 (35)	
Luxembourg		age 57 (40)	
Netherlands			
Portugal		age 55 (30)	
Spain		age 61 (30)	age 60
Sweden	age 61		age 61
United Kingdom			

[a]Early retirement within the first pillar is possible after 25 years of unemployment insurance contributions.

These early retirement possibilities are discussed next.

Existence of early retirement schemes

In the majority of countries, specifically designed early retirement schemes exist and we discuss these within each pension pillar. Starting with the first pillar, several schemes can be distinguished through which early retirement on a public pension is facilitated, summarised in Table 4.3.

1. Flexible retirement schemes. Some countries have adopted flexible pension systems. In these systems, an individual can decide for himself, within certain limits, when to retire. Full flexibility, however, is prevented either by setting a minimum age for retirement or a minimum number of contribution years. In some cases even a maximum age is specified.
2. Seniority pension schemes. The majority of European countries offer the opportunity to retire on a so-called seniority pension, allowing retirement as from a certain age, varying from 55 to 63, conditional on a minimum period of contribution or service years, varying from 30 to 40 years. The early pension serves as a kind of reward for long service to the worker. These schemes can be said to be less flexible than the flexible retirement schemes, since now two conditions have to be met instead of only one. Countries with typically 'low' ages (below 58) are Greece, Italy, Luxembourg and Portugal. In a number of countries, women face both a lower minimum age and a lower minimum contribution period, to acknowledge their probable shorter working experience.
3. Partial retirement schemes. In addition to 'full' retirement schemes, in a great number of European countries, partial or progressive retirement schemes have been

adopted. These allow workers who are approaching the official retirement age to cut down working hours and receive a part-time pension. Progressive retirement has many advantages, including a smoother transition (both financially and socially and both from an individual and a societal point of view) from work to retirement, the prevention of social exclusion for the elderly, a better management of the workforce when labour supply is in decline (as is generally expected due to an ageing population) and the preservation of skills and experience held by older workers (Casey, 1998; European Industrial Relations Observatory Online, 2001). As mentioned in Chapter 1, in light of the ageing population and the growing financial burden this will put on the social security system in general and the pension system in particular, progressive retirement is receiving more and more attention from both governments and researchers.

Apart from these first pillar early retirement schemes, second pillar pension schemes often allow early retirement. These are naturally only present in countries with well-developed second pillar pensions. Generally speaking, early retirement provisions are roughly the same as for public schemes. In some countries, early retirement through second pillar pensions is even restricted by law. For example, in the Netherlands early retirement is only possible within the second pillar but largely restricted by law. Previously, so-called VUT-schemes allowed retirement from the age of 58 with 40 years of service (not earlier, with the exception of civil servants), yet the pre-retirement schemes introduced in the 1990s only allowed retirement from the age of 60. Currently, however, government is further increasing this minimum retirement age to 62 or even 63. The British schemes allow retirement as early as from the age of 50 under specific circumstances, however, for the majority of people, the level of benefits is very poor, preventing them from retiring that early (Hansen, 2000).[6] In France too, industry- or company-wide early retirement schemes have been introduced within the framework of 'early retirement for certain employees' (CATS). Initially, these schemes were meant to facilitate early retirement of workers in physically demanding work, such as the automobile industry, yet currently coverage has increased to other sectors as well (e.g. the food sector, chemicals and even the banking sector). Under the scheme, the state covers part of the early retirement benefits from the age of 57 (58 in the banking sector) if additional conditions are met (e.g. certain number of years working in shifts, production line or inability to deal with modern technologies in the banking sector (European Industrial Relations Observatory Online, 2001). Hence, state influence is still large within the second-pillar early retirement schemes.

Early retirement through the third pillar is commonly most flexible since the individual usually faces no constraints other than the financial one. It fully depends on the extent

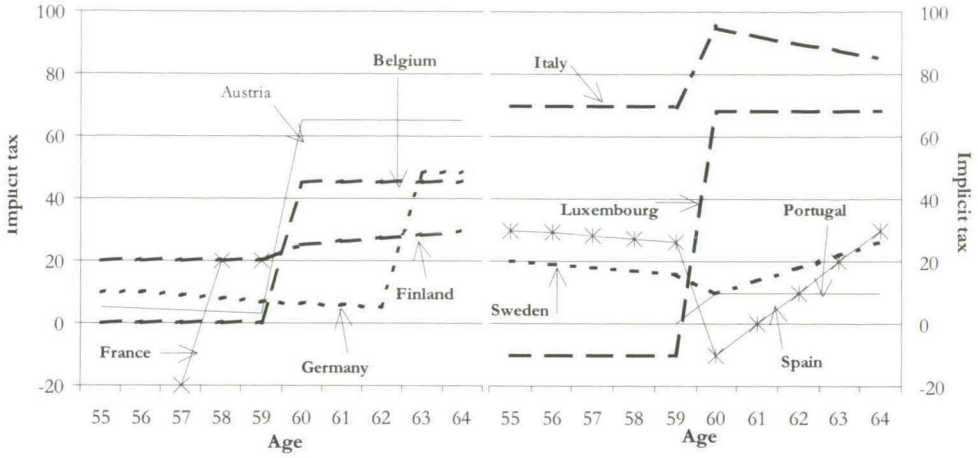
[6]In the United Kingdom, there are typically two groups of workers. On the one hand, there is a small group of workers with generous early retirement schemes. On the other hand, there is a large group of workers with poor early retirement schemes (Hansen, 2000).

of wealth accumulation whether he can afford to retire through a private early retirement scheme (i.e. the individual is restricted by his budget constraint).

Finally, early retirement possibilities embedded in other social security arrangements, typically disability or unemployment need to be discussed. In several countries, specific 'disability or unemployment pensions' exist. These schemes allow the conversion of disability or unemployment benefits into an early old-age pension at a certain age. Consequently, these schemes facilitate the retirement of disabled or unemployed elderly, rather than of employed people. Disability pensions already have a long tradition, because of the earlier direct link between disability and retirement. Unemployment pensions were introduced in the 1970s in most countries to reduce the youth unemployment that existed in those days. Further, in some countries special redundancy schemes allow the early retirement of workers who are made redundant or who are threatened by dismissal because of the firm's reorganisation policy or for firms in difficulties. In addition, unhealthy work schemes allow early retirement for people in unhealthy or arduous work. Such schemes are most common in southern European countries and conditions are sometimes more relaxed for women. Moreover, in some countries, mothers are granted special early retirement facilities. In addition to these disability and unemployment pensions that allow the early retirement of the unemployed or disabled, disability or unemployment schemes might be used as early retirement pathways for the employed. It can even be argued that the existence of the aforementioned disability or unemployment pensions stimulates the use of social security as a transitory phase before full retirement. The required disability or unemployment period is relatively short in most countries. Notwithstanding the reduced freedom of choice as explained in Chapter 3, relaxed entry conditions for senior workers of disability and unemployment schemes have contributed to the increasing number of people retiring though these schemes. For example, the transition into disability is usually driven by poor health, however, the increase in the number of elderly receiving disability benefits in the last few decades has not been accompanied by a declining health status of the elderly (OECD, 1995).

The 'tightness' of the disability schemes can, amongst others, be examined by looking at the minimum level of incapacity to work required for entitlement. The higher this requirement, the less easy entrance to the disability scheme is, and the less likely disability insurance is to act as a substitute for early retirement schemes. Both the Netherlands and Sweden have the least tight disability schemes, with benefits already paid at relatively low incapacities to work (15 and 25 percent respectively). At the other extreme are Ireland and the United Kingdom, that require a full incapacity to work, i.e. disability benefits really targeted at those who are really unable to work because of health problems. As for unemployment schemes, in a number of countries relaxed conditions for the elderly unemployed exists. These might refer either to a reduced job search or to an extended duration of benefits from a certain age.

Figure 4.4: Implicit taxes on continued employment after the age of 55



Source: Blondal and Scarpetta (1999)

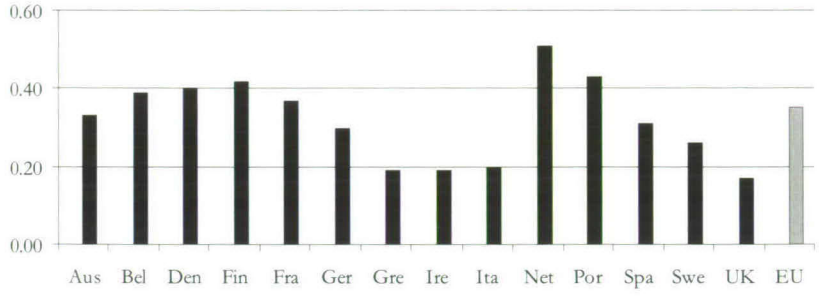
Generosity of early retirement schemes

To assess the incentive effect of the early retirement schemes Blondal and Scarpetta (1999) calculated implicit taxes on continued work at all ages between 55 and 69. Since our main interest goes to the early retirement incentive, we have copied their results only for ages before the official retirement age, as shown in Figure 4.4.[7] The reason for splitting the countries into two separate graphs is purely to enhance readability. These implicit taxes show that incentives for early retirement are very strong in some countries. Implicit rates start increasing rapidly after the first opportunity in terms of the age at which one becomes entitled to early retirement benefits. Early retirement incentives are strongest in Austria, Italy and Luxembourg, with implicit taxes mounting above 60 percent. In other countries, incentives are more modest, especially in Finland, Portugal, Spain and Sweden where implicit taxes remain below 30 percent. In Spain it seems most generous to retire before the age of 60 or to wait until the official retirement age.

To get an idea of the extent to which second pillar pensions encourage early retirement, we use the results of an analysis by Hansen (2000) who calculated net replacement rates of people retiring at the earliest entitlement age for eight European countries. He specifically

[7]The figure shows the estimated implicit tax on continuing to work for an additional year from 55 to 70 for European countries that are known to allow early retirement through public pensions. We did not calculate these rates ourselves, but fully base our figure on the calculations made by Blondal and Scarpetta (1999). 'The tax rates refer to a single person aged 55 in 1995 and with average earnings. It is assumed that the individual has had 35 years of employment at the age of 55, and has paid pension contributions as long as such arrangements have existed or been mandatory. It is also assumed that receiving an old-age pension cannot be combined with continued full-time work [...]. The discount rate is set at three per cent for all countries and all periods, even if empirical estimates suggest that it may be much higher. For the sake of simplicity, survival rates are assumed to be 100 percent up to the expected age of death of a 55-year-old male, and zero thereafter'.

Figure 4.5: Overall gross replacement rates, 1995



Source: OECD Social Protection Statistics(2002)

included second pillar occupational schemes in his analysis. He finds that the French, Italian and Dutch schemes are most generous, with replacement rates of about 80 percent. The schemes in the other countries offer on average 60 percent of previous earnings. For the United Kingdom, typically a distinction can be made between 'poor' schemes offering about 40 percent of previous earnings and 'good' schemes offering almost 80 percent. Note that these replacement rates are all for average earners. While replacement rates are about the same for low- and high-income earners in Italy, France, the Netherlands and Spain, they decline with income in Denmark, Finland, Sweden and the United Kingdom. This is because of the means-tested basic or social assistance pensions in these countries offered to the low-income earners.

Finally, it is of importance to look at the replacement rates of social security. We have already explained that entitlement conditions for elderly workers are relaxed in most countries, but to assess the extent to which the routes offer substitutable early retirement routes, we need to look at their generosity as well. Generally, we find that unemployment benefits are less generous than disability benefits. This might be related to the fact that work-related disability is treated as a collective risk, which is not associated with personal conduct or free choice, whereas unemployment is not, i.e. a person can prevent disability to a lesser extent than he can prevent unemployment. Overall social security replacement rates for the various European countries have been calculated by the OECD for couples, singles, and people with or without children. The averages of these OECD gross overall replacement rates are depicted in Figure 4.5. The generosity is largely determined by the type of benefits. In the case of flat-rate benefits, average replacement rates are usually lower than in the case of earnings-related benefits. The Netherlands has above-average replacement rates, with earnings-related benefits in both disability and unemployment routes. Greece, Ireland, Italy and the United Kingdom share below-average replacement rates, with Ireland and the United Kingdom having flat-rate benefits. Hansen (2000) showed that in some countries replacement rates decline at higher income levels, caused by the income test in many social security schemes.

4.3 Pension systems and regime typologies

After having discussed the structure, flexibility and generosity of European pension systems, we now turn to the discussion of the regime typology. Notwithstanding country differences in pension systems, the question is whether we can cluster them into a limited number of clusters where countries share the same characteristics. When reviewing the literature on pension regime typologies, we generally find two types of typologies: (a) typologies that focus on the extent of pension coverage; and (b) typologies that focus on the delivery of pension benefits. We will describe the main typologies and see how they relate to current pension systems in Europe.

4.3.1 The extent of pension coverage

The Esping-Andersen typology

Perhaps the most cited and criticised welfare state typology is the Esping-Andersen (1990) one. In his 'Three worlds of welfare capitalism', he distinguishes between three different welfare state regimes and the pension system is of major importance to his classification as it is one of the most traditional welfare state pillars. His distinction is mainly based on the degree of decommodification and stratification. *Decommodification* refers to the extent to which the state offers income protection that removes individual dependence on the paid labour market activity or the family, i.e. the level of public interference. Consequently, decommodification is valued by two criteria: (a) whether the individual is entitled to benefits regardless of a paid labour market activity; and (b) whether these benefits provide a socially acceptable living standard. With respect to the first criteria, apart from looking at the coverage of benefits (i.e. universalism versus occupational pensions), Esping-Andersen uses the public-private mix of welfare provision as an indicator for the extent to which the government takes away individual responsibility in protecting against income loss due to incapacity to work. Generally speaking, the higher public expenditures on pensions are as a percentage of total pension spending, the higher crowding-out of private provisions and the higher the level of decommodification. *Stratification* refers to the degree of differentiation between various groups in society that is established by social protection, i.e. selectivity. To measure stratification resulting from pension systems, Esping-Andersen uses, amongst other things, the percentage of public spending used on pensions of public sector employees. The higher this spending, the higher the difference between public and private sector employees with respect to pension treatment, and the higher the occupational segregation, or stratification.

Using these dimensions, Esping-Andersen makes a distinction between three types of welfare state regimes (1990; p.85), summarised in Table 4.4. Without discussing the fit of the countries into these clusters at this point, the three clusters are defined as follows:

- State-dominated conservative corporatist pension regimes. These regimes are characterised by both relatively high decommodification and stratification. Public pension provision is well-developed and the dominant pension pillar, private pension provision, is only of marginal importance and expenditures on civil servants' pensions are relatively high. Such regimes are largely based on the principle of reciprocity or equity, which holds that the standard of living that people have acquired during their working lives should be protected by old-age pensions. According to this principle, resources should be redistributed without changing the fundamental status differentials that exist in society. Pension schemes following this principle are usually earnings-related social insurance schemes. After all, earnings-related schemes assure the preservation of status differentials acquired during working life. We find the majority of European countries in this cluster. These are all countries in which pensions mainly exist as a reward for long service, with the main entitlement being in terms of a minimum contribution period. This reflects the corporatism aspect: strong ties between employer and employees.
- State-dominated universalist or social democratic pension regimes. These regimes are characterised by relatively high decommodification and low stratification. As in corporatist regimes, public pension provision plays a dominant role, private pension provision is marginally developed, but expenditures on civil servants' pensions are low (i.e. no different position in society). Pension rights are not so much related to occupation, yet more universal to residency. Social democratic pension regimes are mainly based on the principle of equality, which holds that all residents should be entitled to a certain living standard, a general level of well-being, i.e. flat-rate benefits. All social risks in society should be pooled and spread equally over the residents, without stratification. Labour participation of individuals is stimulated, both to keep the pension system payable and to strengthen the solidarity in society. Although earnings-related supplementary pension schemes exist in social democratic regimes, benefits are more modest compared to corporatist regimes since employment is strongly encouraged until (or even after) the official retirement age. In summary, pension schemes following this principle are usually universal tax-funded flat-rate, but generous, schemes. Within this regime type we naturally find the Scandinavian countries that are the most social-democratic in Europe. The Netherlands too falls under this heading because of its universal old-age pension.
- Market-dominated or liberal pension regimes. These regimes are characterised by both low decommodification and stratification. Public pension spending is low (i.e. only poverty prevention) and the private pension sector is highly developed. These regimes are mainly based on the principle of need, which holds that people who are not able to maintain a minimum level of subsistence should be covered by social security. According to this principle, resources should only be redistributed to

Table 4.4: European country clustering according to Esping-Andersen regime typology

CONSERVATIVE-CORPORATIST REGIMES	SOCIAL DEMOCRATIC REGIMES	LIBERAL REGIMES
Austria, Belgium, France, Germany, Greece, Italy, Luxembourg, Portugal, Spain	Denmark, Finland Sweden the Netherlands	Ireland United Kingdom

the poorest in society. Following Esping-Andersen (1990), because of the strict entitlement rules and the selectivity that results from that, social assistance benefits are targeted most strongly at those who are really unable to provide pension income of their own. Pension schemes based on this principle are mainly flat-rate social assistance or minimum pensions that are means-tested. It is left to the individual's responsibility to take care of old-age pension provision. The two countries under this heading are both characterised by minimum first pillar old-age pensions and highly-developed second and third pillar pension provision (even compulsory in the United Kingdom).

So far, we have not discussed the fit of the countries into these clusters. The next question of interest is whether this pension regime typology would still hold when we take a more detailed look into the countries' pension systems. Or better, would it still hold when looking at the current status of European pension systems? After all, for his original classification, Esping-Andersen used data from 1980 and it is self-explanatory that pension systems have changed since then. Particularly the public-private mix in pension welfare provision on which his typology is based, has changed in many European countries in recent decades. Consequently, we examine next whether his pension regime classification is still relevant today. To measure decommodification, we look at (a) the type of benefits (universal benefits imply higher decommodification), (b) the public-private mix (larger public share indicates higher decommodification) and (c) the generosity of pensions (higher generosity implies higher decommodification). With respect to other social security benefits (e.g. disability and unemployment) we only look at the generosity of benefits. Benefits are typically employment-related and publicly provided. As for stratification, we look at the type of benefits (flat-rate benefits are least stratifying, means-tested benefits and earnings-related benefits are stratifying). The updated measures are summarised in Table 4.5, using the information explained in the first part of this chapter.

We will now see whether the countries still fit their regime characteristics with respect to decommodification and stratification. Starting with social-democratic regimes, according to Esping-Andersen these are characterised by high decommodification and low stratification. High decommodification in Table 4.5 would then refer to the provision of universal pension benefits, a high share of public pensions in the pensioner's income, and above-average replacement rates for pensions, disability and unemployment. All social-democratic countries do indeed have universal public pensions, though in all

Table 4.5: Update of decommodification and stratification measures of Esping-Andersen regime typology

	Old-age pensions					Disability/unemployment			
	[A]	[B]	[C]	[D]	[E]	$[F]_{dis}$	$[F]_{une}$	$[G]_{dis}$	$[G]_{une}$
SOCIAL-DEMOCRATIC:									
Denmark	TP	FR+MT/ER	0.50	0.63	No	FR	ER	0.44	0.40
Finland	TP	FR,MT/ER	0.93	0.66	Yes	FR,ER	FR,ER	0.53	0.42
Netherlands	TP	FR	0.46	0.41	No	ER	FR,ER	0.63	0.51
Sweden	TP	FR,MT/ER	0.87	0.60	No	FR,ER	ER	0.74	0.26
CORPORATIST:									
Austria	AP	ER	0.94	0.88	Yes	ER	ER	0.53	0.33
Belgium	AP	ER	0.75	0.60	Yes	ER	ER	0.47	0.39
France	AP	ER	0.88	0.79	Yes	ER	ER	0.34	0.37
Germany	AP	ER	0.94	0.68	Yes	ER	ER	0.46	0.30
Luxembourg	AP	ER	0.91		Yes	FR,ER	ER	0.59	
Greece	AP	ER	0.96	1.18	Yes	ER	ER	0.54	0.19
Italy	AP	ER	0.88	0.89	Yes	ER	ER	0.60	0.20
Portugal	AP	ER	0.94	0.89	Yes	ER	ER	0.47	0.45
Spain	AP	ER	0.87	0.95	Yes	ER	ER	0.56	0.31
LIBERAL:									
Ireland	AP	FR,MT	0.51	0.39	No	FR	FR	0.38	0.29
United Kingdom	AP	FR,MT	0.41	0.17	No	FR	FR	0.38	0.17
EU-average			0.78	0.69				0.51	0.33

[A] Pension coverage: TP = total population (universal pension), AP = active population. [B] Type of benefits: FR = flat-rate, MT = means-tested, ER = earnings-related. [C] Share of public pensions in pensioner's income (Source: European Commission (2004). [D] Net replacement rate public pensions (first pillar only, Source: Natali (2004). [E] Special first pillar scheme for civil servants which differs from schemes for employees (i.e. lower contributions, higher replacement rates, earlier retirement)? With respect to second pillar [F] Type of benefits disability/unemployment. See definition under [B]. [G] Gross replacement rates disability/unemployment (Source: OECD Social Protection Statistics, 2002.

countries the replacement rate of this pension is below the European average of 69 percent. This divergence is largest in Denmark and the Netherlands, where the share of the public pension in the pensioner's retirement income is also lower than the European average. Remember though that state influence is fairly large in the second pillar pensions where participation is quasi-mandatory in these countries. As for replacement rates of disability and unemployment, these are generally above the European average in social-democratic countries (except disability benefits in Denmark and unemployment benefits in Finland). We might conclude that decommodification with respect to pension provision is still high in this group of countries, notwithstanding some differences between the countries. Earnings-related benefits are growing though, especially in the Scandinavian pension systems. Such earnings-related benefits are a supplement to the basic universal pension and can be said to increase or preserve the 'status difference' between people with a working history and people without such a history. This is more a corporatist characteristic. Additionally, in Denmark and the Netherlands, the public sector is strongly

encouraging the development of occupational and private pensions, which might indicate a trend towards less state influence and lower decommodification in the future. Stratification in social-democratic countries should be low according to Esping-Andersen and looking at the facts we can conclude that this is still true. Civil servants are, at least within first pillar pension provision, treated in more or lesss the same way as private sector workers, and flat-rate benefits are commonly used in these countries. Within the second pillar, however, civil servants are treated differently: usually they have lower contributions and higher replacement rates. Stratification as a result of the growing second pillar in pension systems has slightly increased in most social-democratic countries.

Looking at conservative-corporatist countries, these are typically characterised by both a high decommodification and a high stratification according to Esping-Andersen. Following the same reasoning explained above, we find that decommodification with respect to pension provision is indeed fairly high in the corporatist countries. Though pension benefits are only awarded to those with working histories, social assistance pensions usually exist for those who were not able to work. In addition, the share of public pensions in the pensioner's income is at or above the European average as are replacement rates of such pensions (except in Belgium and Germany where replacement rates are just below the European average). Looking at replacement rates of disability and unemployment benefits, results are more mixed, and no clear pattern can be drawn from this. As for stratification in the conservative-corporatist countries, first pillar pension systems in these countries are most complicated with specific schemes not only for civil servants but for many occupational groups (e.g. white-collar workers). Earnings-related benefits are dominant, maintaining status differentials acquired during working life. Within the conservative-corporatist regimes, we can see that, generally speaking, some characteristics are strongest in the southern countries. The share of public pension in total retirement income is largest in southern countries, and the replacement rates (except for unemployment in Portugal and Spain) are highest. We will see later that this is a reason for Ferrera (1996b) setting the southern countries apart from the corporatist countries.

Finally, liberal regimes are characterised by a low decommodification and a low stratification and this is still true when reviewing the countries' pension systems. Although pensions are related to employment, they are flat-rate and on a minimum level. Replacement rates of public pensions are lowest among European countries. The means-test assures that public pensions are only awarded to minimum income earners, a typical liberal characteristics. Consequently, the share of public pensions in the pensioner's retirement income is lowest. The British system diverges from the Irish one in that in the first system, supplementary earnings-related pensions are offered by the state (SERPS) while in the latter system this is fully the worker's own responsibility.

Generally, we conclude that by looking at the countries' pension systems, the Esping-Andersen (1990) welfare state typology seems to hold rather well. However, we can see

some diverging trends with both social-democratic and corporatist countries becoming less decommodifying and social-democratic countries becoming more stratifying as a result of the strong development of second pillar pensions. Nevertheless, there are two reasons why we argue that the Esping-Andersen country clustering should not be used for our study. The first is the major developments in European pension systems since the 1980s, and particularly the rise of the second and third pillars in most countries as discussed above. This has changed the public-private mix in pension provision. The second reason is that our focus is on early retirement institutions, which are not taken into account in the Esping-Andersen regime typology. Before turning to our own index, however, we first discuss the second type of pension regime typologies we found in the literature, i.e. those who focus on the delivery of pensions rather than on the extent of pension coverage as Esping-Andersen did (Ferrera, 1996b; Bonoli, 1997; Bonoli, 2000; (Marier, 2002); Bonoli, 2003; Rhodes & Natali, 2003. These typologies account more specifically for the coverage of pensions schemes (universal, occupational, means-tested) as well as the institutions responsible for the management (public, private or multi-pillar). In this respect they account for the fact that pension systems have developed markedly since the 1980s. We will review these more recent typologies below, summarised in Table 4.6.

4.3.2 The delivery of pensions

Within the second type of pension regime typologies, it is common to distinguish between Beveridgean and Bismarckian pension regimes (Bonoli, 1997) or between universalist and occupational regimes (Ferrera, 1996b). Both authors basically use different labels for the same distinction, referring to the historical roots of the pension system. Beveridgean or universalist regimes have their origin in the Danish pension system introduced in 1891, which was targeted at the prevention of poverty and generally provides the eligible population with tax-funded, flat-rate and means-tested benefits. Other countries that started out with such anti-poverty pension systems were the other Scandinavian countries, Ireland, and the United Kingdom. Both the Esping-Andersen (1990) social democratic and liberal regimes have their origin in the Beveridgean regime as shown in Table 4.6. The main difference between the two lies in the generosity of the pension schemes, rather than their historical roots. Post-war developments in the Scandinavian countries led to generous universal basic pensions while post-war developments in Ireland, the Netherlands and the United Kingdom led to earnings-related supplementary pension schemes, mainly second pillar, as shown before (Bonoli, 2000). Bismarckian or occupational regimes have their origin in the German system introduced in 1889, where benefits are targeted at income maintenance and provide eligible employees with contribution-funded earnings-related benefits. Status differentials acquired during working life are maintained during retirement. While the majority of European countries started with such occupational

Table 4.6: Relation between Esping-Andersen welfare state typology to more recent pension regime typologies

	Bonoli (1997)	Ferrera (1996)	Marier (2002)/ Bonoli (2003)	Rhodes (2003)
SOCIAL-DEMOCRATIC:				
Denmark	Beveridgean	Nordic	Multi-pillar	Universal/occup
Finland	Beveridgean	Nordic	State-managed	Universal
Netherlands	Beveridgean	Nordic/continental	Multi-pillar	Universal/occup
Sweden	Beveridgean	Nordic	State-managed	Universal
CORPORATIST:				
Austria	Bismarckian	Continental	Social insurance	Pure occupational
Belgium	Bismarckian	Continental	Social insurance	Occupational plus
France	Bismarckian	Continental	Social insurance	Occupational plus
Germany	Bismarckian	Continental	Social insurance	Pure occupational
Luxembourg	Bismarckian	Continental	Social insurance	Occupational plus
Greece	Bismarckian	Southern	Social insurance	Occupational plus
Italy	Bismarckian	Southern	Social insurance	Occupational plus
Portugal	Bismarckian	Southern	Social insurance	Occupational plus
Spain	Bismarckian	Southern	Social insurance	Occupational plus
LIBERAL:				
Ireland	Beveridgean	Anglo-Saxon	Multi-pillar	Universal/occup
United Kingdom	Beveridgean	Anglo-Saxon	Multi-pillar	Universal/occup

pension systems (i.e. social insurance schemes) post-war developments of the European pension systems led to some Beveridgean influence in some countries, with the introduction of social assistance pension schemes for the elderly and the poor.

As a response to this growing convergence between the two regimes and the increasingly mixed structures, recent pension regime typologies focused on more detailed features of the pension schemes. Ferrera (1996b) allowed for regimes in between the two extremes of universalist and occupational schemes by concentrating on some specific features of pension schemes: (a) eligibility, referring to the difference between universal and selective (i.e. occupational) pension schemes; (b) benefit formulae, referring to the difference between earnings-related and flat-rate benefits as well as to the differences in benefit generosity; (c) financing regulations, referring to the difference between tax-funded and contribution-funded pension schemes; and (d) organisational management arrangements, referring to whose responsibility it is to manage the pension scheme. As we will see, the Ferrera (1996) typology resembles the Esping-Andersen (1990) typology, yet one of the main points of criticism of Ferrera on the Esping-Andersen (1990) typology is that it neglects the reliance on family networks commonly found in the southern European economies. He argued that the southern countries (e.g. Portugal, Spain, Italy and Greece) should be classified as a separate 'family of nations' with common policy characteristics. He points to the dualistic structure of social protection in general, and pension provision in particular, that separates the southern regime from the other continental European countries. On the one hand, workers in the institutional or formal sector contribute to the pension system and

receive generous pension benefits. On the other hand, workers in the non-institutional market or irregular market do not contribute and no guaranteed minimum income exists. These workers have to rely on family or other informal support (church or charity). This dualistic or mixed structure also applies to the management of social security, in some fields (e.g. pensions) the social partners are important, in other fields (e.g. health) the state has taken a more dominant role and pursues universalism in these fields. This specific dualistic structure together with the presence of strong family traditions is lacking in other European countries and sets the southern regimes apart. Ferrera (1996b) therefore distinguishes between four types of 'social policy', conveniently labelled in line with the geographical position in Europe: (1) Anglo-Saxon, pure universalist or Beveridgean countries with social protection targeted at the poor. While a basic minimum pension is provided for by the state, supplementary pension benefits are the individual's responsibility; (2) Continental, pure occupational or Bismarkian countries in which a strong link exists between employment history and pension entitlement (i.e. earnings-related pensions and full pensions for people with a minimum contribution period); (3) Nordic countries with Beveridgean roots but highly developed social protection levels for the whole population; (4) Southern countries with high pension benefits, strong relation to employment as in the continental countries but stronger traditional ties between families and the existence of a dualistic structure in the economy and social welfare as explained before.

Other, more recent pension regime typologies, in turn, cluster pension systems according to the management behind it, both recognising the dominant role of the social partners in the pension system. Marier (2002, p.15), for example, makes a distinction based on 'parliamentary integration versus social partnership'. In the case of parliamentary integration, or state management, employers' and employees' organisations are built within the state, and pension systems remain state-managed. The universal systems in the Scandinavian countries are founded on such management. In the case of social partnership, however, employers' and employees' organisations are more separated from the state and manage (part of) the pension system more independently. Bonoli (2003) further distinguishes between social insurance and multi-pillar systems. Social insurance systems are systems in which first pillar pensions are jointly agreed upon by the social partners and other pillars are of minor importance. By multi-pillar systems, he refers to systems in which the state is mainly responsible for first pillar pensions and the social partners are more directly involved in the second pillar pensions, as in the Netherlands and Denmark.

Rhodes and Natali (2003) used the similarities between these pension regime typologies and extended them by specifically accounting for the multi-pillar structure of current pension systems. They distinguish between four types of pension systems: (1) pure occupational systems; (2) occupational plus means-tested systems; (3) universal occupational systems; and (4) pure universal systems. Both the first and the second regimes have

their origin in the Bismarckian tradition and the core of the pension system is a social insurance scheme. In pure occupational systems, people without contribution histories are not entitled to pension benefits, but depend on benefit systems (typically social assistance scheme) outside the pension system (e.g. Austria and Germany). This sets the pure occupational systems apart from the occupational and means-tested systems. In these latter regimes, either minimum pensions or specific social assistance schemes for the elderly exist as discussed in the first section of this chapter. Second and third pillar pension provision in occupational regimes is underdeveloped, although these are emerging in some countries as explained earlier.

Universal pension systems have their origin in the Beveridgean tradition and the pensions are state-managed, universal and financed by both taxes and contributions. Poverty prevention in old age is integrated into the basic flat-rate pensions, which are rather generous. In addition, supplementary earnings-related pensions are provided within the first pillar (i.e. on a pay-as-you-go basis). Second and third pillar pensions are generally underdeveloped, since there is no need to seek further insurance against old-age risks on the market.[8] Universalist occupational systems are truly mixed systems that have their origin either in the Bismarckian or the Beveridgean tradition. While a basic pension, (either flat-rate, earnings-related, or both), is offered by the state within the first pillar, supplementary pensions are organised within the second-pillar. State influence in the second pillar is sometimes large because of the mandatory or strongly encouraged (i.e. tax exemptions) development of a participation in such pension schemes. Countries that fit this profile best are the Netherlands, Ireland and the United Kingdom. However, these countries still differ from each other. While the Dutch state pensions consist of a universal flat-rate basic pension, both Ireland and the United Kingdom have dual first pillar systems with contributory basic pensions for the active population and non-contributory means-tested social assistance pensions for the poor.

As can be concluded from Table 4.6 where all regimes are summarised, overall the separate classification of Esping-Andersen's liberal welfare state seems to hold best when 'testing' the classification on other characteristics of the welfare state. The conservative-corporatist regime, although consisting of the largest group of countries, seems to hold rather well too, with only minor differences according to the Rhodes and Natali (2003) typology. This sets Austria and Germany apart as true Bismarckian or conservative-corporatist countries with no special social assistance for the elderly. The social-democratic countries seem to become separated as well, with Finland and Sweden remaining true social-democratic countries and Denmark and the Netherlands more converging to a universalist occupational system, resembling the Anglo-Saxon one, yet with more generous benefits. A clustering resulting from the Rhodes and Natali (2003) typology would be:

[8]Note that Rhodes and Natali (2003) include the Swedish mandatory pay-as-you-go occupational pension in the second pillar, yet because of the pay-as-you-go funding we included this in the first pillar.

Pure universal pension system:	Finland, Sweden
Generous universal occupational pension system:	Denmark, the Netherlands
Modest universal occupational pension system:	Ireland, the United Kingdom
Occupational means-tested pension system:	Belgium, France, Greece, Italy, Luxembourg, Portugal, Spain
Pure occupational pension system:	Austria, Germany

In summary, it can be argued that these more modern typologies do account for the developments in European pension systems, something which we missed in the Esping-Andersen typology. However, one aspect has been left outside the discussion until now: the early retirement opportunities. We argue that specifically accounting for early retirement institutions is necessary to correctly cluster countries for further analysis of retirement behaviour. Therefore, in the next section, we will construct a retirement policy index based on the early retirement institutions present in the various countries.

4.3.3 Creating an early retirement policy index

In chapter 3 we explained that when assessing a country's early retirement environment, the level of generosity and flexibility are the main indicators to take into account. Generosity refers to the replacement income (i.e. post-retirement income as a percentage of pre-retirement income) offered by the exit scheme and flexibility refers to the availability of exit schemes (e.g. easy or low entitlement conditions). Starting with the level of flexibility of early retirement schemes (ER), first we look at public or first pillar early retirement schemes. We have to account for differences in the level of flexibility and we have chosen to do so as follows (country scores presented in column 1 of table 4.7):

First pillar pensions:

Score = 1.5	Public schemes that require only either a minimum age or a minimum contribution period.
Score = 1.0	Public schemes requiring both a minimal age and additional conditions (e.g. minimum contribution period or redundancy).
Score = 0	Countries with no first pillar early retirement provisions.

The highest level of flexibility is found in schemes that require only a minimum age or a minimum contribution period, the flexible retirement schemes described in Section 4.2.4. Such schemes are more flexible, or better, it is easier to meet the entitlement conditions, compared to schemes that allow early retirement requiring additional conditions to be met (e.g. both a minimum age and a minimum contribution period or the condition of redundancy). As for partial retirement schemes, on the one hand these might be treated as least flexible, because of the requirement of continued employment. On the other hand, such schemes might be treated as most flexible since it allows the possibility of gradual retirement rather than abrupt retirement. However, because our main interest in

this study is full retirement, we decided to exclude partial retirement schemes from our analysis. As for the level of flexibility, apart from the above score, we added a small extra score (0.2) for Greece, Italy and Portugal to account for the fact that early retirement in these countries is possible at quite low ages (58 or younger) in combination with a minimal amount of working years (35 years or less), as mentioned earlier.

Second, we review the second and third pillar early retirement schemes and for doing so we rely on evidence of the European Commission (2003a), who presented second and third pillar assets as a percentage of Gross Domestic Product (GDP), earlier shown in Table 4.2. We assume that the more such pensions have been developed, the more these are available as early retirement schemes. A larger proportion of the population is assumed to be covered by such pensions. We ranked countries as follows (country scores shown in column 2 of Table 4.7):[9]

SECOND AND THIRD PILLAR PENSIONS:

Score = 1.5	Assets as percentage of Gross Domestic Product $>$ 80 percent.
Score = 1.0	20 $\leq$ Assets as percentage of Gross Domestic Product $\geq$ 80 percent.
Score = 0.5	10 $\leq$ Assets as percentage of Gross Domestic Product $<$ 20 percent.
Score = 0	Assets as percentage of Gross Domestic Product $<$ 10 percent or coverage of the workforce $<$ 10 percent

In column 3 of Table 4.7 we have added the scores for the first, second and third pillar together and this column can be referred to as the flexibility score of ER schemes. It might be argued that the second and third pillar pension schemes might be more flexible compared to public pensions, because of the public administration of the latter. However, we explained that regulation, especially with respect to second pillar pensions, prevents an 'easy use' of such schemes. Therefore, we have not assigned a higher weight to the second pillar early retirement pensions, but have treated them equally to the public sector early retirement pensions.

To assess the overall value of early retirement schemes, we look at the second dimension: the level of generosity of early retirement schemes. As explained before in section 4.2.4, to assess the generosity of public first pillar pensions we use implicit taxes calculated by Blondal and Scarpetta (1999), and again we take national averages. For second and third pillar schemes we rely on the generosity assessment of Hansen (2000). The generosity scores of ER are determined as follows (country scores shown in column 4 of Table 4.7):

[9] As mentioned before, for Sweden the second pillar assets are that large because of the inclusion of the first pillar funded part. To avoid overestimation of the Swedish early retirement provision, we assigned a score of a half to this country.

Table 4.7: Score for flexibility and generosity of early retirement pathways (ER) in Europe

	Flexibility					
	Ist pillar	IInd/IIIrd pillars	Total flex	Gen_{ER}	Gen_{SS}	Gen_{TOT}
Austria	1.0	0.5	1.5	1.5	1.0	2.5
Belgium	1.0	0.5	1.5	1.5	1.0	2.5
Denmark	1.0	1.0	2.0	1.0	1.0	2.0
Finland	1.5	0.5	2.0	1.0	1.0	2.0
France	1.0	0	1.0	1.0	1.0	2.0
Germany	1.0	0.5	1.5	1.5	1.0	2.5
Greece	1.2	0	1.2	1.0	0.5	1.5
Ireland	0	1.0	1.0	0.5	0.5	1.0
Italy	1.7	0	1.7	1.5	0.5	2.0
Netherlands	0	1.5	1.5	1.5	1.5	3.0
Portugal	1.2	0	1.2	1.0	1.0	2.0
Spain	1.5	0	1.0	1.0	1.0	2.0
Sweden	1.5	1.0	2.5	1.0	1.0	2.0
United Kingdom	0	1.5	1.5	0.5	0.5	1.0

Luxembourg is omitted because of unreliable or incomplete information.

GENEROSITY FIRST PILLAR ER SCHEMES:

Score = 1.5 Implicit tax on continued employment $\geq$ 40 percent.

Score = 1.0 10 percent $\leq$ Implicit tax on continued employment $<$ 40 percent.

Score = 0.5 Implicit tax on continued employment $<$ 10 percent

GENEROSITY SECOND AND THIRD PILLAR ER SCHEMES:

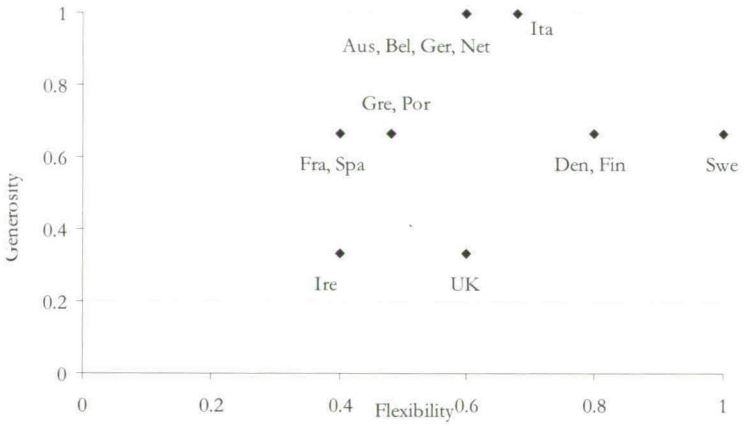
Score = 1.5 Very generous schemes.

Score = 1.0 Moderately generous schemes.

Score = 0.5 Ungenerous schemes.

In Figure 4.6 we have depicted the country scores on the flexibility and generosity of these regular early retirement schemes, i.e. within the pension system. In order to compare these scores later, we have normalised them to a 0 - 1 scale. At the bottom we find that both Ireland and the United Kingdom are ungenerous and moderately flexible. Early retirement is only provided within the second and third pillar schemes. Within this group of countries, we further find that early retirement in Ireland is less flexible than in the United Kingdom. We have explained before that the British system does allow early retirement, especially in the case of disability. Notwithstanding these differences in flexibility, we have decided to put these two countries together in one cluster. In the middle of the graph, with moderately generous schemes, we find France, Greece, Spain and Portugal on the one hand with moderately flexible schemes. Within this group we find higher flexibility in Greece and Portugal, which is caused by the low entitlement conditions as mentioned earlier. On the other hand, we find Denmark, Finland and Sweden with strongly flexible schemes (but still moderately generous benefits). Sweden is most flexible with a full flexible pension age and quite well-developed occupational pension schemes as well. At the top we find Austria, Belgium, Germany, Italy and the Netherlands with

Figure 4.6: Country scores on flexibility and generosity dimension of early retirement index, partial score

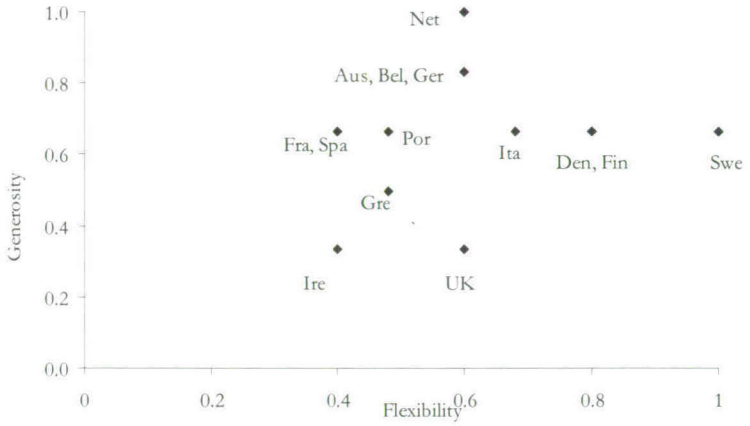


Source: own calculations

moderately flexible schemes, but high generosity. Italy stands alone in this group with a higher flexibility compared to the other countries. Early retirement is either possible at quite a low age (57) with a minimum number of working years (35) or at any age with 37.5 working years. This figure is what we expected from our discussion on early retirement systems and what we learned from other studies as well.

So far, however, we only have part of the story, since we have neglected a third dimension: early retirement routes embedded in social security arrangements. We argued before that for a full description of early retirement, one should also include these routes because of the likely substitutes or complements these are to the early retirement schemes in some countries. This is especially important when comparing countries, since in some countries early retirement is mainly based on disability considerations while in others it is not. To assess the impact of social security routes, we follow a slightly different procedure though. We have seen before that in almost all countries conditions are relaxed for older workers, making the schemes almost equally available as early retirement gateways. It is extremely difficult, if not impossible, to assess differences in the extent of the conditions, especially since lack of control on eligibility for older workers is often present. The lack of control enlarges the ease of access to these routes. Consequently, to assess differences between the countries' schemes, we only look at the generosity of the countries' social security schemes. We argue that social security routes are particularly interesting where they provide above average replacement rates. We rely on the aforementioned overall OECD replacement rates (see Figure 4.5). Scores are constructed as follows (country scores shown in columns 5 of Table 4.7):

Figure 4.7: Country scores on flexibility and generosity dimension of early retirement index, total score



Source: own calculations

GENEROSITY SCORES SOCIAL SECURITY PATHWAYS:
Score = 1.5 Replacement rate ten percentage points above European average.
Score = 1.0 Replacement rate around European average.
Score = 0.5 Replacement rate ten percentage points below European average.

In Figure 4.7 we show the final score (column 6 of Table 4.7) on our early retirement index, i.e. the ER generosity index, is now corrected with the social security generosity index. Correcting for these early retirement pathways embedded in social security routes, we find that both the Netherlands shifts upwards, with an increase in generosity. The Netherlands is known for its early retirement embedded in the disability and unemployment pathways that are relatively generous. In addition, for disability only 15 percent of incapacity to work is required, which is relatively easy to meet at older ages. Consequently, disability is being used as an early retirement pathway, on the initiative of both employees and employers. Italy and Greece on the other hand shift downwards because of their non-generous social security. Overall average replacement rates are below the European average and early retirement is only attractive through the 'standard' early retirement schemes. In summary, we find the following clustering of countries:

Ungenerous, moderately flexible	Ireland, the United Kingdom
Moderately generous, moderately flexible	France, Greece, Portugal, Spain
Moderately generous, highly flexible	Finland, Denmark, Italy, Sweden
Highly generous, moderately flexible	Austria, Belgium, Germany, the Netherlands

As in previous typologies, the two Anglo-Saxon liberal countries are classified under the same heading. Labour participation is strongly encouraged, including participation at older ages. Early retirement is only possible when privately arranged for (or within

Table 4.8: Esping-Andersen and our early retirement policy index compared

Esping-Andersen (1990) index	Early retirement index			
	Ungenerous, mod. flexible	Mod. generous, mod. flexible	Mod. generous, highly flexible	Highly generous, mod. flexible
Liberal	Ireland United Kingdom			
Corporatist		France, Greece Portugal, Spain	Italy	Austria, Belgium, Germany
Social-democratic			Finland, Denmark	Netherlands, Sweden

occupational schemes) but replacement rates are relatively low. As mentioned, flexibility is higher in the United Kingdom compared to Ireland, but generosity of the schemes is comparable in the two countries. At the other extreme, we find countries such as Austria, Belgium, Germany and the Netherlands. These countries have most generous, although moderately flexible, early retirement schemes. The moderate flexibility is caused by the fact that both a minimum retirement age and a minimum work history is required. Countries such as Finland, Denmark, Italy and Sweden have most flexible early retirement schemes, but with only moderately generous benefits. As mentioned, Italy is a bit of an outlier between the Scandinavian countries. With respect to generosity of all early retirement routes, thus including social security pathways, it is much less generous than the previous group of countries. Finally, we have France, Greece, Portugal and Spain that score moderately on both the flexibility and generosity dimension. Except for France, which is different already because of its lower official retirement age, these are all countries in which the welfare state is still in development.

When we compare our index to that of Esping-Andersen (1990) discussed before, we do find some similarities as shown in Table 4.8. In general we find that in countries with low decommodification and low stratification, the liberal regimes in the Esping-Andersen typology, early retirement possibilities are least flexible and generous. By contrast, in countries with high decommodification and low stratification, the social-democratic regimes, early retirement possibilities are most flexible and generous. In between these two we find the corporatist regimes in which decommodification is modest but stratification high. Within these regimes we find that countries with a long welfare state transition (e.g. Austria, Belgium and Germany) offer very generous early retirement to reward workers for their long service. Another group of corporatist countries has a less developed welfare state and only allows moderately generous early retirement for workers with long service. These are the southern countries that Ferrera (1996b) are already set apart from the other corporatist countries. France is a special case. Because of its already lower official retirement age, its early retirement possibilities are limited. On the other hand, occupational schemes are known to exist in France that allow generous early retirement from the age of 57. In our empirical analyses we will test whether France should be classed under the

second early regime type, or in the third, together with Italy.

4.4 Concluding remarks

In this chapter we first gave a detailed overview of European pension systems. We found that social assistance pensions are at the core of almost all European pension systems. Two traditions are distinguished in this, which largely determine the further development of the pension systems. On the one hand, we find the Beveridgean tradition, in which pensions are granted to the whole population, and on the other hand we find the Bismarckian tradition, in which pensions are granted to the employed only. Over time, distinctions between pension systems became more distinct with the Bismarckian pension systems developing supplementary public pension schemes to ensure maintenance of living standards developed during working life for the retired population (i.e. social insurance pension systems developed). Most Beveridgean systems remained targeted at providing only the social assistance pensions and left supplementary provision to the individual's responsibility. We find that, in general, in this latter group of countries, the second and third pillars, i.e. the occupational and private pensions, have developed in the last decades. However, within this group, we find a difference between the Scandinavian countries that provide rather general first pillar pensions, supplemented with an earnings-related component, and the Anglo-Saxon countries in which the first pillar pension remains of a basic, flat-rate level.

In other European countries, too, the importance of developing second and third pillar pensions has grown in recent decades. The majority of the public pensions are funded on a pay-as-you-go basis and of a defined benefit nature, with no direct link between contributions paid and benefits received. For public pensions this is explained by the redistributive character of social security in most countries. Second pillar occupational pensions, we find an increasing number of defined contribution pension schemes in which benefits are derived from the contributions paid, rather than being guaranteed, as in the defined benefit schemes. Combined with funded systems, this is the most 'direct and individual' way of pension wealth accumulation, with the least redistribution. The financing method of the public pensions is more sensitive to population ageing and therefore governments have recently announced reforms to either change public first pillar pensions into a funded system, or shift responsibility for pension provision to the private sector. Apart from this, many governments have changed from final pay rules to average pay rules. With this latter rule, pension income is determined over the average earnings over the whole employment life, including the years with low income at the beginning of one's career. In the final pay rule, only the final years of employment are taken as a reference base, i.e. the years that the workers is likely to have highest earnings. The shift to an average pay rule, the less generous method, is gaining in popularity to reduce incentives

for early retirement in many European countries.

With respect to the country's early retirement age we find that in almost all European countries, early retirement options are widely available. This is, however, not always facilitated through the public (first pillar) pension systems, but in some countries only through the second or third pillar provisions. Arrangements vary from most flexible retirement systems where people only have to reach a certain age or to have contributed for a certain minimum period to be entitled to early retirement benefits to schemes where people can retire early in the case of redundancy. In between these are the most common schemes that allow early retirement from a certain age combined with the requirement of a minimum contribution period. As with the overall pension systems, generosity varies greatly between countries, even with a distinction between income groups within a country, i.e. poor schemes for low-income earners and generous schemes for high-income earners. In addition, relaxed conditions for older workers are applied to disability or unemployment arrangements that translate such routes into substitutes for early retirement schemes in a great number of countries. Relaxed conditions vary from leaner medical criteria (i.e. fewer check-ups required) in disability schemes to non-required job search or extended duration of benefits in unemployment schemes.

The flexibility and generosity, however, differ significantly between countries and by means of a score index on these two items we classified countries into four early retirement clusters. We decided to create our own index because we concluded that existing typologies use rather outdated data and only focus on the entitlement to a pension income at the official retirement age. Since we examine early retirement behaviour in this study, using a wide variety of exit pathways, we considered it useful to elaborate our own country index. When we compare our index to that of the typology of Esping-Andersen (1990), however, we find some similarities. In general we find that in countries with low decommodification and low stratification, i.e. the liberal regimes, early retirement options are least flexible and generous. On the contrary, in countries with high decommodification and low stratification, i.e. the social democratic regimes, early retirement options are most flexible and moderately generous. Labour participation is still highly encouraged. In between, we find the corporatist regimes in which decommodification is modest but stratification high. One group of countries within these regimes are countries with a long welfare state tradition, which offer very generous early retirement to reward workers for their long service. Another group of corporatist countries has a less developed welfare state and only allows moderately generous early retirement for workers with long service. These are the southern countries that Ferrera (1996b) already set apart from the other corporatist countries.

While in this chapter we looked at retirement systems from a macroeconomic perspective, in the next chapter we take a microeconomic point of view by analysing individual early retirement patterns.

Appendix

European pension systems - some age facts

Table A1: Age facts in pension and social security systems

Country	Official retirement age (M/W)	Early retirement age (M/W) + contribution years	Disability pension age (M/W)	Unemployment relaxed conditions
Austria	65/60	61.5/56.5 + 35	61.5/56.5 (1 yr DB)	UP at age 61.5/56.5 (1yr UB)
Belgium	65/62	60 + 32		Reduced job search age 55
Denmark	67/67	60 + 25[a]		Reduced job search age 50
Finland	65/65	60		Reduced job search age 57
France	60/60	56 + 42		UP at age 57
Germany	65/65	63/60 + 35/10	60 (35 yrs ins)	UP at age 60 (1 yr UB, 35 Ins)
Greece	65/60	37.5 or 62 + 33		
Ireland	66/66			UP at age 55 (15 mnth UB)
Italy	65/65	37.5 or 57 + 35		
Luxembourg	65/65	57 + 40		
Netherlands	65/65			Reduced job search age 57.5
Portugal	65/65	55 + 30		
Spain	65/65	60 + 30		
Sweden	65/65	61		Reduced job search age 55
United Kingdom	65/60			Reduced job search age 60

DB = Disability Benefits, Ins = Insurance, UP = Unemployment Pension, UB = Unemployment Benefits.

[a] A voluntary early retirement pay (VEP) is present for people to facilitate early retirement as from the age of 60 in case of 25 years of unemployment insurance contributions.

Chapter 5

Early retirement patterns in Europe: the role of institutional differences

5.1 Introduction

In Chapter 4 we showed that national pension systems in general and early retirement systems in particular differ substantially across countries. An important question now is whether and to what extent institutional differences can explain the variance in observed early retirement patterns across countries. Rather than comparing a large number of 'unique' countries, we have tried to cluster the countries into four distinct and typical types of 'early retirement regimes', as extensively discussed in Chapter 4. The clustering is based on the level of flexibility (i.e. the presence of early retirement schemes and the range of opportunities for labour market exit) and the level of generosity (i.e. the level and duration of benefits as reflected in the replacement rates) of early retirement schemes. Not only do we include formal early retirement schemes within the first (public), second (occupational) and third (private) pillars of the pension system, we also include early retirement pathways embedded in social security arrangements (e.g. disability and unemployment). In particular, we focus on the following research question: Do increased flexibility and generosity of early retirement schemes imply higher early retirement probabilities for the older working population?

Rather than merely analysing differences in early retirement patterns between European countries, we also investigate whether and to what extent the determinants of early retirement behaviour differ across countries with different institutional settings. We test predictions derived from the job search framework and other theories (e.g. human capital theory, matching theory, lifelong learning theories) as explained in Chapter 3. Three types of variables are included in the analysis: demographic, human capital and job-related characteristics. Demographic variables include age, sex, health and family characteristics such as marital status, the presence of children, spousal characteristics

(e.g. employment and health status) and household income. Human capital variables include educational attainment, experience, wage and participation in training. Job-related variables include the sector of employment, the occupation, self-employment status, the number of weekly working hours and unemployment history. By analysing interaction effects between these variables and the early retirement schemes, we try to answer the following research question: To what extent do increased flexibility and generosity of early retirement schemes affect the exit behaviour of various groups of the working population in a similar or different way?

This chapter is organised as follows. Section 5.2 summarises the main predictions derived from various theoretical approaches discussed in Chapters 2 and 3. Section 5.3 describes the data and the model specification. In Section 5.4 the results are discussed with respect to the effects of demographic variables, family characteristics, human capital indicators and job characteristics on early retirement patterns in the different institutional settings. Section 5.5. concludes with the main findings.

5.2 Early retirement regimes and predicted effects on retirement patterns

In previous chapters we explained that when we want to assess the incentive effects of the early retirement arrangements, we need to take into account their flexibility as well as their generosity. The flexibility mainly concerns how much freedom of choice is involved in determining the timing of the exit as reflected in the entitlement conditions of the various early retirement pathways. These entitlement conditions determine whether and when (i.e. at which age or stage in the life cycle), an early retirement offer is made to the individual. In other words, whether the arrival rate is positive or zero at a certain point in time. When an exit offer is received, the individual evaluates its generosity. Generosity refers to the replacement income associated with retirement, i.e. the early retirement benefits relative to the previously earned wage income. This largely determines the utility derived from retirement. The higher the utility derived from retirement, the higher the likelihood that the retirement offer exceeds the individual's reservation utility and the higher his retirement probability. Therefore, we hypothesise that, ceteris paribus: (1) the more flexible early retirement schemes are, the fewer constraints there are to widely use early retirement options in a country; and (2) the more generous the early retirement schemes are, the more widely early retirement options in a country are used. Before elaborating on the use and spread of the existing early retirement schemes in European countries, we first summarise how the predicted effects might be different for countries with higher early retirement provisions, as presented in Table 5.1. Note that we only report the results briefly here, since a detailed discussion can be read in Chapter 3.

With respect to age it is expected that, for various reasons, both the transition probability into retirement and into social security increase with age. This may be attributed to the larger availability of early retirement options for older workers, and to the fact that the entitlement conditions for retirement and social security are less strict for older workers compared to younger workers. It might also be the case that as people grow older, their preferences shift from work to leisure time even though the opportunity costs for reducing working time are higher due to higher wages as a result of experience rating. Further, for older workers the length of the remaining working career diminishes, thereby raising the preferences for leisure in the current period over leisure in future time periods. We expect these effects to be strongest in countries with most flexible or generous early retirement benefits, since the incentives to quit working (the so-called pull factors) are strongest in these countries: (1) the tighter the entitlement conditions, the weaker the incentives to stop working and the weaker the effects of age; (2) the more generous the retirement offer, the stronger the incentive effects to stop working and the stronger the age effects.

In addition to these age effects, other demographic variables are also expected to affect the retirement decision. Women might have lower early retirement probabilities as they are less likely to meet the entitlement conditions as a result of their discontinuous working careers. This negative gender effect is expected to be less strong in countries with less strict entitlement conditions for women. Some European countries have lower early retirement ages for women or lower minimum bounds for the duration of the contribution period (e.g. Austria, Belgium and Germany). We further anticipate that a bad state of health raises the exit probabilities to retirement and social security, with the strongest effects predicted for the latter. This may firstly be attributed to the fact that a bad state of health leads to a lower productivity and consequently to a higher probability of being laid off. Second, a bad state of health increases the chances of entering a disability scheme, the strongest in countries with least strict entitlement conditions. In Chapter 4 we found that countries differ in the required minimum degree of incapacity to work which is required to claim disability benefits. It ranges from 15 percent in the Netherlands to a 100 percent in Great Britain. It is not difficult to imagine that the lower the required minimum degree of incapacity to work, the higher the likelihood of retirement through the disability pathway. Third, because workers in a bad state of health have a lower life expectancy, this might lead to a shift in preferences to current leisure rather than future leisure (Disney et al., 2003).

The exit probabilities derived from the search model are also affected by household characteristics. The expected utility from retirement is anticipated to depend mainly on the presence of dependents in the household, and on the working and health status of these dependents. When the individual has no partner, parents, or children to take care of, he can basically decide for himself when and how he wants to retire, given his budget

Table 5.1: Predicted effects on exit probabilities

	General effect		Countries with very generous or flexible early retirement schemes	
	p(ret)	p(soc)	p(ret)	p(soc)
DEMOGRAPHIC VARIABLES				
Age	++	+	↑	↑
Female	-			↓
Bad health	+	++	↑	↑
Working spouse	?	-		↓
HUMAN CAPITAL VARIABLES				
Education level	?	-		
Training	-	-	↓	
Experience	?	-	↑	
Wage	?	-		↓
JOB RELATED VARIABLES				
Working in industry		+		↑
Job level	?	-	↑	
Public sector	+	-	↑	
Self-employed	-	–	↓	
Hours worked	?	-		
Unemployment history	-	+		

+/- points to a predicted positive/negative effect of the variable on the exit probability and ↑/↓ points to a stronger/weaker effect for countries with higher early retirement provision.

constraint and the restrictions embedded in the various institutional arrangements. The presence of dependents in the household is expected to reduce the transition into early retirement for the individual who is the main breadwinner, most commonly the husband. Because of the higher income needed to cover the costs associated with the living standard of larger households, the utility derived from work is higher for these individuals. For women, or non-household heads, the effect might be reversed because of their greater caring duties. Finally, theory predicts some ambiguous effects of the presence of a working spouse.[1] While spill-over effects of the spouse's income might encourage the individual to retire early, the complementarity of the spouse's leisure time (the higher utility derived from spending the leisure time together) might prevent him from doing so. The spill-over effect of the spouse's income, however, is weaker or even non-existent for transitions into social security, especially in countries where social security benefits are means-tested (i.e. usually countries where early retirement benefits are low).

In Chapter 3, we argued that the job search theory is inconclusive about the effect of human capital on early retirement behaviour. On the one hand, we predict a negative substitution effect of higher human capital endowments on early retirement due to higher opportunity costs of not working (as a result of the higher wage earned by workers with higher human capital endowments). On the other hand, we predict a positive income

[1]The spouse's working status might potentially be endogenous, something which should be tested.

effect of higher human capital endowments on early retirement, because these also imply a higher income after retirement. Generally speaking, we expect that the higher the replacement rate of early retirement schemes, the higher the likelihood of early retirement due to the positive income effect. Note that the predicted ambiguity in the effects of higher human capital is only true for the transition into retirement; higher human capital endowments are expected to lower the likelihood of transitions into social security. The main reasons for this are non-entitlement due to maximum or means-tested benefits, and a higher attractiveness of other early retirement routes due to a more negative status associated with social security for people with higher human capital endowments.

Though the search theory is inconclusive about the general effects of human capital endowments, we elaborate a little more on some specific parts of the worker's human capital, such as his work experience or participation in training, using other theoretical approaches. For example, from job matching theory it can be derived that a long tenure points to a good match between the worker and the employer, which is less likely to be ended involuntarily compared to a short worker-employer relation (Jovanovic, 1979). In this respect, tenure reduces the likelihood of a transition to unemployment. In addition, in countries where early retirement is related to the length of the contribution period, the longer the work experience, the more likely it is that the individual will retire early. Informed workers who have paid contributions to a pension fund for a sufficient number of years are likely to be the claimants of benefits that they have built up, especially when replacement rates are high (i.e. the income effect is likely to dominate the substitution effect). In addition, from human capital theory it is expected that trained workers stay longer in employment, mainly because of the investments made in human capital that lengthen the pay-back period. In this respect, investments in formal on-the-job training are different from those in education, since these latter investments took place early in the worker's career and the pay-back period might already have ended. Again, this effect of participation in formal training on early retirement is expected to be weaker in countries with generous retirement benefits, where the income effect is expected to be strongest.

Finally, looking at job-related characteristics, from human capital theory we expect older workers in the industrial sector to have a higher transition probability into social security compared to service sector workers. The main reasons are that due to rapid technological progress in the capital-intensive industry, the depreciation of human capital as well as the productivity decline due to ageing is faster than in the labour-intensive service sector. This increases the chances of being laid off and of moving into unemployment. Another factor might be that working in industry is physically more demanding than in the service sector, increasing the likelihood of moving into disability. In some countries special redundancy schemes exist that allow firms to lay off redundant older workers on rather favourable terms (i.e. generous replacement rates). In general, public sector workers have the most generous early retirement schemes and are least likely to

move into social security, since they are usually better protected against job loss than private sector workers. The self-employed, on the other hand, are least protected against income loss due to unemployment or disability, because they are often excluded from public early retirement or social security schemes and private protection schemes are generally inadequate. Nowadays, the self-employed are better protected because in a great number of countries, the self-employed are included (either mandatorily or voluntarily) in public schemes. With respect to job level, the most favourable early retirement schemes were developed for white-collar workers. It is still true that the schemes for the highest occupational groups are known to be most generous. However, the effect of job level on early retirement is ambiguous due to the inconclusive effect of the higher wage. Yet, as Lazear (1979) put forward, the existence of seniority wage agreements, which is most common around higher-level occupations, often results in early retirement agreements that are part of the implicit contract between the employer and the worker. For the employer, such seniority agreements work as an incentive to lay off the older employee because it is likely that the wages exceed the marginal product when the worker becomes older.

The empirical analyses in this chapter show to what extent the predicted effects and the expected differences between countries with different early retirement systems really exist. Before turning to our results, we first give a brief comment on the data, the empirical model and the explanatory variables we have used in our models.

5.3 Data and econometric model

5.3.1 Data

For the analyses, seven waves of the European Community Household Panel Survey (ECHP) covering the years 1994-2000 are used. For a detailed description of the ECHP data, the sample selection procedure and the variables, see the Appendix to this chapter.[2] Only workers aged between 50 and 65 were selected for the analysis. The dependent variable is the transition probability from work to a non-employment state, including early retirement, unemployment, disability and inactivity (i.e. without receiving pension or social security benefits).

For reasons explained in Chapter 3, we restrict ourselves to a model estimated on the pooled cross-sections, i.e. we pool all countries and all years into one data file. This means that we give a first account of exits from employment in this chapter, while controlling for observed heterogeneity among workers. We realise that exits are also likely to be influenced by unobserved heterogeneity among workers, but we postpone this discussion until the next chapter. We include dynamics into the analysis by focussing on two time

[2]The data are provided by Eurostat and used with their permission. However, the data provider bears no responsibility for the analyses or interpretations presented in this study.

periods and modelling the transition from employment at t to another labour market state at $t + 1$. Consequently, we always consider pairs of years, ranging from 1994-1995 to 1999-2000. We focus on yearly transitions, realising that people might change labour market states in between time periods. The focus on yearly transitions is more of a practical nature since we do not have monthly information on all our variables of interest. Moreover, we assume that this is only a 'problem' for transitions in and out of unemployment or inactivity, since transitions into other destinations (e.g. retirement and disability) are more permanent. A closer analysis reveals that about eight percent of people who moved from employment at t to social security at $t + 1$ re-enter employment at $t + 2$. These are predominantly people in their early fifties, the re-entry percentage is reduced to about five percent when we look at people aged 55 or over. For people aged over 50 who were observed to move from employment at t to retirement at $t+1$ only about three percent re-enter employment at $t + 2$. This indicates that retirement is indeed a more absorbing state than social security is. Though we realise that social security might not be as absorptive as we assumed it would be, we still focus on the initial transition out of employment. After all, at least 90 percent of the people who left employment, remain out of employment after initially leaving the labour market.[3]

The focus in this chapter is on analysing differences in retirement patterns between countries with various early retirement schemes. In Chapter 4 we showed that the European countries can be grouped into four different early retirement regimes, ranging from countries that score low on flexibility and generosity of early retirement schemes to countries that score high on these aspects. The country clustering we have derived is as follows:

I	Moderately flexible, ungenerous	Ireland, United Kingdom
II	Moderately flexible, moderately generous	France, Portugal, Greece, Spain
III	Very flexible, moderately generous	Finland, Denmark, Italy
IV	Moderately flexible, very generous	Austria, Belgium, Germany, Netherlands

In brief, for the clustering we included two types of exit routes for older workers. First, we looked at the existence and generosity of specific early retirement schemes, either in the first (public), the second (occupational) or third (private) pillar of the pension system. To assess the development of the second and third pillar pension arrangements in Europe, we relied on the evidence on both the coverage ratio (i.e. the percentage of the working population covered by an occupational or private pension) and the amount of pension assets as a percentage of Gross Domestic Product (European Commission, 2003a). To assess the generosity of all schemes, we included the average replacement income offered by the early retirement schemes (Blondal & Scarpetta, 1999; Hansen, 2000). When we

[3]In order to see whether allowing for re-entry makes a difference, we also estimated models excluding people who re-enter into employment from $t+1$ to $t+2$ after having left from t to $t+1$. The results are not significantly different.

only consider these early retirement schemes, we find that Ireland has the lowest early retirement benefits, whereas Sweden has the highest. The latter country is characterised by a truly flexible pension system that allows early retirement from the age of 61 until the age of 70, with no additional entitlement conditions. In Ireland, early retirement is possible only with the support of private schemes, which offer rather poor benefits and, hence, low replacement rates. Second, to account for the fact that some early retirement options are embedded in more general social security arrangements, such as disability or unemployment, we used the replacement rates belonging to these exit routes as indicators for their generosity. Entitlement conditions are relaxed for older workers in nearly all countries, making it difficult to draw conclusions regarding the differences in the prevalence of early retirement options between the various systems. Therefore, we only included the generosity of the schemes and assumed that these early retirement routes were prevalent in all countries. We find that the United Kingdom has the lowest generosity of social security schemes, whereas the Netherlands offers the most generous social security benefits to older workers. The latter country is well known for its generous social security arrangements, while the United Kingdom with its liberal policies provides rather low benefits only to those in need.

We will examine to what extent retirement patterns and determinants of early retirement behaviour are different between these regimes. Before moving to the results, though, we first explain the econometric model that we used for the analysis.

5.3.2 The econometric model

The dependent variable in the analysis is the transition probability from work to a non-employment state, including early retirement, unemployment, disability and inactivity. Empirically, this probability is further specified as

$$P(Y_{it} = j) = X_{it}\beta_t + \varepsilon_{it} \tag{5.1}$$

Several methods can be used to estimate this probability and we have decided to use a multinomial logit model. In Chapter 3 we explained that the multinomial logit model is appropriate here when analysing a limited dependent variable with multiple outcomes.[4] The multinomial model estimates the relative probability of entering a particular retirement state j in the next period $t + 1$, conditional on being in employment in the current period t and relative to remaining employed. The destination states j are defined as

[4]We also explained that a possible problem with this approach is the assumption of independent irrelevant alternatives (IIA). However, we tested for this by removing some of the choice alternatives and reviewing the estimates, which were not systematically different between the models. This leads us to think that the assumption of IIA is not problematic in our empirical application. In further studies we will try to use more appropriate models, such as a nested logit model or a multinomial probit model, that do not include the IIA assumption.

follows (for a full description on the construction of the states see the Appendix to this chapter):

$j = 0$ if no transition out of employment is observed in $[t, t+1]$ - reference
$j = 1$ if transition to social security is observed in $[t, t+1]$
$j = 2$ if transition to retirement is observed in $[t, t+1]$
$j = 3$ if transition to inactivity is observed in $[t, t+1]$

The probability to move from employment into state j is specified as follows:

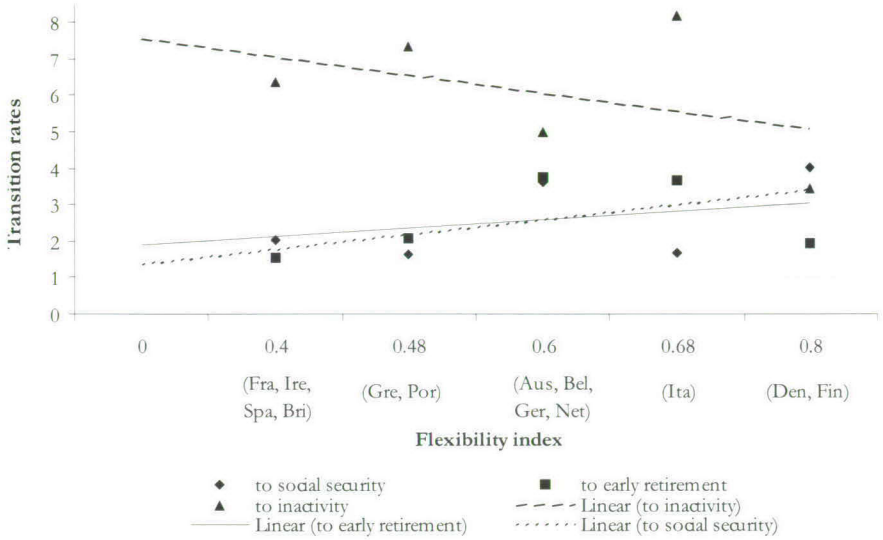
$$P(Y_{it} = j) = \frac{exp(\sum_{k=1}^{K}(\beta_{0j} + \beta_{jk}X_{itk}))}{1 + \sum_{j=1}^{J-1} exp(\sum_{k=1}^{K}(\beta_{0j} + \beta_{jk}X_{itk}))} \tag{5.2}$$

where $i = 1, \ldots, N$ is the number of individuals, $t = 1994, \ldots, 2000$ is the number of time periods, $j = 1, \ldots, 4$ is the number of destination states, K is the number of explanatory variables summarised in vector X, β_{0j} is the destination-specific intercept, β_{jk} is a vector of estimated destination-specific coefficients. Variables in this vector include demographic variables (e.g. age, sex, health, and family characteristics such as marital status, working status of the spouse, the presence of children and the household income), human capital variables (e.g. education level, tenure, participation in training), job-related variables (e.g. business sector, hours worked, occupation, self-employment status, unemployment history), early retirement regime dummies and business cycle effects (for summary statistics on these explanatory variables see the Appendix to this chapter).

A methodological issue that deserves some attention is the issue of panel attrition. Panel attrition refers to individuals dropping from the sample. This is only a problem when such attrition is non-random. For example, one might suspect that people who retire are more likely to drop out of the sample than people who remain employed. Yet, no evidence is found for such non-random attrition when reviewing the literature. To test whether panel attrition is random or not, one could jointly estimate the probability of attrition and the probability of exit out of employment, to account for the possible correlation of the unobserved characteristics. However, at this point, we choose not to model the possible selective attrition of the individual from the panel.[5] By including as many individual characteristics as possible, we hope to minimise the problem.

[5]We first estimated a model in which we included 'missing' as a separate destination state. Subsequently, we estimated the model without this destination state, to see whether this systematically changed the estimation results. One could say we tested for the IIA, with 'missing' as the irrelevant alternative here. The estimates were not systematically different, for which reason we excluded the panel leavers from our analysis.

Figure 5.1: Transition rates into early retirement for workers aged between 50 and 64, by the level of flexibility of the early retirement system



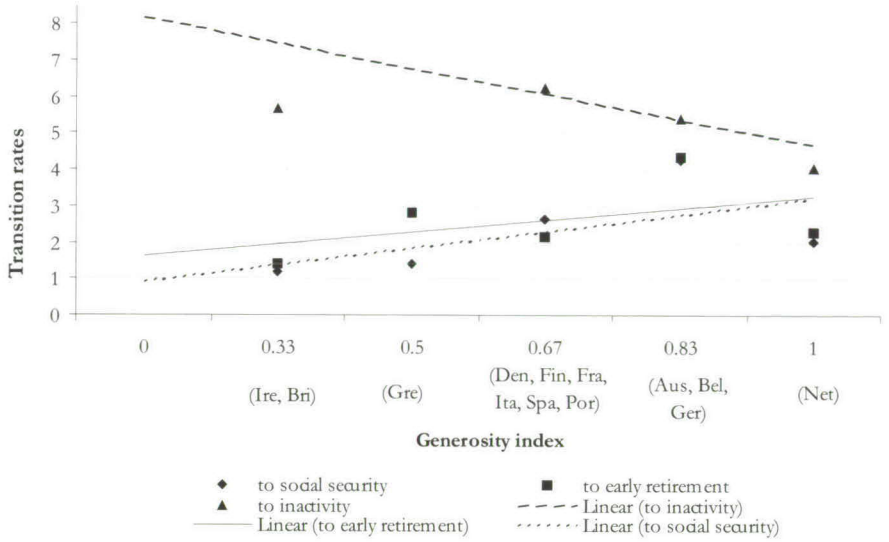
Source: own calculations ECHP 1994-2000

5.4 Early retirement patterns in Europe

5.4.1 Regime differences in early retirement patterns

We start this section by providing some empirical evidence on the two hypotheses put forward in the introduction of this chapter. In other words, on the predicted positive relation between the level of flexibility and generosity of early retirement systems and the exit probability. We present transition rates concerning transitions to the various early retirement states in Figure 5.1. On the x-axis we present the flexibility index as explained in Chapter 4, with a higher index pointing to a higher flexibility (index ranges from zero to one). Weighted average transition rates are calculated for each of the country clusters that have the same score on the flexibility index. Linear regression lines through the scatter-plots are also plotted and we find that both the transition rates into early retirement and into social security are positively associated with the level of flexibility of the early retirement system. In addition, we find that Austria, Belgium, Germany and the Netherlands (countries with moderately flexible early retirement systems), have above average transition rates. As explained earlier and as will be seen in Figure 5.2, these are countries with very generous early retirement benefits. We also find some interesting differences within the 'highly flexible' group of countries. In Italy, transition rates into early retirement are above average, while transition rates into social security are below average. This contrasts with the results for the two Scandinavian countries within this

Figure 5.2: Transition rates into early retirement for workers aged between 50 and 64, by the level of generosity of the early retirement system

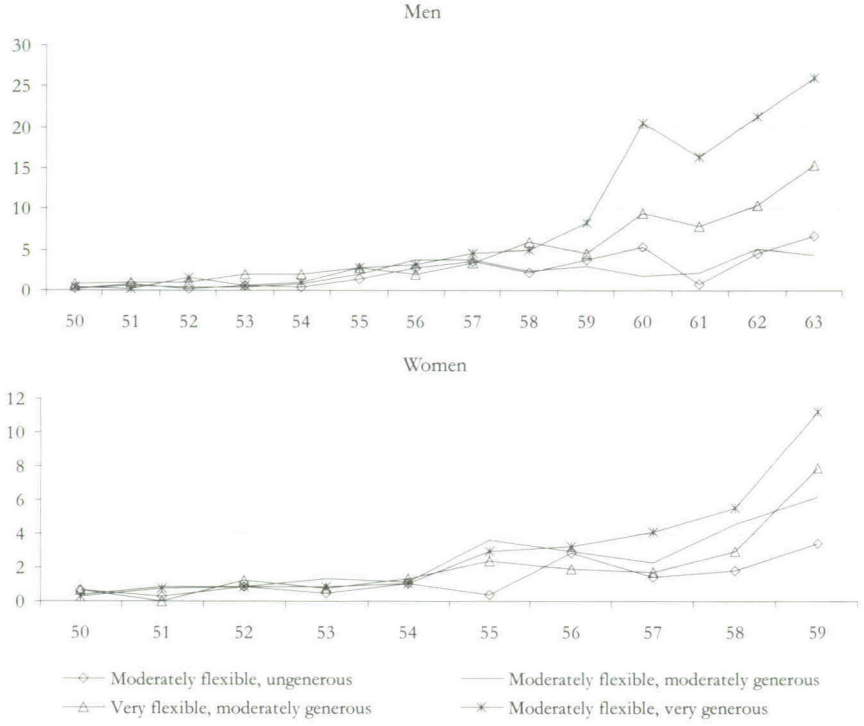


Source: own calculations ECHP 1994-2000

cluster, Denmark and Finland. Again, as we will see below, this is caused by the difference in generosity of the early retirement schemes between Italy and the Scandinavian countries. In addition to the transition rates into early retirement and social security, Figure 5.1 shows the transition rates into inactivity. We find a negative relation between the flexibility of the early retirement system and the transitions into inactivity. In countries where early retirement is most inflexible, workers have almost no choice but to move to inactivity if they want to retire early. When early exit opportunities are available, however, transitions into inactivity become less frequent. Italy seems to be an outlier in this respect, though we suspect that the high percentage of transitions into inactivity might be explained by the low generosity of the Italian social security system.

Figure 5.2 shows the relation between the level of generosity of the country's early retirement system and the early retirement incidence. On the x-axis we now present the generosity index as explained in Chapter 4, with a higher index pointing to a higher generosity (index ranges from zero to one). Weighted average transition rates are again calculated for each of the country clusters that have the same score on the generosity index. We find more or less the same picture as before, with increasing transition rates into early retirement and social security for countries with more generous early retirement systems. We now find that the Netherlands is a bit of an outlier within the cluster of countries with highly generous early retirement schemes, with below average transition rates into early retirement and social security. This is likely to be due to the moderate

Figure 5.3: Hazard rates into early retirement by sex and regime type, 1994-2000

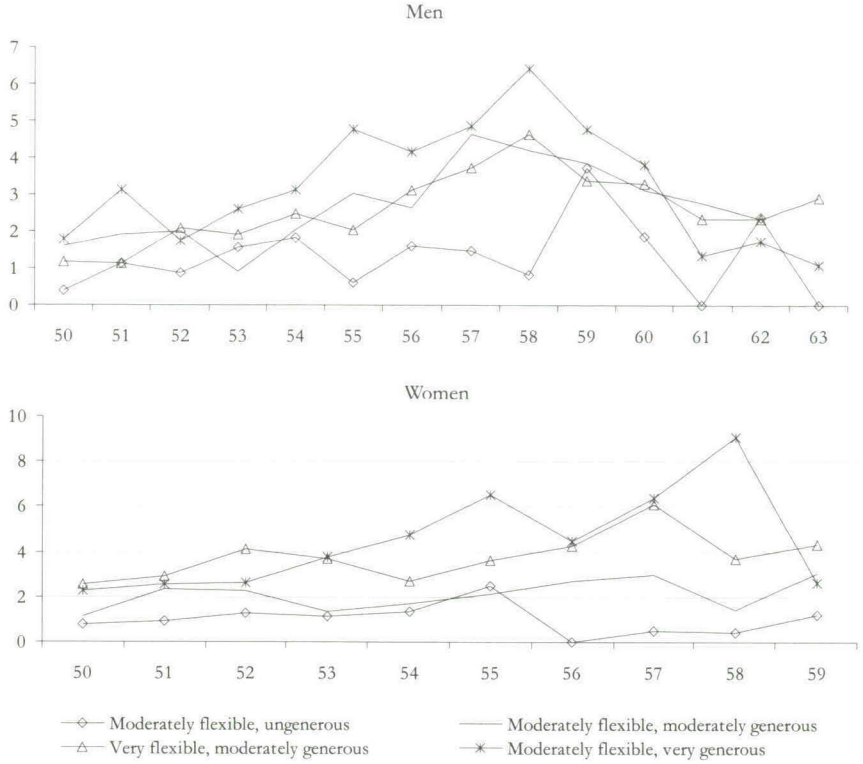


Source: own calculations ECHP 1994-2000

level of flexibility of the Dutch early retirement schemes. Notwithstanding the variety within the clusters, we conclude that our early retirement index picks up differences in early retirement transition rates fairly well. The empirical analysis will reveal to what extent these differences are also significant.

Next, we discuss the hazard rates into the various exit destinations by age and regime type. Figure 5.3 shows both male and female hazard rates into retirement (i.e. not employed and receipt of pension benefits). For women we only depict hazard rates until the age of 60, since in many countries the official retirement age is lower for women. For both men and women we find that the hazard of a transition into early retirement increases with age, but with the rate of this increase being larger for men. In addition, from the age of 58 we clearly observe increasing hazard rates in countries with very generous or very flexible early retirement schemes. For example, over 15 percent of men aged 60 and above move into retirement in countries with very generous early retirement benefits, whereas this is below five percent for workers this age in countries with ungenerous early retirement benefits. We also find spikes in the male hazard rates at the age of 60, which is a common minimum age in early retirement schemes as explained earlier. Although the same pattern is observed for women, differences between the regimes are less pronounced.

Figure 5.4: Hazard rates into social security by sex and regime type, 1994-2000

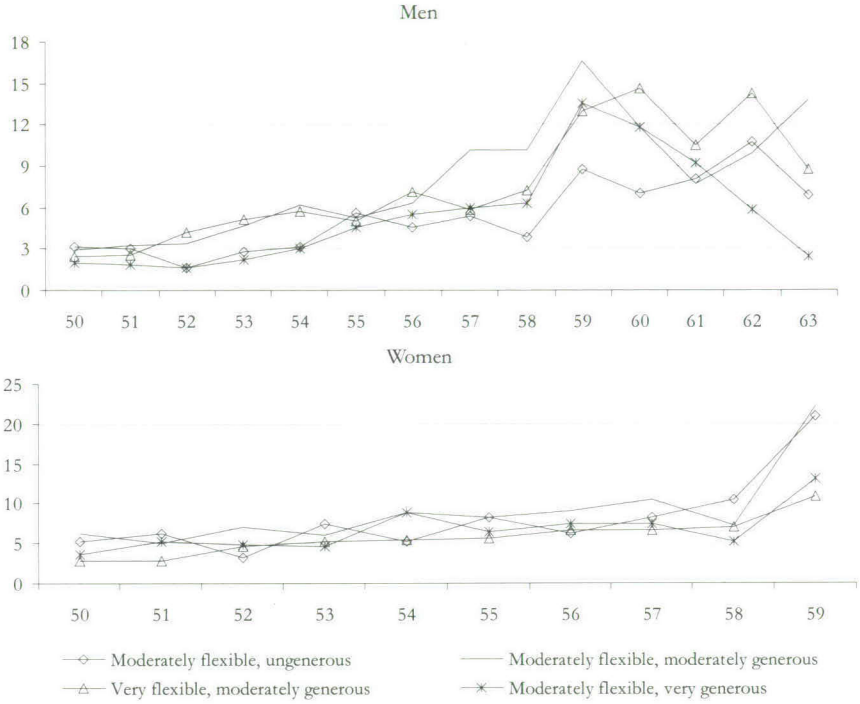


Source: own calculations ECHP 1994-2000

In general, female transition rates into retirement are much lower, mainly because women are less likely to meet the entitlement conditions of early retirement schemes because of discontinuous working careers. Figure 5.4 shows the hazard rates into social security, and we conclude that these show a much less straightforward picture compared to the early retirement figures.[6] We now observe hazards into social security without a clear increasing trend with age. Here too, some interesting results are found. First, we do find some support for our ranking of countries in regime types, although less pronounced than with early retirement. Second, for men there seems to be a kind of substitution effect of social security exit by retirement exit at the age of 58: hazard rates into social security decrease as from that age, whereas those into early retirement seem to accelerate. This effect seems strongest for countries with very generous early retirement benefits. Third, at age 58 we observe a spike in the male social security hazard rates in countries with very generous or very flexible early retirement systems. We have shown that entitlement conditions for unemployment are less tight from this age in these countries, which might

[6]Male hazard rates for countries with ungenerous early retirement systems (regime I) are insignificant from the age of 61, due to an insufficient number of observations.

Figure 5.5: Hazard rates into inactivity by sex and regime type, 1994-2000



Source: own calculations ECHP 1994-2000

explain this spike. Fourth, we clearly find lowest hazard rates for women in countries with ungenerous early retirement systems. This is explained by the means-test that is present in the social security systems in these countries. The majority of women are not entitled to social security benefits because of their working spouses.

Finally, Figure 5.5 shows hazard rates into inactivity. Again we find that after the age of 58, hazard rates increase, though less pronounced as with early retirement. It can be concluded that hazard rates into inactivity for countries with most generous early retirement systems are lowest, whereas those for countries with ungenerous early retirement systems are among the highest. There seems to be a substitution between formal early retirement schemes and becoming inactive without benefits (informal early retirement). For women, we find almost stable and equal hazard rates across all countries, on average at a higher level compared to those of men. We observe a spike at age 59, which is strongest in the countries with inflexible and ungenerous early retirement systems and smallest in countries with most generous and most flexible systems. Again, this points to a potential substitution effect between the formal and informal early retirement routes.

Using the multivariate multinomial logit models, we now examine the determinants of early retirement and consider the impact of regime type on the various exit routes.

5.4.2 Regime differences in determinants of early retirement

Our general model is presented in Table 5.2. This model does not yet contain any interaction effects with regime, such models are estimated separately and presented in Table 5.3. Regime I, representing countries with ungenerous and moderately flexible early retirement systems, is the reference category. We further estimated models for men and women separately, but only relatively small differences are found. Where necessary, however, we report on the observed differences in the model estimates for males and females. We start by discussing the regime differences with regard to the effects of the individual and household characteristics on early retirement exit.

Regime differences in the effect of individual characteristics

The observed age patterns in the hazards into retirement and social security, shown in Figures 5.3 and 5.4, seem to be largely significant when considering the model estimates. We find strongest effects for the transition into retirement and we also find some indication for presence of a substitution effect between social security and early retirement routes. The positive effect of age on the transition into social security is smaller for people aged 60-64 compared to that of people aged 55-59. The effect on the retirement hazard for the oldest group, however, is significantly stronger, which might mirror the substitution effect of social security exit by retirement at those ages. Looking at differences between the regime types, which is the main focus in this chapter, we find that the social security hazard for workers aged between 50 and 54 is least strong in countries with where early retirement is ungenerous and moderately flexible (Ireland and Great Britain.[7]) Even when the entitlement conditions are relaxed, this happens only from the age of 55 or over. In other countries, the age at which relaxed conditions apply has sometimes already been set at 50. The other effects of age on the social security hazard are not significantly different between the various regimes types. We do find, however, that the above-mentioned substitution effects for the oldest age groups are mainly present in Regimes II and IV, where estimated coefficients are negative, though insignificant.

In addition, the retirement hazard is strongest for countries with very generous early retirement benefits (regime IV), with the largest effect for workers aged between 60 and 64. We already observed this result in Figure 5.3 where we found that from the age of 59 the retirement hazard for this regime type is significantly higher than for the other regime types. We have already explained that the higher generosity of early retirement benefits is likely to 'pull' older workers out of the labour market, into early retirement. In addition, we find a significant higher transition probability into retirement for people aged between 50 and 54 in countries with highly flexible and moderately generous early retirement systems (regime III). A closer inspection reveals that this is a sort of 'Italian

[7]Our data only concern Great Britain, rather than the complete United Kingdom.

Table 5.2: Estimation results of the multinomial logit model for transitions out of work into social security, early retirement or inactivity, 1994-2000 ECHP, older workers aged 50-64

	To social security		To retirement		To inactivity	
	Coeff	p>|z|	Coeff	p>|z|	Coeff	p>|z|
Age 50-54	Reference		Reference		Reference	
Age 55-59	0.717***	(0.00)	1.530***	(0.00)	0.757***	(0.00)
Age 60-64	0.678***	(0.00)	2.851***	(0.00)	1.273***	(0.00)
Female	0.063	(0.43)	-0.057	(0.47)	0.417***	(0.00)
Bad health	1.044***	(0.00)	0.563***	(0.00)	0.270***	(0.00)
Average health	Reference		Reference		Reference	
Good health	-0.581***	(0.00)	-0.175**	(0.01)	-0.099**	(0.02)
Married	-0.163	(0.27)	-0.056	(0.72)	0.137	(0.12)
Was married	-0.239	(0.18)	0.711***	(0.00)	-0.388***	(0.00)
Never married	Reference		Reference		Reference	
Has children	0.284**	(0.00)	0.091	(0.32)	-0.147**	(0.02)
Other hh income	-0.002	(0.59)	0.011***	(0.00)	-0.004	(0.14)
Low education	0.070	(0.42)	0.041	(0.64)	-0.015	(0.77)
Med education	Reference		Reference		Reference	
High education	-0.189	(0.15)	-0.045	(0.70)	-0.216***	(0.00)
Training	0.097	(0.34)	-0.270***	(0.01)	-0.192***	(0.00)
Duration < 1 yr	0.967***	(0.00)	0.651***	(0.00)	0.641***	(0.00)
Duration 2-9 yrs	Reference		Reference		Reference	
Duration > 10 yrs	-0.164*	(0.06)	0.146	(0.13)	0.164***	(0.00)
Wage	-0.042***	(0.00)	-0.013	(0.14)	-0.003	(0.60)
Private non-service	Reference		Reference		Reference	
Private services	-0.360***	(0.00)	-0.095	(0.25)	-0.099**	(0.05)
Public sector	-0.454***	(0.00)	0.080	(0.39)	-0.239***	(0.00)
Self-employed	-0.707***	(0.00)	-0.163*	(0.06)	-0.405***	(0.00)
Managers and profs	-0.267**	(0.04)	-0.167	(0.14)	-0.237***	(0.00)
Technicians	0.008	(0.95)	-0.118	(0.32)	-0.051	(0.48)
Clerks and service	-0.128	(0.19)	0.030	(0.75)	0.023	(0.68)
Other (blue-collar)	Reference		Reference		Reference	
Part-time work	0.132	(0.18)	0.461***	(0.00)	0.269***	(0.00)
Was unemployed	0.820***	(0.00)	-0.157	(0.13)	0.105*	(0.07)
Regime I	Reference		Reference		Reference	
Regime II	0.566***	(0.00)	-0.026	(0.84)	0.221***	(0.00)
Regime III	0.947***	(0.00)	0.794***	(0.00)	0.111	(0.11)
Regime IV	1.533***	(0.00)	1.129***	(0.00)	0.039	(0.60)
Year 1995	-0.251**	(0.02)	-0.345***	(0.00)	-0.014	(0.83)
Year 1996	-0.113	(0.27)	-0.127	(0.20)	-0.118*	(0.07)
Year 1997	-0.242**	(0.02)	-0.365***	(0.00)	0.029	(0.65)
Year 1998	-0.382***	(0.00)	-0.395***	(0.00)	-0.061	(0.30)
Year 1999	-0.775***	(0.00)	-0.657***	(0.00)	-0.229***	(0.00)
Constant	-3.629***	(0.00)	-4.560***	(0.00)	-2.913***	(0.00)

* indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$. Number of observations: 56264, Log pseudo-likelihood = -21000.777, Pseudo R2 = 0.0982.

effect'. Transition rates from employment to retirement at age 50-54 are 1.7 in Italy compared to 0.2 in Finland and 0.3 in Denmark, all countries within the same cluster. On average, taking into account all the countries concerned, transition rates from employment to retirement at age 50-54 are about 0.6. These findings are supported by findings of Spataro (2002, p.32), who also found higher hazards into retirement even at ages before

Table 5.3: Estimation results of the models with interaction effects (multinomial logit) between some variables of interest and regime type on transitions out of work into social security or early retirement, 1994-2000 ECHP, older workers aged between 50 and 64

	To social security				To early retirement			
	I	II	III	IV	I	II	III	IV
Age 50-54	ref	0.55***	0.85***	1.37***	ref	-0.36	0.73***	-0.133
Age 55-59	0.44*	0.17	0.21	0.47*	1.14***	0.46	-0.03	1.00***
Age 60-64	0.75**	-0.21	0.21	-0.26	1.99***	0.47	0.27	2.23***
Male	ref	0.63***	0.75***	1.56***	ref	-0.03	0.89***	1.14***
Female	-0.04	-0.20	0.54*	0.02	-0.03	0.09	-0.19	0.03
Bad health	1.74***	-0.31	-0.72*	-1.14***	0.71	-0.48	-0.64	0.33
Avg health	ref	0.28	0.88***	1.59***	ref	-0.22	0.45*	0.82***
Good health	-1.01***	0.68**	0.42	0.32	-0.60**	0.37	0.66**	0.38
Married	-0.69*	0.90*	0.39	0.33	-0.26	0.47	0.50	-0.26
Was married	-0.59	0.66	0.64	-0.16	0.75	0.67	-0.10	-0.88
Never married	ref	-0.24	0.58	1.31***	ref	-0.50	0.44	1.52***
No children	ref	0.69***	1.04***	1.60***	ref	-0.01	0.79***	1.10***
Children	0.83**	-0.86**	-0.59	-0.46	-0.53	0.26	0.82	0.73
Other hh inc	-0.01	0.03	0.02	0.01	0.02***	0.01	-0.01	-0.02**
Low education	0.39	-0.49	-0.52	-0.19	-0.63**	0.39	0.81**	0.85***
Med education	ref	0.91**	1.30***	1.71***	ref	0.01	0.57**	0.88***
High education	-0.45	0.09	0.14	0.29	0.23	-0.53	-0.78**	-0.41
No training	ref	0.57***	0.90***	1.53***	ref	0.04	0.97***	1.20***
Training	-0.05	-0.35	0.36	0.15	0.05	0.19	-0.81**	-0.14
Dur < 1yr	0.58*	0.34	0.50	0.52	0.32	0.48	0.37	0.30
Dur 2-9 yr	ref	0.61**	0.94***	1.47***	ref	-0.49**	0.22	0.56***
Dur > 10 yrs	0.17	-0.42	-0.39	-0.28	-0.77***	0.93***	1.08***	1.08***
Wage	-0.15***	0.12***	0.13***	0.09*	0.01	-0.01	-0.03*	-0.09
Industry	ref	0.46**	0.90***	1.58***	ref	0.33	1.22***	1.46***
Priv services	-0.49*	0.24	0.14	-0.09	0.34	-0.53*	-0.45	-0.49*
Public services	-0.70*	0.30	0.17	0.11	0.64**	-0.57*	-0.76**	-0.47
Not selfemp	ref	0.59***	1.04***	1.55***	ref	-0.19	0.64***	1.05***
Self-employed	-0.62*	-0.10	-0.50	0.16	-0.87***	0.77**	0.82***	0.35
Manag or Prof	-1.40***	1.46***	0.56	1.28***	0.59*	-0.66*	-0.92***	-0.87**
Technicians	-1.05*	1.39**	1.30**	0.90	1.39***	-1.39***	-1.96***	-1.59***
Clerks or serv	-0.47	0.43	0.57*	0.16	0.96***	-0.90	-1.25***	-0.85***
Other occup	ref	0.20	0.63***	1.29***	ref	0.58***	1.59***	1.80***
Fulltime (32+)	ref	0.57***	0.84***	1.58***	ref	-0.01	0.93***	1.28***
Part-time	0.139	-0.01	0.41	-0.32	0.70***	0.11	-0.33	-0.58**
No unemp hist	ref	0.38**	0.78***	1.47***	ref	0.16	1.05***	1.30***
Unemp history	0.50*	0.51*	0.46	0.18	0.47*	-0.61*	-1.26***	-0.49*

* indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$. Estimation of these models has been as follows: we estimated full models including transitions to inactivity, with one interaction effect at the time. For example, one model consists of interaction effects between regime type and gender, another model consists of interaction effects between regime type and age and so on. The results for the transition to inactivity are omitted to enhance readability of the table.

55. We have already shown that generosity of early retirement is as high in Italy as in the countries within regime IV, but that it is the lower generosity of social security that made Italy fit better within the third cluster of countries. We argue that this also signals the effects of a strongly regulated and segmented labour market with low entry rates into jobs for young people and low mobility rates in general. The early retirement options seem to constitute a tool for firms to increase mobility by allowing older workers to leave

and be replaced by younger workers. The macro-economic outcome is a very expensive pension system that is not sustainable in the long run, which is likely to be the reason why the Italian pension system is currently under review.

As far as gender differences are concerned, neither the general model nor the interaction models show significant differences in early retirement patterns between men and women. The observed differences between men and women in Figures 5.3 to 5.5 are not significant when controlling for other background characteristics of male and female workers, with the exception of the hazard into inactivity, which is significantly higher for women. In Chapter 4 mention was made of the fact that early retirement schemes are most aimed at men, who generally belong to the working population. Additionally, even early retirement options as part of the social security system often require a minimum number of working years, a criterion that women find more difficult to meet. Moreover, women are generally not entitled to means-tested benefits because of their working spouses. The inability to meet the conditions of the formal schemes forces women to leave employment without sufficient replacement income. Some authors do find some gender differences, that also point in this direction. For example, both in the Netherlands and Germany, women are found to have lower exit probabilities (to retirement or to social security) compared to men of the same age (Heyma, 1996; Siddiqui, 1997; Oswald, 1999). Our regime interaction model shows that women in countries with highly flexible early retirement schemes (regime III) have a higher probability of moving to social security. A closer inspection of the data reveals that this is a 'Scandinavian effect'. Female transition rates from employment to social security are over three percent in Finland and Denmark while these are only about two percent on average in Europe. Female labour participation has been encouraged strongly in Scandinavian countries which has resulted in high female employment rates for several decades now. Consequently, female workers no longer have a disadvantaged position with respect to fulfilling the entitlement conditions related to past working experience, thereby explaining the difference with other countries. In addition, when estimating interaction effects between gender and age, we found that women aged between 50 and 54 have a significant lower probability of moving into retirement compared to men of the same age. This is most likely to be explained by the fact that women of this age are not (yet) likely to meet the entitlement criteria with respect to the minimum required number of contribution years as a result of their discontinuous working careers. We also estimated interaction models between gender and other covariates of interest, and these will be discussed later in this chapter.

Apart from age, another strong predictor of early exit found in almost all studies on retirement incentives is a bad state of health. Early exit as a result of a bad state of health is socially more acceptable and, traditionally, disability pensions were developed first, allowing retirement as a consequence of declining health. Based on the estimation results of our general model, we would indeed conclude that having a bad state of health increases

the exit probabilities to all destinations and a good state of health prevents workers from moving out of employment before the official retirement age. We find that these effects are strongest for the social security hazard. Kerkhofs et al. (1998) investigated this in more detail and found that people in disability are likely to overstate their health problems. They probably do so to keep their benefit rights. People in retirement, however, are likely to understate their health problems, possibly because there is no relation between the entitlement to benefits and their health status. When we now look at our regime interaction models, we find some interesting differences. First, we find that the positive effect of bad state of health on the social security hazard is significantly strongest in the regimes I and II, and weakest in regimes III and IV. This is most likely explained by the tightness of the entitlement conditions for social security, in particular for disability in the countries with the least flexible early retirement schemes (e.g. regime I and II). The tighter the entitlement conditions for entering social security, the stronger the differences between people in a bad state of health and people in good health, since only people with serious health problems can apply for disability benefits in tight systems. In Chapter 4 we showed that in the countries within regime I (Ireland and Great Britain) a worker has to loose a 100 percent of his earnings capacity to claim disability benefits, while this was only 15 percent in the Netherlands, which belongs to regime IV. This also explains the significant higher transition probability to social security of people in average health in regime III and IV. A minor health problem is sufficient to be able to claim disability benefits and to retire from the labour force. Oswald (1999) also estimated retirement transitions for countries with different entitlement conditions. She included Great Britain (a regime I country) and Germany (a regime IV country) in her analysis and found that health effects are strongest in Great Britain, which supports our findings.

Second, for workers in good health we find a more stable participation in work. Even in regimes with the least tight entitlement conditions for social security or retirement benefits, we find a disincentive to move to social security or retirement. Workers in good health might still experience wage increases associated with seniority or productivity increases, raising the opportunity costs of not working. The disincentive effect on the transition into retirement for workers in good health is not found in countries with very flexible but moderately generous early retirement schemes. A likely explanation is that the high flexibility of the early retirement schemes pulls the healthy older workers out of employment. It might be expected that the aforementioned seniority wage systems are less strong in the regime III, including the Scandinavian countries that are less regulated and stratified (i.e. fewer wage differences due to age or tenure) which might explain the absence of this 'opportunity costs'-related disincentive effect. In this respect it is interesting to note the result of the estimation of a model that we used to test for the effect of the interaction between age and health. We find that the lower probability to exit through retirement for workers in good health is only significant for the 55 to 59 year

Table 5.4: Estimation results of the multinomial logit models for couples only, 1994-2000 ECHP, older workers aged between 50 and 64

	General model	
	To social security	To retirement
Spouse employed, t	-0.222 (0.00)***	-0.292 (0.00)***
Spouse retired from t to $t+1$	-0.836 (0.00)***	-1.389 (0.00)***

	Interaction models							
	To social security				To retirement			
	I	II	III	IV	I	II	III	IV
Spouse employed, t								
No	ref	0.56***	0.72***	1.60***	ref	0.05	1.16***	1.53***
Yes	-0.40	0.15	0.47	0.06	0.09	-0.13	-0.46	-0.60**
Spouse retired from t to $t+1$?								
No	ref	0.69	1.10***	1.21***	ref	-0.44	0.64**	0.43
Yes	-0.94*	-0.12	0.15	0.30	-1.68***	0.28	0.11	0.06

* indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

old workers and not for workers aged above 60. Workers aged below 60 might still count on the earlier mentioned wage increases, whereas workers aged over 60 prefer retirement. They have higher replacement rates due to a longer contribution period and stronger preferences for leisure.

Regime differences in the effect of household characteristics

A second group of demographic predictors of early retirement patterns relates to household characteristics. With the number of dual-earner couples increasing in most countries, a growing number of studies focus on the incentives built into the various systems to retire, particularly within a household context (Blau & Riphahn, 1999; Coile, 2002; Michaud & Vermeulen, 2004). While the majority of these studies uses a joint utility model of retirement behaviour, taking into account the interaction between both spouses' behaviour, we include only a few household indicators in our model to get a first impression of the direction and size of the household effects. In our analysis, we first included marital status though this did not show any meaningful results. The only thing we found is that workers who were previously married and are now divorced or widowed have a higher probability to retire. We suspect that this might be related to the existence of alimony payments and widower's pensions. A closer inspection revealed that this is mainly a gender effect holding for females only, which supports the underlying idea. Rather than including marital status, however, it would be more interesting to look at the effects of the spouse's labour market status on the individual's retirement behaviour. To analyse this, we estimated models only for couples, and the results are presented in Table 5.4.

In general, we find that having a working spouse (at time t) reduces both the probability to move to social security (because the persons are not entitled due to the spouse's

income) and the probability to retire, with the latter being strongest. This supports the 'assorting mating' idea explained in Chapter 3 that people tend to marry partners with the same work-leisure preferences. Our results are in line with those found by Heyma (1996), Spataro (2002) and Deschryvere (2005), but contrast with those found by Miniaci and Stancanelli (1998). They found for Great Britain that having a working spouse increases the likelihood of retirement. It seems that in Great Britain the 'spill-over effect' of the spouse's income is dominant, supporting the individual's retirement decision. When we look at the regime differences in our interaction models, we find that the negative effect of having a working spouse on the retirement hazard is not found in regime I, of which Great Britain is a member. In fact, the effect on the retirement transition is predominantly present in countries with very generous early retirement schemes (regime IV). A closer investigation revealed that this effect is significantly strongest for women. Apparently, regardless of the high generosity of the retirement benefits in these countries, it turns out that older women with a working spouse prefer to continue working, which supports the 'assortative mating' argument. To take the analysis one step further, we included a dummy for a change in the spouse's working status from employment at t to non-employment at $t+1$. In doing so, we get an impression of the impact of the existence of 'joint retirement decisions' within the households. We now find a stronger attachment to the labour force in the case where the spouse continues to work, with no significant differences between either the regimes or the sexes. This indicates that retirement is indeed a joint decision of the couples, which supports earlier findings of Michaud and Vermeulen (2004). A next step would be to estimate such a joint utility model and to investigate how household effects differ between the various European countries, which goes, however, beyond the scope of this study.

Looking at the effects of household income, we decided to include the variable 'other household net income', which refers to total net household income minus the individual's own labour income. This income measure deals with income sources other than the individual's earnings (e.g. non-labour, other household members' labour income) acting as a buffer against income loss due to early exit. Naturally other household members' labour income is related to the employment status of the spouse, and some of the conclusions discussed earlier apply here too. Theoretically it is presumed that the higher this other income is, the fewer incentives there are to continue working. Note that the effect of the individual's own income on early exit is controlled for by including his wage, as will be discussed later. We indeed find that other household income increases the probability to retire. This effect is significantly smallest in the regime with the most generous early retirement schemes (regime IV), where it is least necessary to use own income sources to make a living after retirement because of the generosity of the existing early retirement schemes.

Finally, having children (below the age of 16) generally increases the transition into

social security and reduces the transition into inactivity. The first effect is slightly odd because to be able to support the children, the worker is better off remaining in employment. It might however reflect the involuntary nature of the transitions into unemployment or disability. It also explains the negative effect on the inactivity transition rate, because the income through social security (or continued work) is needed to support the children. The effect on social security exit seems least strong in regime II, countries with moderately flexible and moderately generous early retirement schemes. This might be due to the lack of child allowance, or the existence of ungenerous child allowance benefits in the southern countries belonging to regime II. In other studies, either no account is taken of the presence of children or no significant results were found (e.g. Oswald, 1999). One reason for this might be that children of workers aged over 50 are likely to be at school age already, meaning that for the family involved the care workload is much lower than in the case where the children are still very young.

Regime differences in the effects of human capital indicators

The reported effects of education level are net of any effects that operate through work experience, job level (i.e. occupation) and wages. Following Blau (1994), the observed effects are therefore likely to represent differences in preferences for work or early retirement. In general, we do not find any significant effects of the education dummies, apart from a negative effect of a high education level on the transition into inactivity. This suggests that the higher educated have a higher preference for paid work or 'paid' retirement (receiving either pension benefits or social security benefits), probably to regain the investment in the higher education. The regime interaction models do show some effects. In regime I, low-educated workers are least likely to retire early, which is most likely due to the fact that the early retirement schemes are least generous. This effect is significantly lower and even positive in regimes III and IV, where early retirement schemes are either very flexible or very generous. Opportunities to retire are more readily available and pension replacement rates are higher in these latter regimes, enabling low-educated workers to retire early. In addition, we find that high-educated workers are more persistently employed in regime III. This is in line with findings of other studies in countries within these regimes (e.g. Deschryvere, 2005 for Finland and Pedersen & Smith, 1996 for Denmark). In contrast to other authors that point to similar effects for countries within regime IV (e.g. Antolin & Scarpetta, 1998 and Oswald, 1999 for Germany; Deschryvere, 2005 for Belgium), we do not find significant effects. When we do not control for effects that operate via wages, job level or work experience, as shown in Table 5.5, the model shows that workers with a low education level are more likely to become social security recipients and that workers with high education levels are more persistently employed. We conclude that to investigate a pure education effect (i.e. different preferences for people with different education level), one needs to account for the indirect effects of education

Table 5.5: Estimation results of education effects in multinomial logit models without wage, job level and job tenure

	General model	
	To social security	To retirement
Low education	0.165 (0.03)**	0.069 (0.36)
High education	-0.341 (0.01)**	-0.237 (0.02)**

	Interaction models							
	To social security				To retirement			
	I	II	III	IV	I	II	III	IV
Low education	0.40	-0.28	-0.39	-0.18	-0.59**	0.42	0.84***	0.78***
Med education	ref	0.71**	0.98***	1.33***	ref	-0.05	0.44*	0.89***
High education	-0.33	-0.29	-0.03	0.11	0.10	-0.31	-0.67*	-0.43

* indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

level through wages, job level and job tenure. Otherwise results will be biased.

With respect to the effect of participation in training, we find that this reduces the transition into early retirement or inactivity. We find that this effect of training is particularly true for regime III. This is mainly an effect of the Scandinavian countries, where on-the-job training is high on the political agenda and age discrimination is least likely to exist. In Chapter 7, we investigate the relation between participation in training and early retirement in more detail. As for the effect of work experience, we find that workers with current job durations of less than one year are the ones with least stable employment. This supports the arguments derived from job matching theory that good matches, i.e. long job durations, are least likely to be dissolved (Jovanovic, 1979). We further find that the effect of a short tenure is not significantly different across the regimes. In addition, we find that having a long job tenure increases the labour force participation in countries with ungenerous early retirement schemes (regime I), whereas it increases early retirement in the other regimes, with the strongest effects in countries with very flexible or very generous early retirement schemes (regimes III and IV). This is most likely to be related to the existence of seniority schemes (i.e. schemes in which a minimum contribution period is required for retirement) in all regimes but the first. The hypothesis that the more generous such schemes are, the more they are used seems to receive some support. Finally, we found that the wage level discourages the transition into social security, with the strongest effect in regime I, likely to be due to the existence of low means-tested benefits. Our model shows no effect of wage on the retirement hazard, which supports the ambiguity explained earlier (i.e. negative substitution effect and positive income effect). As with the other human capital variables, we expect wages to be correlated with education level, work experience and job level. When we exclude these variables from the analysis, we find that higher wages increase the stability of employment, as is found in other studies as well (Blanco, 2000; Deschryvere, 2005).

Regime differences in the effects of job characteristics

From theory, it was expected that people working in the industry are more likely to retire early because of less favourable health conditions and because of more rapid obsolescence of their skills due to the faster introduction and use of new technologies. Overall, we find a negative effect of working in the service sector (compared to working in the industry) on the transition into social security, regardless of whether those service jobs are in the private or the public sector. This effect is not significantly different between the various regime types and supports earlier findings of Oswald (1999) for Germany and Blanco (2000) for Spain. Working in the service sector reduces only the retirement hazard in regimes II and IV which is also found by the previously mentioned authors and by Antolin and Scarpetta (1998) for Germany. In addition, we observe some interesting regime differences with respect to public sector employees. We find that such employees have higher retirement probabilities in regimes I and IV, and to a much lesser extent also in regime II. In regimes I and IV, civil servants are treated differently with regard to early retirement provision. They seem to be entitled to generous early retirement schemes, whereas private workers are either excluded, or receive lower benefits. In other words, in these regime types early retirement is more flexible and generous for public sector employees as explained in Chapter 4. Our models show no such effects for regime III, whereas Spataro (2002) did find a higher retirement hazard for civil servants for Italy and Deschryvere (2005) for Finland.

Apart from sector, we also included occupational level and we distinguished between (1) managers and professionals, (2) technicians, (3) clerks and service workers, and (4) other (blue-collar) workers. The latter category of workers is taken as the reference group. Starting with the entry into social security, we find that managers and professionals have a lower likelihood of exit to social security compared to blue-collar workers. This effect is net of the effects operating through wages or work experience. Transitions into social security are often involuntary due to being laid off or becoming disabled, but the likelihood that these events occur is much lower for workers at higher skill-levels. The lower skilled (occupational groups 3 and 4) seem to face such involuntary exits more often in regime I, where exit routes are moderately flexible and provide ungenerous benefits. Looking now at the results for the retirement hazard, we find that higher level jobs have a higher retirement probability in regime I, where early retirement is only attractive through private exit routes. People in higher level jobs, in addition to having higher earnings allowing them to invest in private pension plans, tend to have different saving preferences and tend to save more compared to blue-collar workers. The effect of higher earnings is already captured by the wage level. This job level effect is significantly less important in other regimes, especially regimes III and IV, where early retirement is most flexible and generous and less differentiated by job level. Early retirement is publicly arranged and entitlement is less restricted to workers at higher skill-levels.

Looking at other studies, only a few authors included occupational level in their analyses and an even fewer number report a significant effect. Our results appear to match at least those of Deschryvere (2005). Additionally, as in all other studies of retirement behaviour, we find a higher likelihood to stay in work for the self-employed. The obvious interpretation is that in most countries the self-employed have no opportunity to retire early other than through private arrangements, which are however very costly and hard to afford, especially when the income is low. When looking at the regime differences, we find the attachment to work least strong in the regimes II and III. In these regimes, the self-employed are (voluntarily) covered by the public social security schemes. Second, following Filer and Petri (1988), the self-employed might be better capable of adjusting their working time to their own preferences, thereby raising the utility derived from working, which leads to the postponement of the retirement decision.

Our models further show that part-time workers have a higher probability to move into retirement. Filer and Petri (1988) already noticed that the interpretation of such effects might be problematical since older workers might choose to work part-time as a transitional phase between full-time employment and full-time retirement. In gender-interaction models we found that this effect is significantly stronger for men than for women, which is mainly explained by the fact that on average 90 percent of the men work full-time, compared to about 60 percent of the women. While part-time working women are less likely to retire early than part-time working men, regardless of the retirement pathway, full-time working women are more likely to move into social security compared to full-time working men. Older female workers might be confronted with 'double burden' at work, because of their age and their gender, which increases the risk of being laid off. Looking at regime differences, we find that the positive effect of working part-time on the retirement hazard is significantly weakest in regime IV. Due to the generosity of the early retirement schemes in countries belonging to this regime type, part-time work is of no use as a transitory phase.

We find that prior unemployment experience increases the probability of moving into social security, an effect that is the strongest in regimes I and II. Although research on the scarring effects of unemployment is still rather scarce, some studies show that people with unemployment histories face longer-term problems on the labour market, which increases their re-entry probability into unemployment (Arulampalam et al., 2003). As for the transition into retirement, we generally find that transition probabilities are lower for people with an unemployment record, which is also found by Pedersen and Smith (1996) for Denmark. This is most likely to be explained by discontinuous working careers which constitute a barrier to fulfilling the entitlement conditions. Remarkably though, the effect is positive in regime I, which might point to the position of particular categories of the unemployed workers. We checked whether the spouse is employed, yet the majority of this group is without a partner (30 percent compared to ten percent of workers without

an unemployment record who moved from employment to social security). The fact that they are single, i.e. without any financial responsibility toward a partner or family, might encourage them to go into retirement rather than into social security (again). Finally, to correct for business cycle effects, we included year dummies. The reference year is 1994 and we find that in other years, the likelihood to exit into any of the exit states is significantly lower, except for transitions into inactivity, which are insignificant. The economy in most European countries was in an upswing in the second half of the 1990s, which is likely to explain the lower exit probabilities.

5.5 Concluding remarks

In this chapter we tested whether determinants of early retirement are different for countries with a different early retirement system. We combined the level of flexibility with the level of generosity of benefits to construct a typology of retirement regimes. We found that the more opportunities the regimes offer to exit work, and the more generous the benefit levels belonging to the various exit routes are, the more likely exit takes place at some age thresholds. We found the highest exit rates in countries with the most generous early retirement benefits (i.e. regime IV including Austria, Belgium, Germany and the Netherlands). This points to pull effects arising from the generosity of the arrangements. These effects are most significant for men, which is explained by the dissimilar labour market careers of men and women. Due to their child-rearing and household activities, women generally do not meet the benefit requirements and therefore have fewer opportunities to move into generous benefit schemes at some age. Moreover, we found that employment rates decreased most rapidly with increasing age in the most favourable regimes in terms of early retirement benefit levels. This decrease in employment rates with age is more modest in countries with rather ungenerous early retirement benefit levels. This suggests that the early retirement features we used in our index (i.e. flexibility and generosity of benefits) capture the existing differences in early retirement patterns rather well.

We further conclude that entitlement conditions seem to play an important role in providing incentives to early exit. The hazard rates into retirement showed clear spikes at the age when entitlement to early retirement benefits is guaranteed. In addition, we find that women generally do not meet the early retirement entitlement conditions due to a higher number of job changes and discontinuous working careers. Interestingly, we find that in Scandinavian countries, where female labour participation has been stimulated strongly, women do not have the disadvantaged position with respect to fulfilling the entitlement conditions related to past working experience. Moreover, with respect to health, we found that when entitlement conditions are most tight, social security is primarily used by workers in a bad state of health. When entitlement conditions are least tight, entry into social security schemes is least related to a bad health status. Furthermore, we found

that the self-employed are most stable in working, which is likely to be explained (at least partially) by the exclusion or non-entitlement to public early retirement and social security schemes.

Apart from entitlement conditions, we conclude that the generosity of the benefits also has an important impact on early retirement behaviour. We found that the more generous the schemes are, the less selective early retirement will be. For example, other household income generally has a positive effect on the retirement probability, which is explained by the fact that due to other income sources in the household, the older worker can afford to retire early. This effect is found to be significantly weakest in countries with most generous early retirement benefits. The same applies to the effect of having a low education. In countries with the least generous early retirement provision, the lower educated seem least able to retire early because they cannot afford to. This effect is not found in countries with most generous early retirement provision, where post-retirement income is closer to pre-retirement earnings, thereby encouraging people of all education levels to retire early. With respect to this generosity of schemes, in the next chapter we provide some evidence on the income consequences of early retirement. We investigate whether it is true that replacement rates differ between countries and between population groups within countries.

As for the participation in training of older workers, we found some indication for the fact that training reduces early retirement. However, we suspect that we have to deal with endogeneity bias in the estimated association of training and early retirement. We will investigate this in more detail in Chapter 7 and we will see whether the results we found in this chapter are affected when accounting for such endogeneity. In addition, we did not control for unobserved heterogeneity, but we specifically control for this in the next chapter. Finally, we will use a more challenging modelling technique, i.e. a duration model, in which the panel character of the data is more seriously used. In Chapter 8 we will report on the differences between the results found in this chapter and the next, to see whether controlling for unobserved heterogeneity matters, and to see whether the results are independent of the modelling technique used or not.

Appendix
Data, sample selection, variables and model fit

The ECHP data and sample selection

The European Community Household Panel (ECHP) is a harmonised cross-national longitudinal survey. For a detailed overview of the ECHP data and its resources, see http://epunet.essex.ac.uk/index.php. For the majority of countries, the surveys were carried out using the harmonised ECHP questionnaire. For some countries, however, the institutes in charge of the production of the ECHP converted national data surveys into ECHP format to replace the ECHP from 1997 onwards. In Germany and Great Britain, the derived national data was provided from 1994 to 2001, using the GSOEP and BHPS respectively.[8] For Germany, we found that a number of the variables included in the GSOEP part of the ECHP were missing (e.g. sector of economy, training, job level) so we used the original GSOEP dataset. We thoroughly verified consistency with the ECHP version of the German sample. Furthermore, Sweden is excluded from the analysis because the data contain no panel information (i.e. repeated cross-section) and Luxembourg is excluded because of a large number of missing observations on a great deal of important variables (e.g. education level, participation in training, hours worked, sector of industry).

To focus on retirement before the country's official retirement age, i.e. on early retirement, we only selected workers aged between 50 and the country's official retirement age for the analysis.[9] In the majority of European countries, the official retirement age for both men and women is 65, as can be seen in Table A1 in the Appendix of Chapter 4. In the case where the country's official retirement age, either for men or for women, is different from this, this is accounted for in our analysis, as shown in Table A1. All countries are pooled into one unique data set but the sample size of the sample population aged between 50 and 65 is in no way related to the size of the older population of the countries. We correct for this by using the following weight for the respondents in each country c:

$$\begin{aligned} \text{Popwght}_{ct} &= P_{ct}/S_{ct} \\ \text{where } P_{ct} &= \text{Population aged 50-65 years at } t/\text{Total population at } t \\ \text{where } S_{ct} &= \text{Sample population aged 50-65 years at } t/\text{Total sample population at } t \end{aligned}$$

[8] For a full description of these national panel surveys see the appendix of Chapter 7. Although a sample was added for Northern Ireland in 2001 making the panel suitable for UK-wide research, we mainly use the earlier waves and consequently our study focuses on Great Britain. This explains why we use the term Great Britain in the empirical chapters, rather than the United Kingdom, which we used in previous chapters.

[9] The official retirement age is the age from which workers can claim a full public old-age pension when additional criteria in terms of minimum working years or minimum residency period are met. See Chapter 4 for details on this.

Table A1: Sample population by country, 1994-2000

Country	Age limits		Number of	Country	Age limits		Number of
	Men	Women	observations		Men	Women	observations
Austria	50-65	50-60	7,598	Greece	50-65	50-65	17,132
Belgium	50-65	50-60	6,302	Ireland	50-65	50-65	10,268
Denmark	50-65	50-65	6,989	Italy	50-65	50-60	21,779
Finland	50-65	50-65	8,891	Netherlands	50-65	50-65	12,689
France	50-60	50-60	11,694	Portugal	50-65	50-65	17,590
Germany	50-65	50-65	18,820	Spain	50-65	50-65	20,368
Great Britain	50-65	50-60	10,535	Total			170,655

Dependent variable: Labour market status

The dependent variable in the analysis is a transition from work to another labour market status. Rather than depending on the self-reported main activity, we constructed the labour market status based on more objective criteria such as hours worked and benefits received. Employment is defined as being employed (or self-employed) for at least 15 hours a week. The reason for the threshold of 15 hours is both theoretical and practical. The practical reason is that most employment-related questions in the ECHP are only asked for people working 15 or more. In addition, it is argued that a job of less than 15 hours a week cannot provide sufficient income to live from and additional income sources are needed (i.e. private wealth or other household members' labour income). It is recognised, however, that senior workers might draw a basic pension or minimal social security income and work for a few hours to supplement this. Nevertheless, we define such people as being retired or on social security, since this is most likely their main income source. The non-employment states are constructed using information on type of benefits received: (1) they are classified as 'retired' when they receive any old-age related benefits. This includes first pillar public pensions, second pillar occupational pensions, third pillar personal pensions; (2) they are classified as 'being on social security' when they receive disability or unemployment benefits. We have opted for these two types of benefits because of evidence that these function as early retirement pathways in some countries (OECD, 1995); (3) they are classified as 'inactive' if they receive either other social security benefits or no benefits at all. In practice, it is possible that people receive two or more types of benefits at the same time, for example receiving pension benefits and disability benefits. The number of such 'double' statuses is rather small, with only 1.1 percent of the people in the sample receiving both social security and pension benefits. These people are classified into the category of benefit that is the highest.

Explanatory variables

In this section we explain the definitions of these variables and Table A2 gives the descriptives of the explanatory variables. The individual characteristics in the analysis include age, gender and health status. Rather than imposing a quadratic form on the relation

between age and the exit probabilities into the different destination states, we included as many age categories as possible (50/51, 52/53, 54/55, 56/57, 58/59, 60/61, 62/63, 64) to see spikes in the age distribution of exit to the various destinations. With respect to gender, several approaches are found in the literature. It is often argued that the labour market participation decision as well as the retirement decision is different for men and women, and this has induced many authors to focus only on male retirement behaviour (e.g. Bercovec & Stern, 1991; Blau, 1994; Meghir & Whitehouse, 1997). Others adopted separate models for men and women to show differences in early retirement determinants (e.g. Dahl et al., 2002; Oswald, 1999; Pedersen & Smith, 1996; Peracchi & Welch, 1994). We, however, include a gender dummy in our general model as done by, amongst others, Antolin and Scarpetta (1998), Kapteyn & de Vos (1999), Miniaci and Stancanelli (1998), Quinn et al. (1998) and Siddiqui (1997). In addition to this, we tested gender differences more formally by including gender-interaction terms with all variables of interest and we will report on the observed differences. We further included self-reported health on a three-point scale, ranging from bad to good health. Several authors, including Lindeboom and Kerkhofs (2004), noted that using self-reported health measures might lead to exaggerated coefficients because of the endogeneity problem with health and retirement, i.e. factors that affect the retirement decision might also affect the individual's health status (e.g. age). This seems especially true for transitions into disability and estimated coefficients here are interpreted with caution. From Table A2 we learn that the majority of older people report being in good health and only about 15 percent report being in a bad state of health.

Human capital endowments include the individual's education level, work experience, the participation in training on the job, and wage. Education is measured as the highest educational level attained by the individual, on a three-point scale ranging from low (ISCED level 0-2) to high (ISCED level 5-7). The majority of respondents have a lower education, which is explained by the fact that access to higher education was more restricted in previous decades and people entered the labour market at earlier ages. As a proxy for human capital investments later in life, we include a dummy for participation in formal on-the-job training. Overall work experience, however, is not included in the ECHP and we only note job tenure at the current job. Work experience is available in a continuous trend up to ten years or more and we converted it into a dichotomous variable with three classes: (1) less than one year with current employer; (2) 2-9 years with current employer; or (3) ten or more years with current employer. The majority of respondents have been employed for at least ten years with their current employer. Workers over the age of 50 are less mobile in terms of changing firms because of the risks of becoming unemployed. Both age and tenure are negatively correlated with job mobility (Groot & Verberne, 1997). In addition, we include wage in the analysis and we argue that wage not only reflects a higher education level but also reflects more work experience. Wage is

taken as hourly wages and yearly Purchasing Power Parities are used to translate wages into European comparable values.[10]

Regarding household characteristics, we include some main household variables such as marital status, the presence of children, the presence of a working spouse and the spouse's health status. As for *marital status* we distinguish between couples, people who were a couple in the past but no longer are so due to death, divorce or separation, and people who were never a couple. The majority of older workers (over 80 percent) in the sample are married without children at home. Additionally, we matched individuals to their spouses in the data set and retrieved information on the spouse's employment and health status. Finally, we include household income whereby we subtracted the individual's own labour income from total household income (the own labour income effect is already captured by the hourly wage) to assess the incentive effects from additional household income on his early retirement decision. Household incomes are standardised using the Modified OECD Equivalence scale and expressed in euros (even for non-euro countries) using proper PPP standards included in the ECHP.

Job characteristics include sector of employment, level of job, a dummy for being self-employed, weekly number of hours worked and a dummy indicating the unemployment history. Because of a limited number of cases, we have to use a rather crude indicator for sector of activity. We distinguish between the private non-service sector, the private service sector, and the public sector. As for occupation, we used the three-digit ISCO (ILO Standard Classification for Occupations), that classifies all occupations into nine categories ranging from elementary occupations to legislators and senior officials or managers. About a quarter of the older workers in the sample works as self-employed persons. With regard to hours, we included hours both as a continuous variable and as a dichotomous variable where we distinguish between part-time (less than 32 hours a week) and full-time jobs (32 hours or more a week). The majority of older workers work full-time with an average of 40.9 hours worked a week. Finally, using retrospective information we constructed a dummy indicating whether the individual had been unemployed before his current job.

Model fit information

We provide some information on the model fit of the models we used in our analysis of early retirement patterns in Europe. We compare a model A, in which we include country dummies, with a model B, where these country dummies are replaced by regime dummies according to our retirement scheme classification of countries as explained in Chapter 4. By clustering countries into regimes, the model loses some power, but by comparing the pseudo R-squared of the estimated models, it is shown that the price paid is not very

[10]Purchasing Power Parities (PPPs) are currency conversion rates that both convert to a common currency and equalise the purchasing power of different currencies.

Table A2: Characteristics of respondents, ECHP 1994-2000

	INDIVIDUAL CHARACTERISTICS		
Average age	56.1	Health	
Gender		Bad	14.1
Male (ref)	51.0	Fair (ref)	32.9
Female	49.0	Good	52.5
		Missing	0.6
	HUMAN CAPITAL INDICATORS		
Education			
Low	48.3	Tenure with current employer	
Medium (ref)	25.9	(when employed)	
High	14.5	1 year or less	7.7
Missing	1.4	2-9 years (ref)	17.5
Training (when employed)		10 years or more	64.9
No (ref)	84.5	Average hourly wage (when employed)	6.5
Yes	14.6		
Missing	0.9		
	HOUSEHOLD CHARACTERISTICS		
Marital status		Average household income (total)	15246
Couple (ref)	84.6	Average household income (other)	7336
Was couple	10.5	Spouse's employment status	
Never couple	4.8	Employed	46.7
Missing	0.1	Not employed (ref)	50.5
Has children		Missing	2.8
No (ref)	86.3	Spouse's health status	
Yes	13.7	Bad	13.0
Missing	0.01	Fair (ref)	31.6
Average number of children	2	Good	52.2
		Missing	3.3
	JOB CHARACTERISTICS		
Sector of economy		Occupation (ISCO)	
Private non-services	37.2	Legislators, senior official, managers	10.5
Private services	29.6	Professionals	12.1
Public sector	23.9	Technicians, associate professionals	11.3
Missing	9.4	Clerks	9.9
Is self-employed	28.1	Service, shop, market sales workers	9.8
Average hours worked a week	40.9	Skilled agricultural, fishery workers	11.1
Hours worked a week (dichotomous)		Craft, related trades workers	13.0
Part-time ($<$ 32 hrs)	17.4	Plant, machine operators and assemblers	7.7
Fulltime ($\geq$ 32 hrs)	79.6	Elementary occupations	10.5
Missing	3.0	Missing	4.2
Was unemployed before			
No	82.9		
Yes	17.2		

high, or better that the regime classification captures most of the country variance. The pseudo R-squared of model A, i.e. the model with the country dummies, is 0.1097 and that of model B, i.e. the model with the regime dummies, is 0.0982. The model with country dummies rather than regime dummies, explains about one percent more of the variance between individuals with respect to early retirement patterns. Using a formal log likelihood test, we would have to conclude that the model with country dummies performs significantly better. However, especially when testing interaction effects between countries and covariates, the country model would be less useful because of the insufficient number of observations leading to less robust estimation results.

Chapter 6

Early retirement in Great Britain, Germany and the Netherlands

6.1 Introduction

In the previous chapter we analysed early retirement patterns in Europe, using the ECHP data. The advantage of using this data set is that we are able to include a large number of countries in our analysis and to test hypotheses about the effect of institutions. However, due to the size of the data set and the lack of retrospective information on the respondents' labour market history, the possibilities of analysis are limited. In this chapter we repeat the analysis of Chapter 5 using data for fewer countries but with a longer time horizon, allowing us to estimate a more challenging econometric model, i.e. a duration model. While the analysis in Chapter 5 allowed us to control only for observed heterogeneity, here we can also control for unobserved heterogeneity. Our focus is on the following research questions: To what extent has the development into more flexible and more generous early retirement schemes resulted in higher entry rates into early retirement for the working population? Is the likelihood of early retirement according to the various routes different for different groups within the working population? To what extent does the generosity differ between the various exit routes and between the countries or regime types? For the estimation we use the national socio-economic panel data sets of Germany (GSOEP), the Netherlands (SEP) and Great Britain (BHPS).[1] As we have shown in Chapter 4, and as we summarise briefly in the next section, these three countries are clearly distinct in terms of their early retirement systems.

Although, a number of empirical studies on early retirement behaviour in these three

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[1] In 2001 a sample was added for Northern Ireland, making the panel suitable for UK-wide research. As we use mainly the waves before 2001, our study focuses on Great Britain.

countries have been performed, these are virtually all single-country studies (Meghir & Whitehouse, 1997; Siddiqui, 1997; Antolin & Scarpetta, 1998; Lindeboom, 1998; Miniaci & Stancanelli, 1998; Heyma, 2001; and Blundell et al., 2002), it is only in the case of Oswald (1999) that a comparison has been made between Germany and Great Britain. Meghir and Whitehouse (1997), Siddiqui (1997) and Antolin and Scarpetta (1998) estimate single-risk models, modelling only a transition from work to non-work. Others acknowledge the importance of the various social security pathways into retirement, such as unemployment or disability, and also estimate competing risks models (Lindeboom, 1998; Miniaci & Stancanelli, 1998; Oswald, 1999; Heyma, 2001). Blundell et al. (2002) analyse the effect of incentives from the pension system, taking particular account of the distinction between the public, or state, pension schemes and the occupational pension schemes.

By analysing retirement behaviour in a comparative perspective within a competing risks framework, we believe that our study adds to the existing literature. Moreover, the application of a discrete time duration model (rather than a continuous time duration model), although increasingly used in recent approaches in the empirical social science literature (Narendranathan & Stewart, 1993; Böheim & Taylor, 2000; Jenkins, 2005), has not been applied much in the particular domain of retirement studies. Finally, in addition to studying the determinants of early retirement behaviour in these countries, we briefly analyse the income consequences of early retirement. The predicted differences between countries or between population groups are associated with differences in generosity of the early retirement schemes. For this reason we highlight some evidence on the income consequences of early retirement. Studies on this subject in the countries of our interest have not been widespread and most of them are focussed on retirement at the official retirement age (Jenkins & Bardasi, 2002; Zaidi et al., 2003; Huynen & Fouarge, 2005).

In Section 6.2 of this chapter, we summarise the expected effects on the individual's early retirement patterns. Data and methods are discussed in Section 6.3. In Section 6.4 we present the results of our duration model on early retirement in the three countries. Section 6.5 investigates the income consequences of early retirement in the three countries under scrutiny, and we discuss the observed differences in generosity. Finally, we summarise the main conclusions in Section 6.6.

6.2 Predicted effects on early retirement patterns

Before we turn to the theoretical predictions, we first summarise the differences between the selected countries with respect to the early retirement system. In terms of our early retirement index, which we created in Chapter 4, Great Britain is characterised as a country with ungenerous early retirement benefits, while both Germany and the Netherlands are characterised by very generous early retirement benefits. Whereas the two latter coun-

tries fall within the same regime type of our index, we will see that the structure of their early retirement system is very different. Starting with Great Britain, early retirement is not provided in the first pillar, but only in the second pillar of the occupational or private pensions (SERPS) and mainly for those on higher incomes. Hansen (2000) showed that replacement rates of the occupational early retirement schemes are very divergent, with some schemes offering replacement rates of about 80 percent, whilst other schemes only offer rates of about 40 percent. Great Britain has a strong liberal tradition, implying strong market orientation without much state intervention. In addition, the state encourages the creation of private or occupational pension arrangements by reducing the required contribution payments for the national system. Social security benefit levels are fairly low and usually flat-rated or heavily means-tested. Eligibility criteria are rather tight (e.g. a 100 percent minimum incapacity to work is required to receive disability benefits) and social security exit routes are available only for a selective group of people - those who, for economic reasons or due to health impairments, are incapable of providing for their own income.

As already mentioned, both Germany and the Netherlands have very generous early retirement benefits, with multiple routes being available for early retirement. In Germany, however, early retirement is provided within the first pillar, while this is not the case in the Netherlands. In the German social security system, entitlement and benefits are related to social group or occupational status. Social security benefits and pension schemes are limited to those who are employed or those with an employment record. Early retirement is especially attractive to people with long tenure or a higher occupational status. Social security entitlement is less tight compared to that in Great Britain and at age 60, both unemployment and disability benefits are converted into a permanent pension. Although this latter is also true for Great Britain, in Germany it is much easier to become entitled to benefits. The Netherlands, finally, has a social-democratic tradition with a stronger role played by the state. Social security benefits are often universal (e.g. old-age pensions are not related to employment but to residency), less tight (e.g. only 15 percent minimum incapacity to work is needed to be entitled to disability benefits) and very generous. However, as is the case with early retirement, the Netherlands represents a special case since early receipt of a public pension is not possible the way it is in Germany. Similar to the situation in Great Britain, the provision of early retirement is mainly organised within the second and third pillars of the pension system. In both Great Britain and the Netherlands, participation in second pillar occupational pension schemes is quasi-mandatory, as explained in Chapter 4, and consequently the coverage of such pensions is high: in Great Britain about 70 percent of the working population is covered by an occupational pension and in the Netherlands about 95 percent. The main difference between the British and Dutch occupational early retirement schemes is the generosity level, which is much higher in the Netherlands. Pension replacement rates are about

Table 6.1: Hypothesised effects on transition probabilities out of employment

	Exit into retirement			Exit into social security		
	Germany	Netherlands	Britain	Germany	Netherlands	Britain
DEMOGRAPHIC INDICATORS						
Age	++	++	+	+	+	?
Female	+	?	?	+	+	-
Bad health	+	?	+	++	++	+
Partner employed	-	-	-	-	-	- -
Having dependents	-	-	-	+	+	+
Household income	+	+	+	-	-	- -
HUMAN CAPITAL INDICATORS						
Higher education level	?	?	?	-	-	-
Tenure	++	++	+	-	-	-
Hourly wages	+	?	?	-	-	- -
JOB CHARACTERISTICS						
Self-employed	-	-	-	-	-	-
Public sector employee	++	++	+	?	?	?
Industry	+	+	+	++	++	+

+/- indicates a positive/negative effect, ++/- - indicates a strong positive/negative effect and ? indicates an ambiguous effect resulting from theory.

0.66 in Great Britain, whereas these are about 0.89 in the Netherlands. In addition, entitlement is much more universal and hence less restricted to higher-income earners in the Netherlands.

Table 6.1 shows the contended theoretical effects that were explained in large detail in Chapters 2 to 4 and which are only briefly summarised here.

For the exit into retirement, we expect a positive effect of age, and to a smaller extent also for social security exit. Not only are the conditions for entitlement of a retirement scheme relaxed for older workers, in general, the generosity of the schemes is higher at later ages, as explained in Chapter 4. However, it is also expected that at particular age thresholds the implicit tax on continued work is higher than at later ages and the higher generosity truly pulls older workers out of the labour market. Consequently, we expect peaks in the retirement hazard at the entitlement ages. The age-effect is expected to be strongest in Germany and the Netherlands, where offered replacement incomes after retirement are highest. In addition, the effect is expected to be weaker for social security, since the generosity of such schemes in terms of the benefit level is much lower compared to the retirement schemes. Furthermore, we expect some gender effects in both Germany and Great Britain. In Great Britain, the retirement age for women is lower, and until 1977 married women could choose not to be insured (because their spouse was) for social security benefits, lowering their probability of moving into social security. In Germany, occupational pension schemes allow women to retire with fewer contribution years than men, making it easier for women to move into retirement. Although this rule was changed

with the 1992-pension reforms, the effect is still expected to be present during the 1990s, mainly because the new rule is applied after a transitional period.[2] Finally, with respect to individual characteristics, a bad state of health is expected to decrease one's human capital level because of a lower productivity. Especially in Germany and the Netherlands where disability benefits can already be received at low levels of incapacity (at the level of 25 and 15 percent respectively), this is expected to increase the transition into social security. In addition, a bad state of health might increase the likelihood of a transition into retirement in Germany and Great Britain, where, at the age of 60 workers can become entitled to special disability pensions.

With respect to family characteristics, having a working spouse (or other income sources in the household) might pull the worker out of the labour market because of the positive spill-over effects of these other income sources. Yet, it might also increase the labour supply of the individual because of the complementarity of the spouses' leisure time (i.e. a decreased utility derived from leisure time for the individual when the spouse continues to work). Previous studies show some evidence for the hypothesis that the retirement decision is made jointly with the partner (Clark et al., 1980; An et al., 1999), which supports the positive effect on the individual's labour supply. We will see what effect is dominant in the countries under scrutiny here. In the case of means-tested social security benefits (especially true for Great Britain), having an income-earning spouse is expected to decrease both the arrival and the replacement rate of social security offers, and hence the acceptance probability of such offers. In addition, having dependents (either children or other relatives who need to be cared for) is expected to increase the utility from employment because of a greater need for resources. This increases the reservation wage and reduces the acceptance probability of exit offers. On the other hand, in the case of special social security benefits to support child-rearing, such as child or family allowances, the present value of the offered social security income stream is higher, thereby increasing the acceptance probability of such offers.

Furthermore, it is argued that an individual's transition probability largely depends on his human capital level. Following human capital theory developed by Becker (1964), it is argued that people with higher human capital endowments spend more time and resources to build up their human capital. They are expected to have a higher utility from work to make their investment worthwhile, implying a higher reservation utility and a lower transition probability. However, the relation between human capital and retirement is more complicated. People with high human capital endowments usually earn higher wages

[2]For more details on the German pension reforms see Börsch-Supan and Wilke (2003) and Berkel and Börsch-Supan (2003).

which generates both a substitution effect and an income effect on retirement exit. On the one hand, the higher earnings increase their reservation utility (it raises the opportunity costs of retirement) and hence, ceteris paribus, lower the acceptance probability of exit offers (i.e. a negative substitution effect). On the other hand, higher earnings imply higher post-retirement income since this depends on previous earnings. This increases the utility flow derived from retirement (i.e. positive income effect). The higher the replacement rate of exit offers, the stronger this income effect will be. For social security, a higher human capital is expected to reduce the transition probability mainly due to a reduced entitlement (i.e. maximum or means-tested benefits reduce entitlement for people with higher earnings due to higher human capital levels) and the unattractive status associated with it. This is expected to be especially true for Great Britain, where social security is most targeted at poverty prevention (i.e. means-tested). Tenure is expected to increase the acceptance probability of retirement offers since a longer tenure often means more years of contribution to a pension scheme, resulting in generous retirement offers. This is especially true for the Dutch and German pension systems where most schemes offer very generous early retirement benefits.

With respect to job characteristics, the self-employed are expected to have a lower probability of a transition out of employment because they get unfavourable exit offers. The self-employed are usually excluded from social security, except in the Netherlands, where special, but voluntary, social security arrangements exist for the self-employed. In addition, they usually have no occupational pension schemes though they can build up their own pension, often with rather poor entitlement levels. As for the effects of industrial sector, the coverage of early retirement schemes has nowadays increased to virtually all sectors of the economy, though retirement offers are still most generous in the public and the insurance sectors. These were among the first sectors offering early retirement schemes. In addition, it can be argued that in sectors where the older workers' productivity declines fastest with age, such as in the primary or industrial sectors (more physically demanding work tasks), older workers are more often pushed into exit by their employers. Quitting one's job is not seldom an involuntary choice leaving very little room for the worker; if he waits for a next offer, the offer is likely to be worse. In many cases, employers who want to downsize their companies encourage older workers to take up early retirement or social security. It is not uncommon for employers to offer supplementary occupational benefits that increase the replacement rate of the exit offers.

6.3 Data and methods

6.3.1 Data and sampling

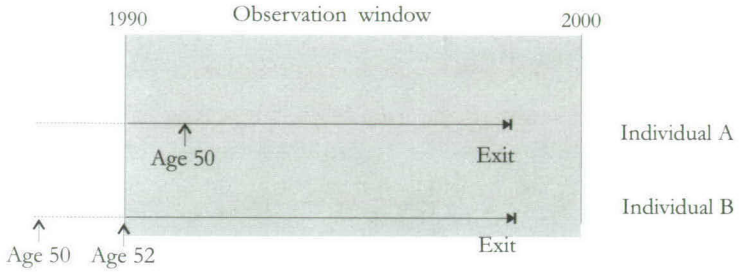
The data used in this chapter are taken from three independently designed, though comparable, country-specific panel surveys. For Germany we use 11 waves (1990-2000) of the German Socio-Economic Panel Survey (GSOEP), for Great Britain we use 11 waves (1991-2001) of the British Household Panel Study (BHPS) and for the Netherlands we use 12 waves (1990-2001) of the Socio-Economic Panel survey (SEP). All these panel surveys are designed to describe the socio-economic position of individuals over time. Extensive information is obtained on individual, household, human capital, labour and income characteristics. The sample is restricted to people aged between 50 and 65 who are employed for at least 15 hours a week.[3] The age of 50 is chosen as a lower limit because the retirement process is assumed to start at that age (Antolin & Scarpetta, 1998; de Klerk & Timmermans, 1998; Lindeboom, 1998; Oswald, 1999). The age of 65 is chosen as an upper limit because in all three countries this is the official retirement age starting from which (full) public old-age pensions are received. However, in Great Britain the official retirement age for women is still 60 and therefore this threshold is used as the upper limit for British women in this study.

The dependent variable in our study is the duration in employment after the age of 50. In this way, we model the observed exit out of work at specific retirement ages. When using this duration definition, some methodological issues need attention. A first issue is delayed-entry.[4] For workers who entered the panel survey at the age of 51 or older, and who are still employed, it is not certain whether they were employed as of the age of 50 years, as is the case with individual B in Figure 6.1. We only observe workers during our observation period (roughly from 1990 to 2000). For individual A there is no problem, since this individual reaches the age of 50 during our observation period. Individual B, however, is a delayed entrant: He comes under observation at age 52, and we do not know whether he was employed or not as from the age of 50 onwards. Can we exclude such delayed entrants from our analysis? The percentages of delayed entrants are rather high: 57.7 percent in the German sample, 59.3 in the British sample and 50.0 percent in the Dutch sample. Deleting them from the sample would reduce the explanatory power of

[3]Individuals from the first wave who match these criteria are selected, and subsequently individuals are added in later years either when they reach the age of 50 while being employed or when they enter the panel survey.

[4]In a review of D'Addio and Rosholm (2002) on the subject of censoring and truncation, shows that definitions with respect to this might differ across the literature. We take the definition chosen by Yamaguchi (1991) in which truncation refers to a spell which is already in progress when the observation period begins. Censoring in this respect refers to a spell of interest which has ended before the observation period begins, and is thus not observed at all. Censoring is discussed later in this section.

Figure 6.1: Delayed entry



our analysis substantially. However, without any further information on these individuals, we would have to make assumptions about the labour market status of these individuals for the years after the age of 50 up to the age at which the individual enters the panel. For individual B, for example this refers to two years in between the ages of 50 and 52. Fortunately, in all three panels, retrospective information on the individual's employment history is available, enabling us to reconstruct the time span between the age of 50 and the age of panel entry for the majority of delayed entrants and to retain them in the analysis.

Still, some observations have to be excluded from the analysis, for two reasons: (1) for some individuals, retrospective information on their labour market history is missing; and (2) some of the delayed entrants experienced non-employment spells in between the age of 50 and the age of panel entry.[5] Ideally, such spells ought to be included in our analysis since they represent transitions out of employment after the age of 50, which is the variable of interest in our study. Unfortunately, since they are derived from retrospective history files, no information on explanatory variables (i.e. we only have the labour market status) is available and we have decided to exclude these observations from the analysis.[6] The number of excluded observations is relatively small in the German and Dutch sample (respectively 2 and 5 percent of the total sample), but still fairly large in the British sample (24 percent of the total sample). A closer inspection of these observations reveals that these are mainly women (over 60 percent of the discarded observations) who had an employment spell at least ten years before they entered the panel (almost 90 percent of the discarded observations). The group, therefore, consists mostly of women who left the labour force because they had children (the average age at which they experienced their last employment spell is 35) and who re-entered the labour market at the age of 50 or over (the average re-entry age is 52). When interpreting the results for Great Britain, we have

[5]This is usually referred to as left-censoring: the event of interest took place before the observation period started. The individual has already experienced an exit out of employment after the age of 50, but before we were able to observe him.

[6]In the literature we found no single, generally accepted, way of dealing with left-censoring. We further argue that it is not certain that the possible bias of not accounting for left-censoring is worse than a possible bias as a result of the controlling mechanism used to account for left-censoring.

to take this into account. The group of women who re-entered the labour market after giving childbirth and who are included in the sample, is likely to be underrepresented. In the end, the sample population for Great Britain consists of 2,356 observations, for Germany of 3,092 observations and for the Netherlands of 1,580 observations.

Another methodological issue that requires attention is the issue of panel attrition. Panel attrition refers to people who drop out of the sample. This is only a problem when such attrition is non-random. For example, one might suspect that people who retire are more likely to drop out of the sample than people who remain employed. Yet, no evidence is found for such non-random attrition when reviewing the literature. To test whether panel attrition is random or not, one could jointly estimate the probability of attrition and the probability of exit out of employment, to account for the possible correlation of the unobserved characteristics. However, at this point, we choose not to model the possible selective attrition of the individual from the panel.[7] By including as many individual characteristics as possible, we hope to minimise the problem.

The destination or retirement states are constructed from the samples using information on the employment status and the benefits received. The information on received benefits has been used instead of the individual's self-reported activity status, because one of the main goals of this study is to examine the impact of institutional differences in entitlement to social security benefits on exit behaviour.[8] Ideally, with respect to transitions into social security, a distinction between the states of unemployment, disability and social assistance would be preferred. However, the number of observations for each state appears to be too low. For this reason, the destination states are combined and a move to either of the three states is considered to be a move into social security. As a result, the destination states for workers aged between 50 and 65 who are working at least 15 hours a week are:

1. Employment, which is referred to as right-censoring since the event of interest occurs after the observation period has ended. By including employment as one of the competing risks, we have accounted for this right-censoring;
2. Retirement, not being employed and receiving either a public pension, an occupational pension or a private pension;
3. Social security, not being employed and receiving either unemployment, disability or social assistance benefits;
4. Inactivity, not being employed and not receiving any of the above mentioned benefits.

[7]We first estimated a model in which we included 'missing' as a separate destination state. Subsequently, we estimated the model without this destination state, to see whether this systematically changed the estimation results. The estimates were not systematically different, for which reason we excluded the panel leavers from our analysis.

[8]For the GSOEP and the SEP, the information on income for wave t is retrieved from wave $t+1$, as explained in detail in the Appendix to this chapter.

In practice it is possible that people receive two types of benefits at the same time, for example receiving retirement and disability benefits. The number of such 'double' statuses, however, is rather small; only 4 percent of the people exiting in the Netherlands and Germany, and 8 percent in Great Britain. In this case, people are placed in the state that renders them highest benefits.

6.3.2 A discrete-time competing-risks model of retirement

The empirical model used in this study is a discrete-time competing-risks model. Although it is recognised that the underlying transition process out of employment might be viewed as continuous (one might 'decide' to exit employment at any time) a discrete-time model seems most appropriate since the data are gathered on a yearly basis. The model also allows easy handling of time-varying covariates (Fields & Mitchell, 1984; Siddiqui, 1997). The inclusion of such covariates seems important for modelling the retirement decision since this decision is clearly affected by changes in health, wages or the household situation (i.e. household income). A single-spell model is used implying that only the first exit out of employment after the age of 50 is modelled, in other words, re-entry is assumed not to take place.[9] A competing-risks model is the most appropriate way to test the underlying theoretical (behavioural) model, which presumes that in the case where we observe a person moving from work into retirement, such a move, due to higher utility attached to it, is preferred above staying in work or moving into social security or inactivity.

The set of destination states is represented by J with $j = 0$ if the destination state is employment (i.e. no exit observed), $j = 1$ if the destination state is retirement, $j = 2$ if the destination state is social security (i.e. disability or unemployment) and $j = 3$ if the destination state is inactivity (i.e. no social security or pension benefits). Following this, the discrete time hazard out of employment into one of the exit states j is the probability of making a transition in the t-th interval, conditional on survival to the beginning of the interval (Jenkins, 2005), or

$$h_j(t) = P(T_j = t \mid T_j \geq t) = \frac{f_j(t)}{S(t-1)} \tag{6.1}$$

with $f_j(t)$ being the destination-specific density function at time t and $S(t-1)$ being the survival function in employment until the beginning of the current time interval t. T_j represents the observed duration of employment until exit to destination j. As a proxy for this, the duration in employment after the age of 50 is used: T_j = observed exit age - 50.

[9]Re-entry rates after initial retirement appear to be below five percent, except for Great Britain, where these are about ten percent in the case the worker becomes unemployed. However, at this stage, we have decided to analyse only the first exit out of employment analogous to Miniaci and Stancanelli (1998) and Oswald (1999) for Great Britain. In future work we will try to estimate multiple-spell models as performed by Meghir and Whitehouse (1997), using Markov-chain types of models.

In Chapter 3, we explained that our data are not intrinsically discrete, but interval-censored and Jenkins (2005) shows that the log-likelihood function only by approximation equals the sum of the destination-specific transition intensities. Further assumptions about the 'within-interval hazard rates' are necessary. For example, one could assume that the exit out of employment only occurs at the end of the time interval, as did Narendranathan and Stewart (1993) in their analysis of exit out of unemployment. Or one could assume that the (continuous) hazard is constant within the time intervals. Jenkins (2005) shows that in the case of a relatively small interval hazard rate, this latter approach produces approximately the same estimation results as the multinomial logit approach developed by Allison (1982) for intrinsically discrete data. He showed that estimating a multinomial logit model applied to person-period data is one way of estimating a competing risks duration model in discrete time.[10] The specification for the destination-specific hazard rates is then given by

$$h_{ij}(x_{it}, t) = \frac{exp(\beta_{0j} + \beta_j X_{it} + \theta_{jk})}{1 + \sum_{j=1}^{3} exp(\beta_{0j} + \beta_j X_{it} + \theta_{jk})} \tag{6.2}$$

for individual $i, i = 1, \ldots, N$, $j = 0, 1, 2, 3$ with $j = 0$ or continued employment as the reference category, where X_{it} is a vector containing the individual's constant and time-varying explanatory variables, β_j is a vector of destination-specific parameters, β_{0j} being the destination-specific intercept and θ_{jk} is the destination-specific baseline hazard. For the specification of this baseline hazard, several options exist. We have opted for a flexible specification of the model though full flexibility would require us to add duration dummies for each duration interval, or as in our model, at each retirement age. For the sake of the estimation of the model, we have decided to use a piecewise constant hazard model, including dummies not for each age, but only k two-year age groups (i.e. age 50/51, 52/53, ..., 62/63). θ_{jk} is constant within each of the k intervals, but differs between them (Jenkins, 2005). The main reason for this aggregating over the two-year time intervals is that there might be insufficient observations for a shorter time interval of one-year, i.e. no exits, to identify the dummy parameter estimates of the model. This would make the estimation of a model with unobserved heterogeneity unfeasible, since the model iterations would presumably not converge (McVicar & Podivinsky, 2003).

Let τ_j be the destination-specific censoring indicator that is equal to j if a transition is observed to destination state j and is 0 otherwise, then the corresponding likelihood contribution of individual i is equal to (D'Addio & Rosholm, 2004)

[10] A person-period file refers to a file in which the number of cases, or rows, per individual is equal to the number of periods the individual is at risk of experiencing the event of interest, in this case retirement into one of the specified destination states.

$$L_i(\beta_0, \beta, \theta) = \prod_{t=1}^{t} \frac{exp[\sum \tau_j(\beta_{0j} + \beta_j X_{it} + \theta_{jk})]}{1 + \sum_{j=1}^{3} exp(\beta_{0j} + \beta_j X_{it} + \theta_{jk})} \tag{6.3}$$

As a next step, we include a correction for unobserved heterogeneity to this model. Unobserved heterogeneity refers to differences in attributes (often across individuals) of factors that are relevant for economic choices but are not observable to the researcher (e.g. differences in taste, motivation or ability between individuals). When unobserved heterogeneity is not accounted for in duration models, positive duration dependence is likely to be underestimated (or negative duration dependence overestimated) and the estimated coefficients for time-varying covariates are likely to be biased (Lancaster, 1990). Especially when estimating transitions out of employment, unobservable individual characteristics such as work effort, ability and motivation or cultural and social norms might affect the retirement transition (D'Addio & Rosholm, 2004). Reviewing the literature on how to control for such unobserved heterogeneity, several models have been proposed, both parametric and non-parametric. Following Vermunt (2002), the main difference between these models is the assumption made about the distribution of the latent variable capturing the unobserved heterogeneity. For the analyses in this chapter we adopt a non-parametric approach to deal with unobserved heterogeneity that has been introduced by Heckman and Singer (1984) in economics.[11] The Heckman approach is virtually identical to the approach based on latent class models, which are commonly used in sociometric approaches (Vermunt, 2002). The core assumption of this model is that, apart from observed characteristics, unobserved characteristics account for differences in transition behaviour between a number of classes in the sample, or ℓ classes. Consequently, each group of individuals or each class, has its own intercept $\beta_{0j\ell}$ for the estimated hazard into the various destination states. While the number of classes is rather arbitrary, Guo and Rodriguez (1994) showed that about two or three different classes generally suffice.

Using the same notation as before, the destination-specific hazard then becomes

$$h_{ij}(x_{it}, t) = \frac{exp(\beta_{0j\ell} + \beta_j X_{it} + \theta_{jk})}{1 + \sum_{j=1}^{3} exp(\beta_{0j\ell} + \beta_j X_{it} + \theta_{jk})} \tag{6.4}$$

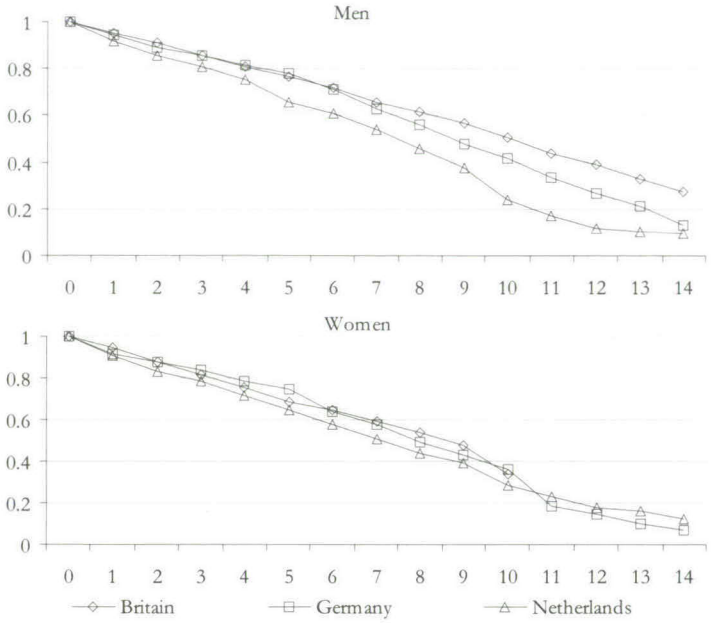
and the corresponding likelihood contribution of an individual i is then equal to

$$L_i' = \sum_{\ell=1}^{L} L_{i|\ell} \pi_\ell \tag{6.5}$$

where π_ℓ are the location or support points.

[11] Within a parametric approach one would add a random term to the model, for which a distribution must be assumed. Both the gamma and the normal distribution are commonly found in the literature. For a good overview of a parametric correction for unobserved heterogeneity in discrete time duration models see Jenkins (2005, p.82-84).

Figure 6.2: Survival functions in employment for older workers, by sex and country



Source: own calculations using GSOEP, BHPS, SEP

Apart from age, which is included in the baseline hazard, the main variables that are considered to have an effect on the individual's retirement decision are derived from the theoretical framework as discussed before. We include demographic indicators (e.g. sex, health, family status, the presence of dependents and/or a working spouse, the household income), human capital indicators (e.g. education level, tenure, hourly wage), job-related indicators (e.g. sector of industry, type of employment, the number of weekly working hours, the preferred number of weekly working hours) and the national unemployment rate. The latter variable is included to correct for the fact that older workers might be more at risk of being laid off or pushed into early retirement in times of economic downturn and high levels of unemployment. The way we construct these variables is explained in the Appendix to this chapter in which we also present some descriptive information.

6.4 Country-differences in early retirement patterns

6.4.1 Determinants of early retirement

Duration dependence

To gain a first impression on the cross-country differences in exits from employment, we have plotted the survival functions for men and women in Figure 6.2. The survival rate

is the number of older workers that remain employed at each duration interval, i.e. the labour participation rates of older workers at each age between 50 and the country's official retirement age. For men, the data confirm the expected country differences. For example, at the age of 60, about half of the older males in Great Britain have left the labour force compared to about 60 percent in Germany and about 85 percent in the Netherlands. For women, the pattern is somewhat different. First, until the age of 56 we observe the lowest employment rates for Dutch women and the highest for German women. After this age, until the age of 60, Germany and Great Britain switch places, indicating the early retirement practices of German women as they already exit from the age of 56 years. We no longer have survival rates for Great Britain after the age of 60, since 60 is the official retirement age for British women. Again we observe the very strong early retirement patterns in Germany, especially at the age of 60. As discussed in Chapter 4, up till 1992, special conditions existed for German women, thereby facilitating early retirement at this age.

To investigate the effects of the individual's background characteristics, we estimated a full model with inclusion of the few country dummies (the results are shown in Table 6.2) and models with interaction terms between the explanatory variables and country (the results are shown in Table 6.3). Great Britain is treated as the reference country. Note that the main effects of the interaction terms are therefore valid for Great Britain, while the estimated interaction effects exhibit the divergence from this main effect for the remaining two countries.

Table 6.2: Estimation results of a competing risks model for employment spells after age 50 that can end in retirement, social security or inactivity; full country model with and without correction for unobserved heterogeneity

	Full model, competing risks (without correction for uh)			Full model, competing risks (with correction for uh)		
	to ret	to soc	to ina	to ret	to soc	to ina
Age 52-53	**0.13**	**-0.31***	**-0.21**	**0.11**	**-0.30***	**-0.19**
	(0.58)	(-1.77)	(-1.32)	(0.53)	(-1.74)	(-1.20)
Age 54-55	**0.87*****	**-0.05**	**-0.02**	**0.86*****	**-0.06**	**0.00**
	(4.47)	(-0.30)	(-0.12)	(4.38)	(-0.33)	(0.01)
Age 56-57	**1.35*****	**0.55*****	**0.39****	**1.35*****	**0.51*****	**0.44****
	(7.11)	(3.35)	(2.45)	(6.98)	(3.07)	(2.57)
Age 58-59	**2.47*****	**0.42****	**0.28**	**2.51*****	**0.36***	**0.32**
	(14.08)	(2.22)	(1.51)	(13.89)	(1.87)	(1.62)
Age 60-61	**3.21*****	**0.38**	**0.81*****	**3.43*****	**0.26**	**0.75*****
	(16.80)	(1.37)	(3.57)	(15.25)	(0.91)	(3.18)
Age 62-63	**2.98*****	**0.15**	**0.54***	**3.33*****	**0.00**	**0.40**
	(13.53)	(0.38)	(1.73)	(11.22)	(0.00)	(1.24)
Female	**0.12**	**-0.03**	**0.75*****	**0.00**	**0.09**	**0.78*****
	(0.99)	(-0.20)	(5.68)	(0.02)	(0.62)	(5.54)
Bad health	**0.51*****	**0.72*****	**0.04**	**0.57*****	**0.73*****	**0.04**
	(5.53)	(6.17)	(0.39)	(5.49)	(6.25)	(0.34)

continued on next page

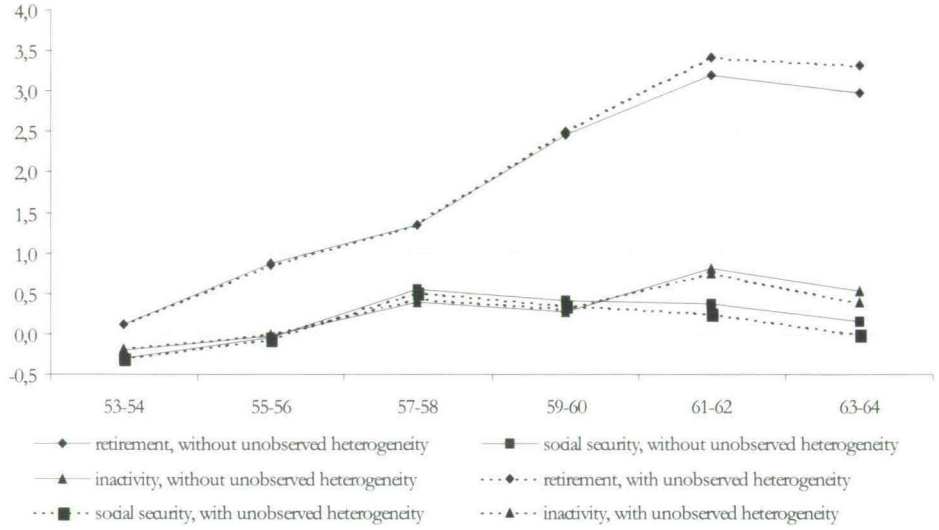
Table 6.2: continued

	Full model, competing risks (without correction for uh)			Full model, competing risks (with correction for uh)		
	to ret	to soc	to ina	to ret	to soc	to ina
Single	**-0.01**	**0.16**	**-0.45*** **	**0.05**	**0.09**	**-0.53*** **
	(-0.08)	(0.93)	(-2.79)	(0.37)	(0.51)	(-2.82)
Partner employed	**-0.35*** **	**-0.25***	**-0.17**	**-0.38*** **	**-0.18**	**-0.17**
	(-3.54)	(-1.94)	(-1.42)	(-3.50)	(-1.39)	(-1.37)
Dependents	**-0.27*** **	**0.10**	**-0.01**	**-0.27** **	**0.06**	**-0.01**
	(-2.80)	(0.89)	(-0.05)	(-2.56)	(0.48)	(-0.08)
Household income	**-0.01**	**0.00**	**-0.01***	**-0.01**	**0.00**	**-0.01***
	(-1.49)	(0.76)	(-1.77)	(-1.45)	(0.77)	(-1.82)
Medium education	**0.19***	**-0.52*** **	**-0.00**	**0.19**	**-0.28** **	**-0.03**
	(1.76)	(-3.92)	(-0.01)	(1.56)	(-2.24)	(-0.20)
High education	**0.18**	**-0.76*** **	**0.14**	**0.21**	**-0.67*** **	**0.11**
	(1.52)	(-4.09)	(0.97)	(1.51)	(-3.57)	(0.74)
Tenure	**-0.00**	**-0.01***	**-0.00**	**0.00**	**-0.01**	**-0.00**
	(-0.17)	(-1.74)	(-0.54)	(0.28)	(-1.18)	(-0.80)
Hourly wage	**-0.00**	**0.00**	**0.00**	**-0.00**	**0.00**	**0.00**
	(-0.34)	(0.73)	(0.26)	(-0.29)	(-0.03)	(0.28)
Commercial services	**0.12**	**-0.02**	**0.17**	**0.19**	**0.01**	**0.16**
	(1.02)	(-0.11)	(1.28)	(1.41)	(0.05)	(1.17)
Non-commercial services	**0.04**	**-0.40****	**-0.42****	**0.07**	**-0.34***	**-0.42****
	(0.28)	(-2.23)	(-2.46)	(0.41)	(-1.85)	(-2.38)
Self-employed	**-1.36*** **	**-0.59*** **	**0.89*** **	**-1.58*** **	**-0.64*** **	**0.96*** **
	(-7.01)	(-2.67)	(6.42)	(-6.91)	(-2.84)	(6.21)
Public sector	**0.31****	**-0.54*** **	**0.09**	**0.33****	**-0.50*** **	**0.07**
	(2.41)	(-2.91)	(0.52)	(2.36)	(-2.65)	(0.39)
Hours worked	**0.00**	**-0.01**	**-0.02**	**0.00**	**-0.00**	**-0.02*** **
	(0.29)	(-1.48)	(-3.30)	(0.06)	(-0.40)	(-3.31)
Wants less hours	**0.07**	**-0.00**	**-0.27****	**0.09**	**0.001**	**-0.29****
	(0.77)	(-0.01)	(-2.33)	(0.87)	(0.01)	(-2.35)
Unemployment rate	**0.17*** **	**0.29*** **	**-0.01**	**0.18*** **	**0.30*** **	**-0.01**
	(5.22)	(6.12)	(-0.15)	(5.04)	(6.26)	(-0.30)
the Netherlands	**0.52*** **	**1.15*** **	**0.33**	**0.41**	**1.23*** **	**0.35**
	(3.44)	(5.72)	(2.11)	(2.35)	(5.87)	(2.12)
West-Germany	**-1.01*** **	**-0.41****	**0.101**	**-1.26*** **	**0.01**	**0.13**
	(-7.25)	(-2.36)	(0.64)	(-7.26)	(0.05)	(0.84)
East-Germany (former)	**-0.19**	**1.371*** **	**-0.19**	**-0.16**	**1.40*** **	**-0.17**
	(-0.89)	(7.45)	(-0.80)	(-0.68)	(7.35)	(-0.68)
Intercept-1	**-5.82*** **	**-5.42*** **	**-3.31*** **	**-5.55*** **	**-6.12*** **	**-3.73*** **
	(-14.71)	(-10.43)	(-7.83)	(-12.66)	(-10.49)	(-6.91)
Intercept-2				**-11.26**	**-5.54*** **	**-2.44*** **
				(-1.56)	(-8.15)	(-4.36)

* indicates $p < 0.10$, *indicates $p < 0.05$, *** indicates $p < 0.01$.

The estimated baseline hazards are plotted in Figure 6.3 and show evidence of the exit probabilities into the various states increasing with age. We have already pointed out that we use a flexible specification of the baseline hazard by grouping the duration dummies into two-year age groups. From the estimation results reported in Table 6.3, we find higher exit probabilities at all ages compared to workers aged between 50 and 51, only for the

Figure 6.3: Estimated baseline hazards into various exit states for older workers, with and without correction for unobserved heterogeneity

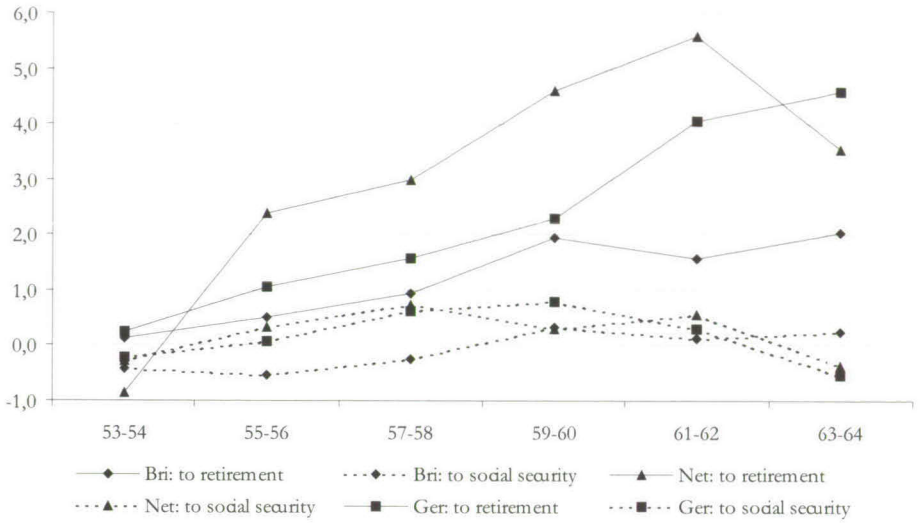


Source: own calculations using GSOEP, BHPS, SEP

transition into retirement. We have plotted these baseline hazards for the full model (i.e. including all countries) into the various destination states, with and without a correction for unobserved heterogeneity. We hardly find any difference between the baseline hazards with and without correction for unobserved heterogeneity, especially not with respect to the substantive outcomes. It is only for the highest two age intervals that we find that not correcting for unobserved heterogeneity leads to a slight underestimation of the positive duration dependence in the baseline hazard to the retirement state. When using a flexible specification of the baseline hazard, it is a common finding in the literature that the estimated hazards are rather insensitive for leaving out the unobserved heterogeneity term (Böheim & Taylor, 2000; McVicar & Podivinsky, 2003). For the baseline hazards into social security and inactivity, we do not really find positive duration dependence and we find that not correcting for unobserved heterogeneity slightly overestimates the baseline hazards. This difference is not likely to be significant though. In addition, we find some evidence of a substitution between exits into social security and retirement. Whereas the baseline hazard into retirement increases as from the age interval of 56-57, the baseline hazard into social security decreases as from this age interval.

In general, correcting for unobserved heterogeneity improves our model a little, as the likelihood functions. shown in Table 6.2, reveal. This indicates that there is an unobserved factor Z, which refers to attitude, motivation or ability, and which affects the older workers' probability of staying in employment. In addition, although the unobserved factor does not vary with the covariates, we find that some of the observed factors

Figure 6.4: Estimated baseline hazards into various exit states for older workers, by country



Source: own calculations using GSOEP, BHPS, SEP

included in the model change size and significance somewhat by correcting for unobserved heterogeneity. This points to some correlation between these observed factors X and the unobserved factor Z. This correlation exists with respect to having a medium or higher education level, being in good health, being self-employed and working in non-commercial services. We believe that the model with correction for unobserved heterogeneity yields the 'cleaned' coefficients on the observed factors.[12] For this reason and because the model with correction for unobserved heterogeneity has a better model fit, we have decided to present the baseline hazards with correction for unobserved heterogeneity.

In Figure 6.4 we have plotted the country-specific baseline hazards into the various exit states. We find the same pattern that we found earlier when looking at the survival plots. We observe increasing hazards into the retirement state for all countries. The age-specific increase in the exit to retirement starts earliest and is most prevalent in the Netherlands. In the other two countries, the increase in the exit probability to retirement is more modest, at least until the age of 60. After this age we observe a steep increase for Germany while the retirement hazard in Great Britain remains about the same. For the Netherlands we observe a drop in the retirement hazard in the highest age group. This is related to the financial incentives in the Dutch second pillar pension system. The implicit tax on continued work in the Netherlands is highest until the age of 62 as already shown by Nelissen (2001). The British pension system seems to provide an incentive to retire at the age of 60, whereas the German peak is reached one year later, at the age of 61. In

[12]This is only true if the correction for unobserved heterogeneity is correct. When this is not the case, the 'new' covariates are biased rather than 'clean'.

Table 6.3: Estimation results of the country interaction models (competing risks models) including interaction effects between the explanatory variables and country for exits out of work into social security or retirement of older workers aged between 50-64

	To retirement			To social security		
	Main	Interaction		Main	Interaction	
	Bri	Net	Ger	Bri	Net	Ger
Male	ref	1.08***	-1.00***	ref	1.26***	-0.26
Female	0.34*	-1.03***	0.25	0.08	0.14	-0.24
Good health	ref	1.02***	-1.11***	ref	1.35***	-0.05
Bad health	0.61***	-0.77***	0.17	0.96***	-0.12	-0.52*
Not single	ref	0.94***	-0.86***	ref	1.31***	-0.33*
Single	0.23	-0.77***	-0.38	0.19	-0.07	-0.10
Spouse not employed	ref	1.05***	-0.80***	ref	1.63***	-0.11
Spouse employed	-0.34**	-0.08	-0.12	-0.49*	0.42	0.27
No dependents	ref	0.83***	-0.81	ref	1.62***	-0.11
Dependents	-0.13	-0.20	-0.36	0.50	-0.71	-0.48
Low education	ref	1.09***	-0.47	ref	1.07***	-0.49
Med education	0.23	-0.21	-0.59	-0.89***	0.50	0.48
High education	0.44***	-0.81***	-1.11***	-1.06***	0.70	0.19
Tenure	0.00	0.01	0.00	-0.01	0.00	0.01
Hourly wage	0.04***	-0.04***	-0.06***	-0.15***	0.15***	0.15***
Industry	ref	1.04***	-0.86***	ref	0.72**	-0.37*
Commercial services	0.10	-0.02	0.13	-0.19	0.81**	-0.09
Non-commercial services	0.32	-0.64**	-0.31	-0.70**	0.98**	0.04
Not self-employed	ref	0.84***	-0.94***	ref	1.32***	-0.28
Self-employed	-1.27***	-0.53	0.67	-0.51*	0.10	-2.05*
Private sector worker	ref	0.93***	-0.86***	ref	1.24***	-0.35*
Public sector worker	0.50***	-0.49**	-0.22	-0.72**	0.51	0.01
Hours worked	0.00	0.00	-0.02*	0.00	-0.03**	-0.01
Sat with hours	ref	0.97***	-0.71***	ref	1.31***	-0.32
Prefers less hours	0.39***	-0.69***	-0.42*	0.04	0.00	-0.05
Unemployment rate	0.08**	0.17*	0.56***	0.29***	-0.19	0.24**

* indicates $p < 0.10$, *indicates $p < 0.05$, *** indicates $p < 0.01$.

these two countries, retirement offers are seemingly less frequent than in the Netherlands and there is less 'free choice' involved in choosing the age to retire, implying that these systems are less flexible than the Dutch system. Furthermore, it might be argued that once an offer is obtained, people are likely to accept it, because waiting for a better offer at a later stage might be a risky strategy. Future offers might be less attractive, and risk-averse agents are likely to accept the offer at the earliest age, which explains the observed peaks in the retirement hazard.

With respect to the age dependence of the hazard into social security, we find no clear significant effects. We only find minor evidence for a continuously increasing hazard into social security with age. For Germany and the Netherlands, we observe a significant higher probability to move into social security until the age of 60, after which the estimated baseline hazard starts decreasing. This might point to a substitution effect between the social security and retirement routes, since from the age of 60 most workers are eligible for early retirement benefits and do not need to 'retire' through social security arrangements. For Great Britain, this substitution effect does not seem to exist. Both the estimated

Table 6.4: Alternative baseline hazard specifications

		Full model	Interaction models		
			Main	Interact Net	Interact Ger
Log(duration)	to retirement	3.139***	1.567***	2.398***	2.383***
		(18.91)	(9.40)	(7.51)	(6.40)
	To social security	0.457***	-0.095	0.511**	0.665***
		(3.32)	(-0.73)	(2.45)	(3.11)
	To inactivity	0.203***	0.143	0.039	0.195
		(2.76)	(1.32)	(0.23)	(1.12)
Duration					
	To retirement	0.355***	0.206***	0.353***	0.267***
		(17.39)	(9.76)	(7.37)	(6.87)
	To social security	0.055***	0.004	0.053	0.086***
		(2.93)	(0.12)	(1.08)	(2.08)
	To inactivity	0.056***	0.011	0.043	0.101
		(3.16)	(0.41)	(1.03)	(2.59)

* indicates $p < 0.10$, *indicates $p < 0.05$, *** indicates $p < 0.01$.

baseline hazard to retirement and to social security remain rather stable as from age 60. Two alternative specifications of the baseline hazard, one linear and one log-linear as shown in Table 6.4, revealed that there is some positive duration dependence for the social security hazard, yet to a much smaller extent than compared to the retirement hazard. The slope of the estimated linear graph for duration dependence is significantly smaller for social security and steepest for retirement. Moreover, the positive duration dependence of the social security hazard is mainly found for the Netherlands and Germany, the two countries where it is contended that social security arrangements are used as an early retirement gateway. We also find some positive duration dependence for the transition to inactivity, yet to a much smaller extent than compared to the retirement hazard. Transitions into inactivity are less restricted to age, since no entitlement conditions have to be fulfilled.

Demographic indicators

With respect to gender differences, the full model shows a significantly higher probability only for women to move into inactivity. When we look at the interaction models, however, we find that country differences remove the effect for retirement exit. In both Great Britain and Germany we find that women have a higher probability to move into retirement, while Dutch women have a lower hazard into retirement. These results are in line with earlier findings of Lindeboom (1998) and Heyma (2001) for the Netherlands and Siddiqui (1997) and Oswald (1999) for Germany. In both Great Britain and Germany women still face less tight conditions for entry into early retirement schemes, which are absent in the Netherlands. In this latter country, men and women are treated equally in retirement schemes and women are less likely to meet the conditions with respect to the minimum number of working or contribution years due to disrupted working careers. Their contribution record is hence too short or they have paid too few contributions due

to part-time work to afford early retirement. The contended positive effect of a bad state of health on the exit probability is observed for both the transition into retirement and into social security, with the latter effect being the strongest, indicating that health impairments are more prominent for exit into disability. In addition, Kerkhofs et al. (1998) found that people who move into disability have a tendency to overstate their health problems in order to become entitled to disability benefits. The effect on the retirement hazard is strongest in Great Britain and Germany, which is explained by the fact that special disability schemes exists for people in bad healthin these countries within the early retirement schemes.

In all countries, workers with a working partner are less likely to exit to retirement hazard and to a lesser extent also to exit to social security. We found no significant country differences here. Our results are different from those of Miniaci and Stancanelli (1998), who found a positive effect on the retirement hazard of having an employed spouse in Great Britain. However, looking at the effects of household income, we find a positive effect of household income on the retirement hazard in Great Britain. The more income is earned by people in the household (either the individual, his spouse or other people in the households), the higher the likelihood of the retirement of the older worker in the household. It seems that when the income earned by both spouses is sufficient to afford a move into early retirement, the individual will exit early. In some cases this might be a joint decision of both partners but to establish this, we need to estimate a joint utility, model which goes beyond the scope of this study. For the Netherlands and Germany, this positive income effect is apparently less significant and less strong. This is probably related to the fact that retirement in the latter countries is more attractive for a larger part of the population due to its universal character and therefore less dependent on other financial resources in the household, as seems to be the case in Great Britain. In this latter country, we find a negative income effect for the transition into social security, which is likely to be due to the existence of means-tested benefits. Again, this effect is less strong in the other two countries, where social security benefits are generally not means-tested. In addition, it turns out that having dependents reduces exit to retirement most likely because of the higher income needs of the household that are better met by continued work. Looking at the interaction models, however, we find that the effect disappears as a consequence of the insignificant country differences.

Finally, we find that Germans from the Eastern region are more likely to exit work and to move into social security. This might be due to the increased instability of employment in this part of Germany. The inhabitants of the former East Germany had to face strong barriers after the transition in 1989 to catch up with the West Germans, a factor that particularly pertains to older workers.

Human capital indicators

The presumed negative effect of a higher education level on the exit into social security is confirmed by our data. The results of our full model show that people with the lowest education level have the highest probability of moving into social security. From the interaction models we can conclude that this effect is equally strong in all countries. These latter models also show some interesting country differences of the effect of education level on the exit into retirement. Whereas having a high education level increases the retirement probability in Great Britain, this effect is significantly weaker in the Netherlands and Germany, where it even reduces the probability to retire early in these countries. This supports the ambiguous expectations derived from theory with the income effect being dominant in Great Britain and the substitution effect being dominant in Germany. The stronger attachment to the labour market of higher educated workers in Germany was also found by Antolin and Scarpetta (1998) and Oswald (1999). This serves as an argument for using a competing risks model rather than a single risk model. A single risk model we estimated (i.e. for just the transition from work to exit, without distinguishing between the different exit destinations) shows no significant effects of the education variable, which is likely to be due to the differences between the various exit routes.

With respect to wages, the full country model does not exhibit any significant results but we do find some interesting country differences when we look at the interaction models. Analogous to the education effect, we find a dominant income effect in Great Britain with higher wage income exerting a positive effect on the retirement exit. For Germany, we find a dominant substitution effect, meaning that higher wages reduce exit into retirement. With strong seniority wage agreements existing in Germany, the opportunity costs of retirement are higher. For the Netherlands, no effect of wage is found on the exit into retirement. For Great Britain, we further observe that higher wages, just like household income, reduce the probability of exit into social security, whereas this effect is around zero in the remaining two countries. The reason for this is again the existence of means-tested benefits in Great Britain. From theory, tenure was expected to have a positive effect on the exit into retirement and a negative effect on exit into social security, but no significant effects are found. Note that part of the effect of tenure is incorporated into the baseline hazard since this represents the duration of employment after the age of 50. The tenure variable refers to the work experience before age 50.

Job-related indicators

Being self-employed reduces both the chances of exit to retirement and to social security in all countries. The self-employed are usually excluded from social security protection and only participate in private early retirement schemes, which are more costly. They have a lower likelihood of exit out of employment in general, while they cannot afford to

quit their self-employed job and need to continue to work up to later ages. The negative effect on exit into social security is strongest in Germany, where the entitlement to social security benefits is strongly related to previous employment records and where the self-employed are generally excluded from the social protection schemes. In addition, we do find the expected positive effect of working in the public sector on the retirement hazard and the expected negative effect on exit to social security. In general, as explained earlier, public sector employees were among the first to profit from fairly generous early retirement benefits. Moreover, in the shielded public sector, workers are usually the best protected against the income risks of job loss, explaining their lower likelihood of moving into social security. We find that the higher exit rates to retirement of public sector workers is least prevalent in the Netherlands. As explained in Chapter 4, early retirement schemes in the Netherlands offer universal benefit schemes (VUT schemes), which only differ from the ones for the public sector because of their lower retirement age. In the Dutch sample, the average age of early retirement of public sector workers is 55.0, whereas the average age of early retirement of private sector workers is 56.6. From theory we suspected that workers in industry are more likely to exit to social security because of their higher risks on unemployment and disability. Our findings show no sign of this presumed effect, though we find a similar effect for the non-commercial services in Great Britain and Germany while for the Dutch service-sector workers this effect is significantly lower. Dutch commercial service workers even have a higher probability to move into social security which might be due to the very generous early retirement schemes in this sector (i.e. the banking and insurance sectors).

As a proxy for the impact of people's preference for working, both the actual and preferred weekly number of working hours were included in the model. The evidence we found is rather mixed. First, workers working more hours have a lower probability to transit into social security in the Netherlands, whereas no effects are found for the other countries. Working more hours signals a stronger commitment to work, either due to preferences for work or to higher income needs. Second, older workers who have a preference for working fewer hours than they currently do, have a higher probability to retire in Great Britain, while the reverse is found for the other two countries, especially in the Netherlands. A possible explanation might be that part-time work is common in the Netherlands, allowing workers who want to reduce their working hours to do so. In Great Britain, where part-time work is less common, workers are more or less obliged to retire because there are no part-time jobs available to them.

Finally, we find that the national unemployment rate has the expected positive effect on both the retirement and social security hazards. In addition, both effects are strongest in Germany and Great Britain, probably due to the fact that Germany has a higher unemployment rate. It seems true, however, that older workers are especially vulnerable to early exit in times of economic recessions as was the case in the early 1990s.

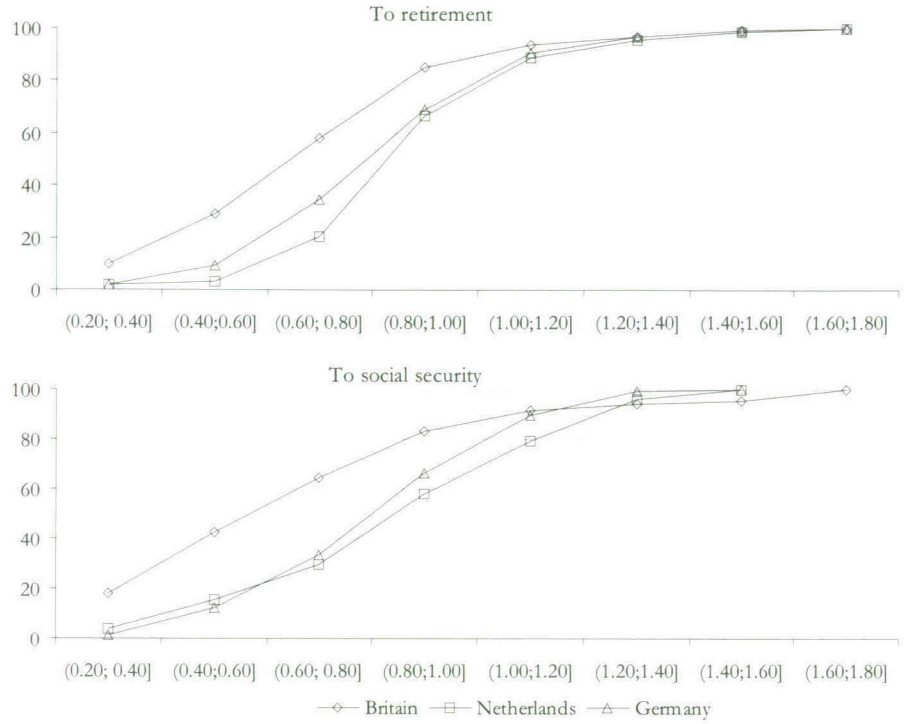
6.4.2 Income consequences of early retirement

In this section, we briefly analyse the income effects of early retirement in the different institutional settings.[13] As explained in Chapter 2, exit into early retirement is usually possible at the 'price' of a lower income in the years after retirement, compared to the income during the years of working. Older workers are willing to pay this price because their preference for leisure has increased. From theory we expected differences in these income drops between countries, between schemes and between different groups of workers (e.g. public sector workers versus private sector workers). It is the purpose of this section to present some evidence on this issue. Analogous to a paper of Zaidi et al. (2003) we focus on net equivalent household income. We use household income because we believe that especially for retirement, individuals share resources with other family members. For example, as explained in Chapter 4, pension benefits often depend on the family status of the individual (i.e. the dependent spouse or the children). For the same reason, we use net income rather than gross income. Differences in gross income are expected to be large. Tax exemptions might be different between the countries, leading to differences in income after retirement. Finally, to control for differences in household size between individuals, we use equivalent household income, using the OECD modified equivalence scale.

One way to examine the income consequences of retirement is to look at the replacement rates: the share of the income received during working life that is maintained during retirement. In Figure 6.5 we have plotted the income replacement rates for workers who retired from t to $t+1$. The replacement rate is calculated as the ratio of net equivalent household income at $t+1$ over net equivalent household income at t. We included only people who left at least two years before the official retirement age (commonly 63, except for British women, which is 58) since from this age income effects might be different due to the entitlement of public old-age pensions in all countries. We find that replacement rates are generally lowest in Great Britain, where half of the retired workers have a replacement rate of 60 to 80 percent of previous income. In both the Netherlands and Germany, replacement rates are higher with 60 percent of the retired workers having a replacement rate between 80 and 100 percent of previous income. These country differences comply with our expectations. In addition, it is interesting to look at differences in the replacement rates between the different retirement pathways. In all countries, replacement rates of social security are lower compared to those of retirement. This differences is largest in Great Britain where the ratio of the average replacement rate of social security to the average replacement rate of retirement is 0.95, compared with 0.99 in the Netherlands and 0.98 in Germany. Looking at Figure 6.5 we find that in Great Britain the median replacement rate lies between 60 and 80 percent for retirement and between 40 and 60

[13] We only provide some descriptives here. Modelling income consequences of early retirement could have a chapter on its own devoted to it, and yet, goes beyond the scope of this dissertation.

Figure 6.5: Replacement ratios of retired individuals by country (cumulative frequencies)

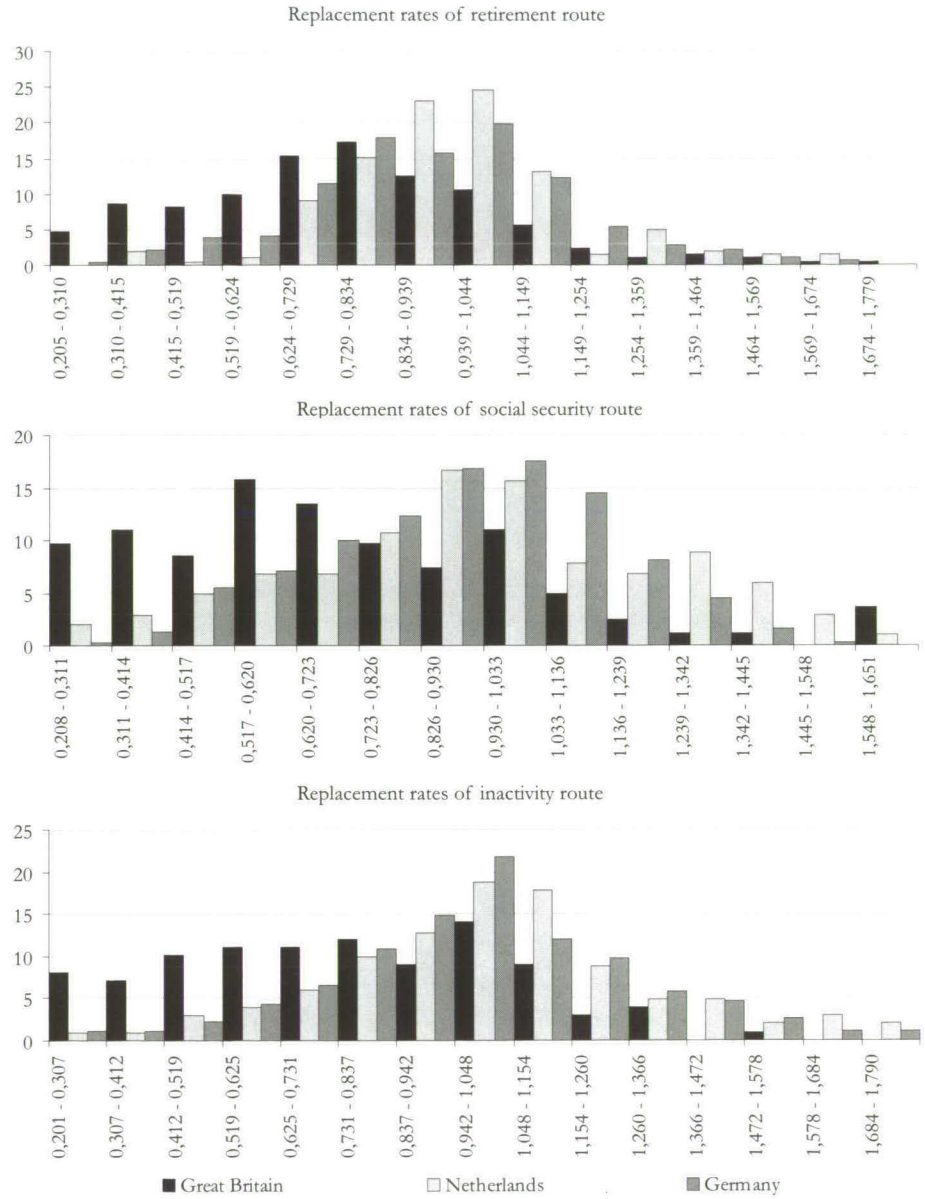


Source: own calculations using GSOEP, BHPS, SEP

percent for social security. In the other two countries the distributions for the two pathways look much more alike, with the median replacement rate being between 60 and 80 percent for retirement and social security in Germany, and between 80 and 100 percent for retirement and social security in the Netherlands. In Chapter 4 we explained that social security in these latter countries is much more generous compared to Great Britain, with even higher replacement rates for older workers. With respect to the inactivity exit, we find that in Great Britain the average replacement rate is about the same as that of the retirement exit (i.e. average replacement rate is 0,75). In Germany and the Netherlands, however, we find that the average replacement rate of the inactivity exit is actually higher than that of the retirement route. The ratio of the average replacement rate of inactivity over that of retirement is 1.06 in Germany and 1.10 in the Netherlands.

In addition, it is interesting to look at the spread of the replacement rates of all routes in the three countries under scrutiny. The distributions are plotted in Figure 6.6. We observe that the replacement rate of the retirement exit is least spread in the Netherlands, which is explained by the fact that the early retirement schemes (VUT schemes) offer roughly the same conditions for all workers. Almost all workers who are entitled to an early retirement scheme, are entitled to retirement benefits that amount to about 80 to

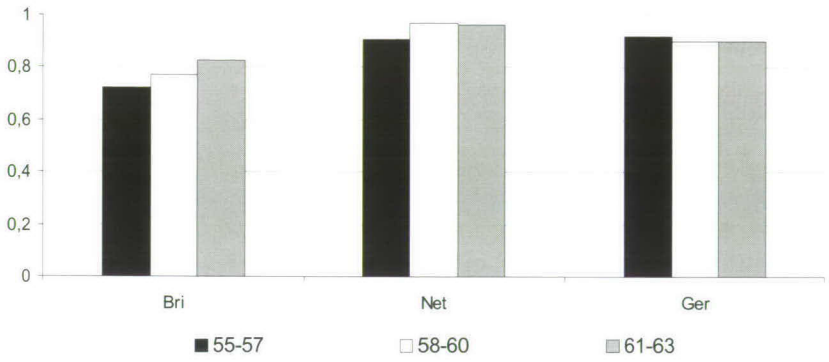
Figure 6.6: Replacement ratios of retired individuals by country and exit route



Source: own calculations using GSOEP, BHPS, SEP

90 percent of their previous wage earnings. We observe the highest spread in Germany, which is explained by the fact that early retirement schemes are very different for people in different occupations and for workers of different levels. Looking at the social security exit, we find a higher dispersion of replacement rates in all countries. This is likely to be due to

Figure 6.7: Replacement ratios of retired individuals by country and age, exit into retirement pathway only



Source: own calculations using GSOEP, BHPS, SEP

the fact that social security benefit levels depend on specific individual characteristics. For example, disability benefits depend on the minimum incapacity to work and workers are assumed to differ with respect to such characteristics. The German distribution of social security replacement rates is clearly left-skewed, implying that there is a relatively large number of workers receiving low replacement incomes, while a small group of workers receive high replacement incomes. Again, this is due to the higher selectivity in the German social security system. Finally, when we look at the distribution of replacement rates of the inactivity exit, we find that the dispersion is now largest in Great Britain, whereas in Germany and the Netherlands, it is more concentrated.

Previous studies showed that the level of replacement income during retirement is different at different retirement ages (Blondal & Scarpetta, 1998; Hansen, 2000; Nelissen, 2001). Because of this, the pension system provides incentives to retire at certain ages and disincentives to retire at other ages. To see whether we find evidence for this, we have plotted the average replacement rates by retirement age in all countries, in Figure 6.7. In the Great Britain and the Netherlands we find an increasing replacement rate with age, whilst for Germany we find almost stable replacement rates with age. Looking at the estimated hazard rates into retirement as depicted in Figure 6.3, we can conclude that for the Netherlands we find similar patterns when comparing the two figures. For the Netherlands we found a strong increase in the hazard rate with age, which is probably because of the increasing replacement rates with age. For Great Britain, however, we find a more modest increase in the hazard rate, whereas we find a relatively strong increase in the replacement rates. For Germany, we find the reverse, with a relatively steep increase in the hazard rate, whilst a corresponding increase in replacement rates is not found. We have to note, however, that the number of observations for which we have reliable replacement rates is relatively small, which might explain this. A more detailed study on replacement rates is advised, however, we leave this for future research.

6.5 Concluding remarks

In this chapter, job search theory is used to explain older workers' retirement behaviour. The study is comparative and longer running panels of three countries are used: Germany, Great Britain and the Netherlands. Older workers are assumed to search for the optimal timing and exit route into retirement. The decision rule applied here follows neo-classical economic theory by contending that individual agents aim at maximising utility. The acceptance decision depends on the so-called reservation utility, the arrival rate of exit offers, the utility derived from these offers, the search costs (both out of pocket costs and opportunity costs) and the worker's intertemporal preference for work and leisure. This acceptance decision, and hence the transition probability is expected to differ among individuals as well as among countries. The main purpose of this study is to find out which factors can explain retirement behaviour and to what extent differences in the observed retirement patterns can be explained by differences in institutions and social security benefit entitlements. The countries are chosen because of their differences in social security policies and their being members of different welfare state regimes.

The results show that these differences in policies and regime type are largely reflected in the retirement behaviour of older workers. In Great Britain, with a liberal market-oriented welfare strategy, the lowest number of early exits are found. In addition, the majority of workers who leave employment use occupational or private retirement schemes, whereas in Germany and the Netherlands social security is more frequently used as an early exit pathway. The hazard into social security clearly increases with age in these countries. Both the German and Dutch welfare states are characterised by more state interference, resulting in more generous and universal social security arrangements. The results also show that although in all countries the retirement hazard increases with age, this increase is significantly stronger in the Netherlands and Germany compared to Great Britain. Moreover, while Germany and Great Britain show peaks in the retirement hazard at marked ages, in the Netherlands, retirement offers are received over a longer period, from age 60 till age 62. In addition, some evidence is found for a substitution effect between the social security exit and retirement in the Netherlands and Germany as of the age of 60. From that age, the retirement hazard increases fast, whereas the social security hazard decreases.

Concerning the effect of other covariates, the outcomes show that the countries are not as dissimilar as expected. With respect to the *hazard to retirement* we find limited variance in the sign of the covariates, although the significance differs between countries. The only effect which is equally strong for all countries is a negative effect of having an employed partner. Germany and Great Britain show some similarity in that a bad state of health increases the exit probability into retirement, while working in the public sector, and a higher unemployment rate increase the hazard. However, they particularly differ with

respect to the effect of the wage level. In Germany a higher wage decreases the retirement hazard while in Great Britain the reverse is found. For Great Britain it is likely to be true that the negative substitution effect of the wage level on early retirement is compensated by a positive (wage or household) income effect. The Netherlands and Great Britain share the finding that the self-employed are less likely to exit into retirement, though the effect is significantly stronger in the Netherlands. From theory, it was expected that Germany and the Netherlands would be much more similar in these respects and Great Britain would be the outlier. This seems generally not the case, though the country interaction models show that at least some evidence for this exists.

With respect to the *hazard to social security* the three countries share the fact that a bad state of health increases the likelihood of exit into social security, with the weakest effect found in Germany. This is explained by the availability of generous disability pensions being part of the retirement schemes in this country, acting as a substitute for exit into social security. In both Germany and Great Britain, a negative effect on the social security hazard is found for having a higher education level, for being self-employed and for working in the public sector. The Netherlands and Great Britain share the finding that having a higher wage reduces the social security hazard. Finally, in all countries a higher unemployment rate increases the exit chances into social security, with a significantly stronger effect in Germany. In general we find support for the hypothesis that the higher the replacement rate offered in the various pathways, the higher the likelihood of early exit. The country evidence indeed shows that the lowest replacement rates and lowest transition probabilities are observed for exit into social security compared to exit into retirement. In addition, we observe the lowest replacement rates and lowest exit probabilities in Great Britain, whereas the highest are found in Germany and the Netherlands, both countries having more generous and more flexible early retirement systems. We also find some evidence for higher replacement rates at higher ages, explaining why the hazards increase with age. However, for reasons yet to be established, this latter effect is not as clearly observed in all countries.

These observed differences indicate that institutions and social security policies indeed play a role in explaining older worker's retirement behaviour across countries. The study adds to the literature in the use of long-running panel data, allowing us to apply advanced duration models and to correct for unobserved heterogeneity. In addition, its comparative perspective permitted us to focus on the role of the institutional context for explaining country differences. In the near future, the approach needs to be extended and refined by including more detailed institutional characteristics of the social systems, such as the replacement rates of the various exit routes at different ages. Changes in policies, benefit levels and hence replacement rates over time, as well as changes in human capital investments have to be taken into account to improve the explanatory power of our models and the robustness of our parameter estimates. Finally, the inclusion of more

countries and more regime types, as in Chapter 5, would allow us to test formally to what extent regime types and differences in institutional arrangements are important as well as structural dissimilarities, such as differences in human capital investments, in population composition and in labour market characteristics.

Appendix

The construction of the variables

Table A1 presents some descriptives of our indicator variables. The covariates are divided into four groups: demographic indicators, human capital indicators, job-related indicators and macro economic indicators.

Table A1: Summary of sample covariates, by country

	Great Britain (BHPS)	The Netherlands (SEP)	Germany (GSOEP)
DEMOGRAPHIC INDICATORS			
Sex			
Male	57.1	70.2	64.9
Female	42.9	29.8	35.1
Health condition			
Bad / fair	23.3	75.5	58.1
Good	76.7	24.5	41.9
Single	14.6	15.3	13.7
Partner is employed	76.2	59.0	60.8
Dependents in the household	48.6	45.3	51.1
Mean total household income[a]	18355	15577	22402
East-German			27.0
HUMAN CAPITAL INDICATORS			
Education level			
Low	39.6	27.4	26.0
Medium	27.4	45.5	58.2
High	33.1	27.1	15.8
Tenure before age 50	20.2	16.8	24.8
Hourly labour income[b]	10.2	17.6	12.6
JOB-RELATED INDICATORS			
Job status			
Self-employed	19.4	11.5	7.9
Public sector employee	30.0	25.6	28.4
Sector of industry			
Primary sector / industry	31.9	29.2	54.8
Commercial services	34.0	28.7	16.7
Non-commercial services	34.1	42.2	28.5
Mean hours worked	40.9	37.3	41.3
MACRO ECONOMIC INDICATORS			
Mean unemployment rate 90-99	7.6	5.3	8.4

[a]Standardised using Modified OECD Equivalence scale, expressed in Euros. For Great Britain and Germany gross incomes reported, for the Netherlands net income.
[b]Expressed in Euros.

Because of the higher male employment rate in all countries, men are over-represented in the various country samples. Female labour participation is lowest in the Netherlands, although a recent study of Vlasblom and Schippers (2004) shows that the Dutch female participation rates, including those of older women, have been rising the fastest among a number of European countries. Separate estimation of the models for men and women has to be preferred, although the resulting lower number of transitions into the various

exit states might also yield biased estimation results. Therefore, we have decided to include a dummy to control for differences between males and females in their retirement behaviour. With respect to health, we rely on self-reported health, rather than other measures of health. The main reason for this is the inconsistency between the separate panels of the more objective health measures. Some questions are present in one panel set but absent in another, making it difficult to derive a comparable measure of health.

The individual's education level is measured using a rather crude index only distinguishing between three levels of education: low, medium and high. For Germany, low refers to education levels of less than high school; medium to completed high school; and high to levels higher than high school. For Great Britain low includes people having a qualification lower than the 'O' level; medium refers to people having a 'O' or 'A' level qualification; and high refers to people having higher qualifications or degrees. For the Netherlands the 'Standard Education Classification' (SOI-1978) is used and low refers to primary and first-level secondary education (secondary education of a maximum of four years); medium refers to second-level secondary education; and high refers to higher and academic education. In Germany and the Netherlands, the majority of older workers have a medium education level, while in Great Britain the majority seem to have a low education level. Tenure is measured as the duration of the employment spell before the age of 50, because the duration of employment from this age is the dependent variable in our models. We use the gross individual hourly wages, and of the three countries these appear to be highest in the Netherlands. Perhaps the seniority wage system is most rewarding to older workers in the Netherlands.

Household characteristics include a dummy for being single, the spouse's employment status, a dummy for having dependents (either children or other people) in the household and household income. Only about 15 percent of the older workers are single, and with respect to the spouse's employment status, the Netherlands resembles a rather 'traditional' role pattern with husbands working full-time and spouses not working at all at later ages. In Great Britain, we found the highest percentage of two-earner families, which reflects the typical 'dual earner' model in liberal regimes, where both spouses work long hours. With respect to household income, ideally we wanted to exclude the individual's own labour income: however, this appeared impossible in the Dutch case. Therefore, for the Netherlands net equivalent annual total household income is included (as well as gross individual hourly wage.[14] To minimise the collinearity problems, household income is only included for people living in households consisting of at least two persons. In addition, to get a clearer picture of the effects of income, an interaction effect between household income and hourly wage is included. For Great Britain and Germany, gross equivalent annual 'other' household income is included, i.e. net of individual gross labour earnings. Finally, for the German sample, a dummy is included to control for the effect of dissimilar

[14]For standardisation, the modified OECD equivalence scale is used.

arrangements in former East-Germany. The two parts of Germany still differ with respect to their retirement schemes.

Job characteristics include actual weekly working hours, the preferred weekly working hours and dummies for being self-employed, being a public sector employee and being a service sector worker (both commercial and non-commercial). The highest percentage of self-employment is found in Great Britain which might be explained by the liberal, market-oriented welfare state in which the incentives to work either in paid work or in self-employment are strong. In both the Netherlands and Great Britain, the majority of older workers is found in the service sector. The correlation between working in the public sector and working in the service sector appeared to be sufficiently low (Netherlands 0.30, Germany 0.56 and Great Britain 0.46) to include both of these variables in the model. In all countries, older workers primarily work full-time. To control for business cycle effects, the national unemployment rate is included.

Chapter 7

Training of older workers and retirement

7.1 Introduction

In this chapter we focus our attention on the training of older workers and its effect on the retirement decision. Our interest stems from the fact that economic theories, and human capital theory in particular, suggest that depreciation of human capital might play a role in explaining retirement patterns (Alders, 1999). This helps to explain the growing interest for training of older workers on the part of the research community in recent decades. Moreover, the concept of 'lifelong learning' is nowadays at the core of the policy debate in Europe. Older workers should be kept within the labour market for a longer period of time, and one of the means of achieving their continued employment and improving their productivity is by increasing their participation in training programmes, as argued in a European policy report (2003). In the employment guidelines established in July 2003, it states that "Access of workers to training is an essential element of the balance between flexibility and security and the participation of all workers should be supported, taking into account the returns on investment for workers, employers as well as society as a whole". It is further argued that "It is important that there is a significant increase in investment by enterprises in the training of adults with a view to promoting

**Part of the research of this chapter was carried out as part of the work of the European Panel Analysis Group (EPAG) on 'The Dynamics of Social Change in Europe'(HPSE-CT-1999-00032) under the programme 'Improving the Human Research Potential and the Socio-Economic Knowledge Base' of the EC's Fifth Framework. Some of the results are printed in Berthoud, R. and Iacovou, M. (2004), Social Europe - Living standards and welfare states, Edward Elgar, Cheltenham and in Schils, Trudie and Muffels, Ruud (2003) 'The Ageing Workforce and Labour Market Mobility - Do Mobility Patterns Differ between Age Groups and Welfare Regimes?', EPAG Working Paper, no. 44, Colchester: The University of Essex.

productivity, competitiveness and active ageing (European Commission, 2003b)." Failure to train older workers could lead to a rapid skill obsolescence which might result in severe employability problems for older workers as well as a deterioration of the skill level of the workforce in coming decades and a further increase in the number of early retirees (OECD, 1999). These expectations are derived from human capital theory that predicts that human capital investments (i.e. participation in training) are lower for older people compared to younger cohorts. The main reason for this being the higher transaction costs associated with training of older workers. The obsolescence of human capital due to a lack of investments not only reduce life-time income, but also the price of early retirement, as put forward by Alders (2004) as well as increase job to non-job mobility of older workers. However, these predictions have been hardly tested empirically. It is the aim of this chapter to establish whether these, and other, predictions are true when examining the evidence for a number of European countries over a number of years.

In Chapter 5 we concluded that training has a positive effect on the labour market attachment of older workers in that it reduces the probability of retiring early. In the present chapter, we elaborate on differences in training both between and within groups of younger and older workers. More precisely, we investigate to what extent participation in training is lower for older workers than for younger age groups. In addition, we investigate to what extent other determinants of training (e.g. education level, work experience) are different for older workers compared to their younger co-workers. By analysing this in a comparative perspective, we are able to examine the differences between countries. Countries not only differ with respect to the institutional structure of their early retirement schemes - as we have seen in earlier chapters - but they also differ with respect to their training facilities. We investigate to what extent such institutional differences reflect differences in training of older workers. In this respect, our study is complementary to a recent study of Arulampalam et al. (2004), who investigated participation in training in ten European countries. However, we specifically focus on older workers, while older workers aged over 55 were excluded from their analysis. Additionally, the modelling technique used in our paper, adds to their paper as we specifically correct for possible selection bias due to non-random employment decisions.

Although, in Chapter 5, we modelled the effect of training as an exogenous effect on the retirement probability, we have reason to believe that this is not entirely correct. From both the theoretical and empirical discussions on the training incidence of older workers in this chapter we conclude that some of the observed characteristics affect both the decision to retire and to participate in training, meaning that we have to deal with the collinearity between the explanatory variables. As a result of this endogeneity problem, a model that compares the retirement behaviour of trained older workers (i.e. treated group) with that of untrained older workers (i.e. control group) with equal observable characteristics might lead to biased results. In this chapter we first test to what extent

such an endogeneity problem is observed in the countries in our analysis. Additionally, we show how the participation in training, corrected for the endogeneity bias, affects the exit behaviour of older workers.

The chapter continues as follows. In Section 7.2 we discuss the economic theories that account for the participation in training of older workers. We use human capital theory as the leading theory in this respect. In Section 7.3 we discuss the data used for estimation, present some descriptive statistics, and explain the methods used to analyse the participation in training. Section 7.4 discusses the estimation results of the empirical models. In Section 7.5 we discuss our tests on the endogeneity issue and highlight countries where this exists. Furthermore, we discuss the methods for correcting for endogeneity bias and we show how training affects the exit probabilities. The chapter ends with Section 7.6 comprising the concluding remarks.

7.2 Training of older workers: theoretical framework

According to human capital theory (Becker, 1964), investments in human capital can be seen as the building up or the formation of capital (knowledge-based or skill-based) within people. Human capital refers to formal and informal knowledge obtained through pre-school learning, (primary, secondary and tertiary) education and job-related training. With respect to the latter, a distinction is made between (a) formal training, which refers to formally organised activities such as apprenticeships, workshops and courses; and (b) informal training, which refers to learning by doing and hence to work experience. While Mincer (1962), for example, includes both forms in his on-the-job training concept, we make a distinction between formal and informal training. Our focus is on formal training, i.e. the participation in courses offered on-the-job.[1] When investing in on-the-job training, both employers and workers must evaluate the costs and benefits of such training. Costs not only include direct costs such as equipment and materials used, but also indirect costs such as the value placed on the time and effort of the trainees as well as on that of their employers. The main expected return on training is an increase in productivity, which is expected to result in an increase in earnings for the worker.[2] However, with respect to the willingness to pay for training, Becker clearly distinguishes between two types of training: general training that also raises the productivity of the worker in other firms, and specific training that raises only the productivity in the firm offering the training. Since returns of general training are not firm-specific, rational employers provide such training only if they can shift the costs to workers. Moreover, workers are usually willing to pay for these costs since the training raises their overall productivity and hence expected overall

[1] In the analyses, however, we include informal training by including work experience as a variable.

[2] Rationally behaving firms pay their employees equal to their marginal products. When productivity, i.e. the marginal product, increases, so do wages in a fully competitive market.

earnings, regardless of the kind of employer they work for. Specific training, on the other hand, mainly yields firm-specific returns and the readiness on the part of the employee to pay is not as clear-cut as with general training. In the case where the employer pays for the specific training and the worker leaves the firm after a while, the employer is faced with a lower productivity because the new employee will not have the same productivity as the trained employee. In the case where the worker pays for the specific training and he is laid off, he will earn a lower wage in his new job because the training he received in his old job is of no value to the new employer (i.e. his marginal product is not higher). Both parties thus face a risk when paying for the training. In theory, when behaving rationally, they would share the costs (Becker, 1964).

Following from this, it is expected that age reduces the probability of participating in training programmes. The main reason for this is that net training costs (i.e. benefits minus costs) associated with older workers' participation in training are higher, for several reasons. First, net training costs are higher because of the shorter payback period for older workers (Becker, 1964). Although retirement at the official retirement age is not mandatory in most European countries, it is common practice to retire at that age. Additionally, the mere existence of early retirement opportunities reduces the expected payback period and discourages both older workers and employers from investing in training.[3] Second, the returns from training are lower at higher ages because of human capital depreciation (Neumann & Weiss, 1995). One of the factors causing this human capital depreciation is obsolescence. As a consequence of technological developments at the workplace, current workers' skills become less valuable in economic terms. The rate of obsolescence is expected to be highest in the technologically advanced capital-intensive industrial sector rather than in the labour-intensive service sector. The rate of obsolescence is lower for people with higher education levels (Brunello, 2001). The main reason is that the highly-educated worker has generally spent more years in education building a larger knowledge base. In addition, according to Brunello (2001), the rate of obsolescence also depends on the type of education the individual has received. In countries where the education system primarily offers general education, the rate of obsolescence is higher compared to countries where the education system is more targeted toward vocational skills (e.g. apprenticeship systems in Germany and the Netherlands). Apart from obsolescence, other factors affecting human capital depreciation include physical deterioration and non-employment situations (Arrazola & de Hevia, 2004). Third, it is often presumed that older workers are less trainable than younger workers because both their learning ability and their flexibility is considered to be lower (Casey & Bruche, 1981). This is expected to increases the costs and efforts associated with the training activities for older workers.

[3]Note that causality can run both ways here. A lack of training might induce early retirement, yet the mere existence of early retirement might reduce participation in training.

Apart from age, a worker's human capital endowments are expected to affect his training probability. Generally speaking, two contradictory perspectives are distinguished:

1. The accumulation perspective of lifelong learning predicts a positive relation between a worker's human capital and his participation in training. Within this perspective it is argued that especially people with higher human capital endowments are more likely to accumulate skills and knowledge during their working career compared to people with lower human capital levels. This supplements the explanation given earlier that training costs are generally lower for people with higher human capital.
2. The compensation perspective of lifelong learning holds that it is especially workers with lowest human capital endowments who need to be trained to make up for their lack of skills and knowledge. Training is a requirement for remaining employable and become integrated into society. This is expected to be strongest in countries with ungenerous social security benefits where paid employment is the main source of income.

From Chapter 3 we learned that the main predictors of a worker's human capital are his education level and his work experience. We will now examine how the two different perspectives apply to the various sources of human capital and whether we expect to observe differences between younger and older cohorts of workers.

First, since education systems have developed over time, and access to higher education has increased in most countries, older cohorts of workers have, in general, lower education levels compared to younger cohorts. In addition, older workers received their formal education in the past, suggesting that the effect of former education on the likelihood of participating in training is higher for younger workers. For employers, education level is a good way of screening new workers (Stiglitz, 1975). Second, older workers generally have acquired more work experience, thereby raising their human capital. More work experience indicates that the employee has been involved in the informal on-the-job learning process, and most probably in formal learning activities as well. Job matching theory contends that a longer tenure points to a good worker-job match (Jovanovic, 1979), which decreases job-to-job mobility and increases the returns and the likelihood of training. However, for older workers this effect might be offset by shorter remaining job duration because of early retirement prospects, especially in countries with generous (early) retirement benefits.

In addition to age and human capital effects on the likelihood of participating in training, we expect other variables to exert an effect on a worker's likelihood of participating in training. A good state of health, for example, is expected to affect the older workers' likelihood of participating in training positively. For workers in a bad state of health, the productivity increase due to training is expectedly to be low, the exit risk (especially into social security) high, and the training of people in a bad state of health might be more

difficult (e.g. caused by reduced time spent to training because of health problems). All these factors raise the net training costs for people in a bad state of health. In addition, workers employed on a flexible or temporary contract basis are expected to have a shorter payback period and hence a lower probability of participating in training. However, as put forward by Arulampalam et al. (2004), there are some reasons why the reverse might be found: (1) When flexible or short-term contracts are treated by employers as a probationary work period (e.g. very common in Austria and the Netherlands), training might be seen as a way to value the worker's productivity before offering him a permanent contract; (2) In some countries (e.g. Finland, France, Italy and Spain) special regulations exist that allow the use of flexible contracts for training purposes (OECD, 1999).

In sum, we expect the following effects:

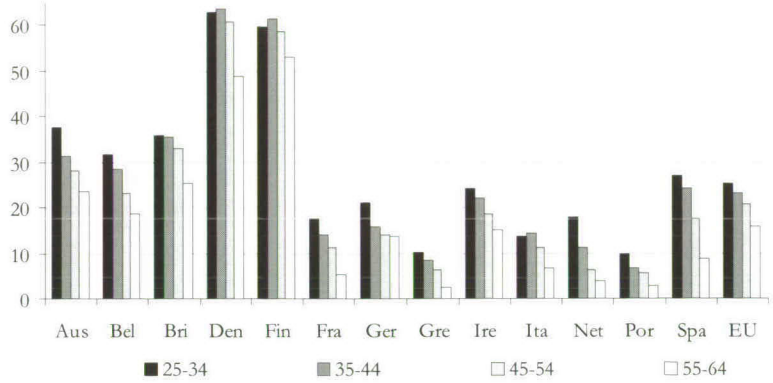
$\partial P(\text{training})/\partial \text{Age}$	< 0	
$\partial P(\text{training})/\partial \text{Education}$	> 0	Accumulation perspective
$\partial P(\text{training})/\partial \text{Education}$	< 0	Compensation perspective
$\partial P(\text{training})/\partial \text{Education}$ for young workers $> \partial P(\text{training})/\partial \text{Education}$ for older workers		
$\partial P(\text{training})/\partial \text{Tenure}$	> 0	Job matching theory
$\partial P(\text{training})/\partial \text{Tenure}$	< 0	for older workers when early retirement is generous
$\partial P(\text{training})/\partial \text{Health}$	> 0	
$\partial P(\text{training})/\partial \text{Temp contract}$	< 0	

In section 7.4 we investigate to what extent these predicted effects on a worker's training probability are supported empirically. We first show some evidence on country differences in formal training.

7.3 Country differences in on-the-job training

Before turning to our empirical model and estimation results, we first show some evidence on the country differences in participation in formal training. Figure 7.1 shows the percentages of workers receiving training by age and country. These results compare fairly well with other studies on training incidence in Europe (Arulampalam et al., 2004; OECD, 1999). In all countries, the percentage of workers receiving training declines with age, yet we observe some interesting differences between countries. We find the highest percentages of training across all ages in Denmark and Finland. Scandinavian countries are renowned for having a long tradition of lifelong learning within firms and organisations and for their policies of promoting 'employability' practice (Antikainen, 2001). Although the training incidence is lowest for the oldest age group, nevertheless about 50 percent of older workers participate in on-the-job training. We have shown, in Chapter 4, that both countries are characterised by moderately generous early retirement schemes, which might be an incentive for older workers to remain employed and to participate in train-

Figure 7.1: Training incidence of older workers in Europe 1994-2000, by age and country



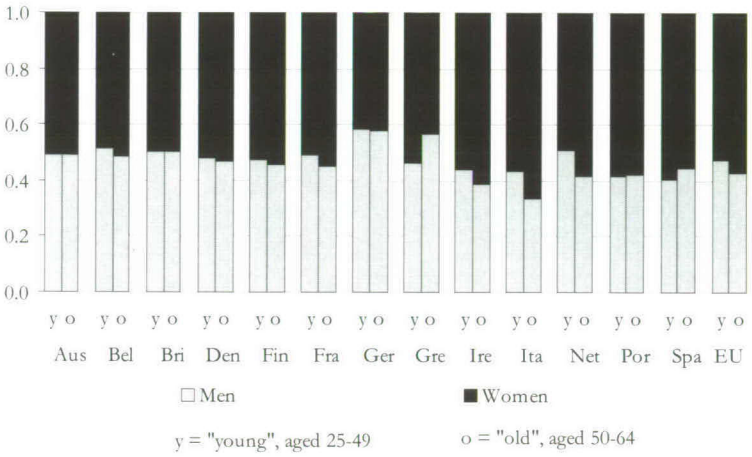
Source: Own calculations, ECHP 1994-2000 pooled data

ing. A second group of countries, comprising Austria, Belgium, Ireland and Great Britain, shows average participation rate in training with about 15 to 20 percent of older workers participating in job-related training programmes. Interestingly, these countries represent different clusters when it comes to the generosity of early retirement schemes. Early retirement is most generous in Austria and Belgium, but ungenerous in Ireland and Great Britain. The relatively high participation in training of older workers in the first two countries might indicate that these workers are a very select group. People who are still employed at older ages in countries where early retirement is most common and generous are expected to show a higher work attachment, either because of preference or because of financial obligations. Overall, in Greece and Portugal we find lowest participation rates of training. Looking at the participation in training of older workers (aged 55 and over), this is also extremely low in other countries, such as France and the Netherlands, where less than five percent of the workers are participating in formal training. These countries all have moderately or highly generous early retirement schemes. Overall, we can conclude that the country clustering we developed does not entirely fit when we look at the training incidence of older workers.

Next, we show some details of the composition of the group engaged in formal training. In Figure 7.2 we show the composition by sex, i.e. the percentage of males and females among the trained workers by age group.[4] In the majority of countries, about half of the trained individuals are female. In some countries, i.e. in Ireland, Italy, Portugal and Spain, we find a slight over-representation of females among the training participants and only in Germany do we find the opposite with about 60 percent of the trained workers being male. Looking at the difference in composition by sex between the younger workers (i.e. aged

[4]Note that we conditioned on workers who are observed to be in employment at the time of training and the period thereafter. In this way we have corrected for differences in exit probabilities by sex.

Figure 7.2: Composition of trained workers' group by sex and country, 1994-2000



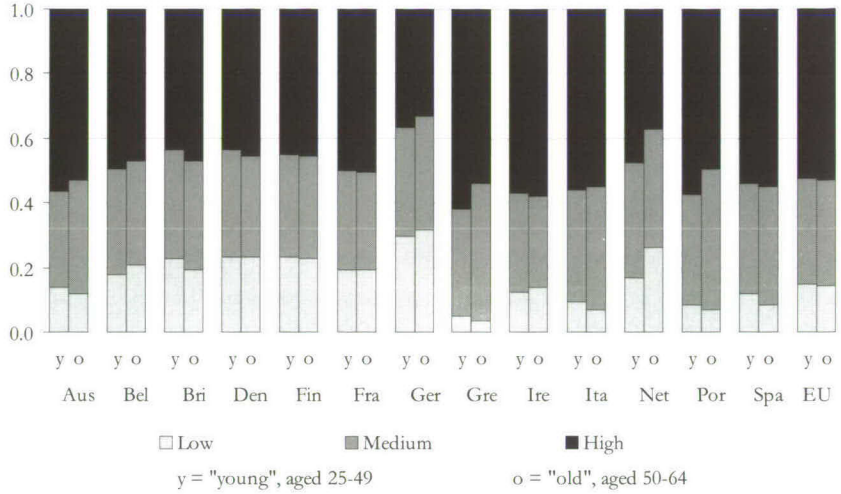
Source: Own calculations, ECHP 1994-2000 pooled data

between 25-49) and older workers (i.e. aged between 50 and 64) we find that, on average, the percentage of females among the training participants is higher in the older age group. This is especially true for Ireland, Italy and the Netherlands. Using the compensation theory discussed earlier, the explanation for this might be that especially older women are more likely to participate in training, partly to offset their lower education levels and possible human capital depreciation as a consequence of disrupted working careers (Mincer & Ofek, 1982).

Looking at the composition of the trained workers' groups by education, as shown in Figure 7.3, we find some interesting differences.[5] Looking at the European average, we find that about half the trainees have a higher education and we also find that the likelihood of participating in training increases with education level. This supports the accumulation perspective of lifelong learning theories explained earlier. Moreover, as for Europe as a whole, we find no difference between the age groups. However, when we look at the results for single countries, we do find some small differences. Germany differs in that training seems more evenly distributed among workers with different education levels. The worker's educational attainment does not seem to matter with respect to the likelihood of participating in training, which might be related to the apprenticeship system in Germany. In this system, educational differences might be equalised since all apprentices receive quite intensive vocational on-the-job training. In a large number of countries (e.g. Austria, Belgium, Germany, Greece, but especially in the Netherlands and Portugal) we find that the percentage of higher educated workers among the trainees is

[5]Note that we conditioned on workers who are observed to be in employment at the time of training and the period thereafter. In this way we have corrected for differences in exit probabilities by education level.

Figure 7.3: Composition of trained workers' group by education and country, 1994-2000



Source: Own calculations, ECHP 1994-2000 pooled data

lower for the older age group, although differences are small in most cases. In Denmark and Great Britain, we find the reverse, with the percentage of higher educated among the trainees being slightly higher for the older age group. From theory, we expected training costs to be higher for older and low-educated workers, but we only find a limited degree of support for this in Italy, Spain and Great Britain. Here, the percentage of low-educated workers among the trainees is lower for the older age group.

The estimation results will reveal whether the reported differences from this descriptive perspective are significant. First, however, we discuss the methods and data used for estimation.

7.4 Modelling the participation in training

All analyses in this chapter have been performed using seven waves of the European Community Household Panel Survey (ECHP) covering the period 1994-2000.[6] For an overview of the data, the sample selection procedure and the descriptive statistics on the explanatory variables, see the Appendix to Chapter 5.

The dependent variable in our analysis is a binary indicator that takes a value of one if the individual is involved in formal training at t, and zero otherwise. The question in the ECHP is whether the worker is engaged in any job-related training programmes. This means that informal on-the-job training is not included, yet we include current job

[6]The data are provided by Eurostat and used with their permission. However, the data provider bears no responsibility for the analyses or interpretations presented in this study.

duration to account for this. There is some additional information in the ECHP on the type of training, but the majority of formal on-the-job training is vocational. Only about 14 percent is general training. We argue that in modelling on-the-job training, we have to deal with a possible selection bias. We only observe participation rates in training for those who are employed, but when the employment decision is not random, sample selection problems are likely to exist. For example, when workers are a non-random subsample of the population due to the fact that these people share higher abilities, estimation results are likely to be biased. To correct for this possible selection bias, a Heckman (1976) model can be applied. The standard Heckman model employs a probit model for the selection equation and an OLS regression for the substantial equation. This is not applicable in our case, since both the dependent variable in the selection equation (employment) and the dependent variable in the substantial equation (training) are binary. In fact, we have the following model:

$$
\begin{aligned}
y_{1i}^{*} &= \beta_1 x_{1i} + \mu_{1i} && \text{(substantial equation)} \\
y_{1i} &= \begin{cases} 0 & \text{if } y_i^{*} \leq 0 \\ 1 & \text{if } y_i^{*} > 0 \end{cases} \\
y_{2i}^{*} &= \beta_2 x_{2i} + \mu_{2i} && \text{(selection equation)} \\
y_{2i} &= \begin{cases} 0 & \text{if } y_{2i}^{*} \leq 0 \\ 1 & \text{if } y_{2i}^{*} > 0 \end{cases} \\
\mu_{1i} &\sim N(0,1) \\
\mu_{2i} &\sim N(0,1) \\
Corr(\mu_{1i}, \mu_{2i}) &= \rho
\end{aligned}
$$

We are interested in the estimation of the likelihood of participating in training, y_{1i}^{*} which is a function of x_{1i} representing a vector of observed variables and an unobserved error term μ_{1i}, with $i \in 1, \ldots, N$ being the individuals. However, y_{1i}^{*} is a latent variable and we only observe a binary indicator y_{1i} that takes the value of 1 if a person is engaged in training and 0 otherwise. In addition, training is only observed for people who are employed, i.e. when $y_{2i}^{*} > 0$. This again is a latent variable and a function of x_{2i} representing a vector of observed variables and an unobserved error term μ_{2i}. β_1 and β_2 are the vectors of estimated coefficients. When the correlation between the error terms of the two equations, ρ is zero, the non-selection model provides unbiased results. Yet with the correlation term being different from zero, the correction for selection bias is necessary. In Stata 8, this model is available through *heckprob*. A joint likelihood function of both equations is then estimated by maximum likelihood. A more detailed explanation of this model is provided by van de Ven & van Praag (1981).

Covariates included in the probit equation for the participation in training (i.e the substantial equation y_{1i}^{*}) are derived from the theoretical hypotheses explained earlier, with

the main covariates being age, sex, health, education level, job duration, hours worked, hourly wage, industrial sector, a dummy for whether the worker is employed on a temporary contract, a variable to account for the level of his job (e.g. supervisory task or not) and country dummies. Covariates included in the probit equation for employment (i.e. the selection equation) are the ones that proved to be significant predictors of the exit probability from the analyses in previous chapters, such as age, sex, health, education, household size, the presence of a working spouse, country and year dummies. Identification of the model is assured by means of exclusion restrictions. In other words, there are covariates in vector x_{1i} that are not in vector x_{2i} (e.g. job duration, hours, wage, sector, type of contract and job level) and the other way around (e.g. household size, presence of a working spouse and year dummies are included in vector x_{2i} but not present in vector x_{1i}). For summary statistics on these covariates, we refer to the Appendix of Chapter 5.

7.5 Results

7.5.1 Participation in training

In Table 7.1 we present the results from our probit models for the likelihood of participating in training, i.e. the models with and without selection correction (i.e. selection bias caused by non-random exit from the labour force as explained earlier). Tables A1 and A2 in the Appendix of this chapter show the age and country interaction models we estimated for the interaction effects between age or country and several explanatory variables.

Starting with the effect of age, as expected, we find that the likelihood of participating in training decreases with age. The correction for selection bias is mainly relevant for the oldest age group. If we were to use a model that does not take into account the fact that the employment rates are lower among the oldest group of workers, the negative age effect would be over-estimated. Furthermore, we find strongest age effects in the Netherlands, Portugal, Greece, Spain and Belgium, and weakest effects in Great Britain, Denmark and Finland. This supports our descriptive findings shown in Figure 7.1. In addition, we find that women have a higher probability of being engaged in training than men. The effect is stronger when we correct for the lower employment probability for women. When we look at the age-gender interaction effects, we find that the effect is strongest for women aged over 45. This supports the idea put forward by Arulampalam et al. (2004) that women are in higher need of training because they change jobs more frequently or because they have temporarily dropped out of the labour market due to care obligations. Despite the fact that the ECHP does not contain information on the entire work history, looking at current job durations we find that that these are indeed shorter for older women (aged over 45) compared to men of the same age. For example, about 71

Table 7.1: Estimation results of a probit model for the likelihood of participating in training, with and without a Heckman correction for selection bias, ECHP 1994-2000

		Non-selection model		Selection model	
		coefficient	abs z-value	coefficient	abs z-value
35-44	(ref: 25-34)	-0.118***	(11.54)	-0.129***	(10.60)
45-54		-0.237***	(19.63)	-0.240***	(19.58)
55-64		-0.401***	(22.85)	-0.303***	(5.29)
Female	(ref: male)	0.093***	(9.47)	0.163***	(4.34)
Bad health	(ref: fair health)	-0.044**	(2.13)	0.012	(0.31)
Good health		0.034***	(3.49)	0.014	(0.94)
Low education	(ref: med educ)	-0.376***	(31.90)	-0.346***	(14.39)
High education		0.260***	(23.84)	0.237***	(12.98)
Duration 2-9 yrs	(ref: 2-9 years)	-0.152***	(14.08)	-0.156***	(14.26)
Duration > 10 yrs		-0.161***	(12.16)	-0.165***	(12.25)
Hours worked		0.004***	(9.34)	0.004***	(8.72)
Hourly wage		0.012***	(11.52)	0.012***	(11.43)
Was unemployed before		-0.098***	(9.56)	-0.099***	(9.43)
Temporary contract		-0.036***	(2.73)	-0.038***	(2.84)
Works in services	(ref: industry)	0.136***	(13.29)	0.139***	(13.42)
public sector worker	(ref: private sect)	0.229***	(23.12)	0.222***	(21.73)
Non-supervisory job	(ref: interm job)	-0.173***	(17.26)	-0.177***	(17.33)
Supervisory job		0.113***	(9.38)	0.107***	(8.68)
Denmark	(ref: Britain)	0.691***	(30.65)	0.686***	(29.27)
Netherlands		-0.829***	(39.10)	-0.807***	(32.56)
Belgium		-0.314***	(12.64)	-0.276***	(8.95)
France		-0.689***	(33.78)	-0.667***	(27.09)
Ireland		-0.361***	(14.65)	-0.328***	(10.15)
Italy		-0.624***	(29.28)	-0.573***	(16.92)
Greece		-1.066***	(38.10)	-1.004***	(22.31)
Spain		-0.257***	(13.03)	-0.210***	(6.78)
Portugal		-0.842***	(33.49)	-0.840***	(33.26)
Austria		-0.023	(0.99)	-0.005	(0.19)
Finland		0.613***	(28.21)	0.629***	(28.66)
Germany		-0.596***	(33.67)	-0.574***	(29.73)
1994	(ref: 2000)	0.823***	(21.47)	0.689***	(7.51)
1995		0.880***	(22.81)	0.744***	(8.13)
1996		0.853***	(22.16)	0.717***	(7.76)
1997		1.171***	(30.30)	1.000***	(10.65)
1998		0.749***	(19.35)	0.618***	(6.81)
1999		0.722***	(18.63)	0.592***	(6.57)
Constant		-1.402***	(28.75)	-1.209***	(10.27)
Observations		224236		400856	

Absolute value of z statistics in parentheses. * points to significance at 10% level, ** to significance at 5% level and *** to significance at 1% level.

percent of older male workers have been employed for more than ten years in the current job compared to only 61 percent of older female workers. This leads us to suspect that women indeed experience more job changes and discontinuous working careers. When we look at the country-interaction models, we find some differences between the countries. Strongest positive age effects are found in Ireland and Spain, both countries with rather traditional role patterns where women are likely to be non-employed and have working spouses. The fact that women are employed in these countries might indicate a higher attachment to the labour force and a higher willingness to invest in training for these

women. In Belgium and France, the effect for women is reduced to about zero, while in Germany we find a negative effect for women on the probability of training.

As for the effects of health, we find some interesting differences between the non-selection model and the selection model. If we did not correct for the fact that unhealthy workers are less likely to be employed, we would conclude that the probability of participating in training for such workers is lower compared to workers in better health. However, when corrected for the higher exit probability of unhealthy workers, we no longer find any effects of health, except in some countries. In France, Greece, Ireland and Spain, the probability of being engaged in training is lower for workers in a bad state of health. In Austria, Belgium, Finland, the Netherlands and Spain workers in good health are the ones with the highest training probabilities. Unfortunately, we do not have an explanation for these country differences. In addition, looking at age interactions, we find a slightly lower training probability for workers aged between 35 and 44 reporting a bad state of health. We have already mentioned that training costs are expected to be highest for people in a bad state of health, which explains these effects.

To test the hypothesis following from life-long learning theories on the complementarity of the level of human capital and the participation in training, we first consider the effects of education level. In general, we find support for the accumulation perspective: having a high education level increases the probability of being engaged in training, whereas having a low education level reduces it. These results are in line with existing studies (e.g. OECD, 1999; Brunello, 2001; Arulampalam et al., 2004), who all report complementarity effects of education and training. In the latter study, this effect of education on the likelihood of participating in training is not found for both sexes in all countries. Whereas the effect is found for both sexes in Great Britain, Denmark, Finland, Italy and Spain, it is only found for men in Austria and Ireland and only for women in the Netherlands. Rather than decomposing the education effect by gender, we have included interaction effects between age and education. We find that the accumulation effect is especially true for young workers, i.e. the positive effect of having a high education for being trained decreases with age. The negative effect of having a low education for being trained is still true for the oldest group of workers (aged between 55 and 64) but less strong for the group of workers aged between 45 and 54. When we consider the country differences with respect to the effect of education, the observed complementarity between education level and the likelihood of participating in training seems strongest in Austria, Greece, Ireland, Italy and Spain, and weakest in Germany. This latter might be due to the apprenticeship system, as argued before, which is expected to give workers a solid vocational training at the beginning of their careers.

Looking at the predicted effects of job duration, note that we have information only on tenure of the current job, not on the full employment history of the individual. We find that the longer a worker has been in his current job, the lower the likelihood of

being trained. We explain this with the fact that people who have longer job tenure, have most likely received more on-the-job training, especially informal learning-by-doing. One could argue that the compensation perspective holds, which states that low-skilled workers, regardless of whether these skills have been acquired through formal or informal education and training, are the ones that need to be trained. When we look at the interaction with age, we find that this effect of being trained while being on the job for a short time period is strongest for the youngest group of workers. This is largely explained by the fact that long job durations (i.e. over ten years) are rare among the youngest workers. The correlation between age and job duration is 0.3978. About 30 percent of the workers aged between 25 and 34 had started the current job within the previous year compared to only 11 percent among workers aged between 55 and 64. From the country interaction models we conclude that tenure in the current job does not have an effect in Great Britain, Denmark, Finland or Germany. For the first three countries, this is likely to be due to the general higher training incidence. For Germany, we have already shown that trainees differ less with respect to education level, and now we find the same with respect to tenure. We also included a dummy that indicates whether the worker has experienced an unemployment spell. We find that such an experience reduces the likelihood of participating in training. Several studies have shown that workers with unemployment spells have higher human capital depreciation compared to workers who were continuously employed, which explains this (Mincer & Ofek, 1982; Kunze, 2002; Edin & Gustavson, 2004). Moreover, in previous chapters we showed that workers with unemployment spells are most likely to leave the labour force. This higher exit risk increases net training costs and reduces the probability of being trained.

Apart from education level and tenure, the job level might also be seen as an indicator for a higher human capital level. We measured job level using a variable that stated whether the worker has a supervisory job or not. As with education level, we find support for the human capital theory, meaning that especially people with higher job levels (i.e. higher human capital levels) are most likely to be engaged in job-related training. In contrast with the education level, however, we now find strongest effects for the older workers. Especially older workers with supervisory tasks on the job participate in training. We might conclude that for both the youngest group (aged between 25 and 34) and the oldest group (aged between 55 and 64) most evidence points to support for the accumulation perspective of lifelong learning, yet through different channels. For the youngest group of workers, both a higher education level and a higher job level increase the probability of training. For the oldest group of workers, however, the effect of higher education is reduced (most likely because of obsolescence of education) but the effect of job level is stronger. This supplements the explanation given earlier that education level mainly works as a screening device at the beginning of one's career (Stiglitz, 1975), but seems of less importance when workers are older. Work experience (generally leading to

a higher job level) replaces the effect of education. Looking at country differences, we find that the higher training probabilities for higher-level workers are especially found in countries such as Austria, Belgium and Germany. These are all countries where status differentials acquired through promotions matter most (strong stratification as explained in Chapter 4). Through formal training, the higher-level workers might want to secure or increase their position.

Looking at the effect of hours worked, we see that working more hours increases the probability of being engaged in training. The predicted probability for people working full time is 0.17, while for people working part time it is three percentage points lower, namely 0.14. This finding supports the human capital prediction that for people working more hours, there are simply more hours available during which training can pay off. Looking at the country-interaction models, we find that the effect is not found in all countries, though. Strongest effects are found in Austria, Belgium and Germany, the same group of countries as before with highest levels of stratification where working more hours might safeguard a better career. Our results are comparable to those of Arulampalam et al. (2004) who found that "part-time and full-time workers are as likely to start training in any year" for the majority of European countries in their sample.

From theory we expected that workers with a temporary contract have a lower probability of being engaged in training since the payback period of the investment in training is shorter compared with people in permanent contracts. The results of Arulampalam et al. (2004), who found support for this in five out of the ten countries, are largely confirmed by the results found here. Further, we observe some interesting country differences. We find the strongest effects in Great Britain, Denmark and Finland but we find contrary effects in France, the Netherlands and Portugal. A closer analysis shows that for France this is mainly a female effect, while for the Netherlands this is mainly a male effect. We suspect that workers on temporary contracts in these countries are less heterogeneous compared to other countries, and that these workers are expected to move into permanent contracts after a while. For the Netherlands it is known that temporary contracts are part of a probationary period and training then works as a screening device to screen the most able workers, who are then offered a permanent contract. To investigate this in more detail, it is interesting to look at the age-interaction models. We find that the higher probability of participating in training for people on temporary contracts is highly correlated with age. For the youngest workers, the effect of a temporary contract on the probability of training is positive, while for older workers reverse effects are found, with lowest probabilities of training among workers on a temporary contract. As mentioned earlier, training older workers in general is more costly and especially not profitable if they are employed on a temporary contract. With the growing prevalence of temporary and flexible contracts in Europe, this reduced involvement in training of people employed on flexible contracts tends to have the effect of reducing the average skill level of the workforce in the future

(OECD, 1999).

As far as the sector is concerned, we looked at differences in training between the service sector and the industrial sector and between the public sector and the private sector. Starting with the former, we find higher training probabilities for service-sector workers, regardless of whether these are commercial or non-commercial services. This effect is significantly strongest for the youngest cohort and continuously declines with age. We suspect that the decline in manufacturing employment and the increase in service sector employment has shifted some workers from the industrial sector to the service sector. Professional skills and attitudes needed in the service sector, however, are different from those required in the industrial sector, which might explain the higher training for service-sector workers. Observed country differences seem to support this idea, with the strongest effects found in countries where the economy is developing more slowly (e.g. Italy, Spain and Portugal) and the weakest effects found in countries with 'modern' economies (e.g. Germany, France and the Netherlands). In a study of the OECD (2001), two more explanations are given for higher training among service-sector workers. The first is the relatively higher education level of workers in the service sector compared to workers in the industrial sector. This has, however, already been accounted for in our model. The second explanation is to be found in the information technology (IT) revolution. It is argued that workers in the service sector use computers most intensively and with the rapid development in this sector, continuous retraining is necessary to keep the workers up-to-date with the new software programmes.

In addition, we generally find that public-sector workers have a higher probability of participating in training. The most likely explanation for this finding is that training activities are more common in the public sector, being less subject to market competition than employers in the private sector. Moreover, we find that this positive effect of the public sector is significantly smaller for older workers. Compared to older workers in the private sector, the need to participate in training activities to maintain productivity is smaller for older workers in the public sectors. Protection of workers in general and older workers in particular is usually highest in the shielded public sector. In addition, early retirement entitlement is generally very generous in the public sector, which might prevent older workers in this sector from investing in training. For example, we find weakest effects in Belgium, Germany and the Netherlands, where early retirement entitlement is known to be most generous in the public sector, as explained in Chapter 4.

Finally, a technical comment is appropriate here. The Heckman probit model generates a parameter ρ, which measures the correlation between the residuals of the two equations, i.e. the selection or employment equation and the substantial or training equation. We find that the estimated ρ is -0.16. This negative coefficient suggests that unobserved characteristics (i.e. incorporated into the error term) that increase people's employment probability, reduce the likelihood of being trained. For example, the unobserved factor

'ability' is likely to be incorporated into the error term and when more able people are more likely to be employed, they are less likely to receive training. When this ρ is equal to zero, separate estimation of the two equations yields unbiased results. The null hypothesis that ρ is equal to zero is rejected with a p-value of 0.061. This supports our idea of the presence of selection bias, which needs to be controlled for. We recognise, however, that the null hypothesis is only rejected at the ten percent level.

7.5.2 Training and early retirement

A following question of interest is whether participation in training reduces the probability of early retirement. That would imply that increased supply of training for older workers might have an effect on their labour participation. To get a first impression of this, in Table 7.3 we show percentages of workers who leave the labour force cross-tabulated by training incidence and country. On average, we conclude that the percentage of workers leaving employment is about eight percentage points lower when workers participate in training. Looking at country differences we can divide Europe into two groups. The first group consists of countries in which the difference in exit percentages is above average, including (from highest to lowest difference) Spain, Finland, Austria, Denmark, Italy, Belgium and Greece. The second group consists of countries in which the difference is below average including (from highest to lowest difference) France, the Netherlands, Ireland, Great Britain, Germany and Portugal. Interestingly, we find some differences with the clusters of countries we derived in Chapter 4. First, within two clusters we find small country differences. In countries with ungenerous, moderately flexible early retirement schemes (Ireland and Great Britain), we find small differences in exit rates of trained and untrained workers. This is explained by the fact that exit rates are low in general. In countries with highly flexible, but moderately generous early retirement schemes (Denmark, Finland and Italy) we find large differences in exit rates of trained and untrained workers. We explain this by the fact that the high flexibility of early retirement schemes (i.e. least tight entitlement conditions) increases the lay-off probability for workers. Training acts as a screening device and separates the most productive workers from the least productive ones. The first group maintains their employment status, whereas the second group retires early, either voluntarily or involuntarily. Second, we find large country differences in the two remaining clusters. In countries with moderately generous and moderately flexible early retirement schemes, we find both small (France and Portugal) and large differences (Greece and Spain). The same holds for countries with moderately flexible, but highly generous early retirement schemes.

Based on these cross-tabulations, one would conclude that training increases the labour force participation of older workers. In order to see whether this is still true when correcting for other characteristics of the individuals as well, we have to model the effect of

Table 7.2: Percentages of older workers (age 50-64) leaving the workforce by receiving training and country, ECHP 1994-2000.

	No training	Training	Reduction
Austria	16.97	8.59	8.38
Belgium	11.29	5.99	5.30
Britain	8.82	7.65	1.17
Denmark	12.54	6.56	5.98
Finland	14.56	7.02	7.54
France	10.15	7.64	2.51
Germany	15.79	13.74	2.05
Greece	13.97	8.14	5.83
Ireland	10.16	8.14	2.02
Italy	14.39	7.62	6.77
Netherlands	8.43	6.74	1.69
Portugal	10.52	9.47	1.05
Spain	15.81	7.46	8.35
Average	12.34	8.02	4.32

training on the exit decision. We now only focus on workers aged between 50 and 64.

In general, the transition from employment to non-employment for older workers (i.e. aged over 50) can be modelled by a standard probit model of the form (Greene, 2000)

$$y_i^* = \beta x_i + \alpha d_i + \epsilon_i \tag{7.1}$$

where y_i^* is an unobserved latent variable that assumes a positive value when the underlying observable indicator y_i is equal to 1 and a negative value when y_i is equal to 0. $y_i = 1$ indicates that we observed a transition out of employment for worker i from one wave to another and $y_i = 1$ indicates no such transition.[7] x_i denotes the vector of exogenous explanatory variables, including age, health, sex, education level, work experience, job status, sector of industry, hours worked and β is the corresponding vector with estimated coefficients. In addition, d_i is a dummy variable taking the value 1 if individual i is enrolled in any formal on-the-job training activity and 0 otherwise. α is then the estimated coefficient for the effect of training on the exit probability. In this standard probit model, the error term is continuously distributed ($\epsilon_i \sim N(0,1)$) independent of both the dummy variable for participation in training and the vector of explanatory variables x_i. In other words, the decision to participate in training is assumed to be exogenous, as was the case in our analyses in Chapter 5. Table 7.4 shows the predicted probability of exit (i.e. leaving employment regardless of the destination state) for people who participate in training and for those who do not. We indeed find largest differences in exit probabilities in the above mentioned countries (i.e. Austria, Belgium, Denmark, Finland, Italy, Greece and Spain), with a reduction in the exit probability of at least five percentage points as a

[7]Formally we could write 7.3 as $y_{it}^* = \beta x_{it} + \alpha d_{it} + \epsilon_{it}$, but since we do not use a panel model we excluded the ts from the equation. Our transition indicator is determined for all years in the sample and year dummies are included to pick up any business cycle effects.

Table 7.3: Predicted probabilities for exit for training participants and non-participants, results from single equation probit model

	Single equation probit (training exogenous)		Difference between p(exit | train=0) and p(exit | train=1)
	p(exit | train=0)	p(exit | train=1)	
Austria	0,154	0,083	0.07
Belgium	0,114	0,060	0.05
Britain	0,095	0,083	0.01
Denmark	0,106	0,061	0.05
Finland	0,129	0,063	0.07
France	0,078	0,061	0.02
Germany	0,161	0,140	0.02
Greece	0,124	0,079	0.05
Ireland	0,077	0,063	0.01
Italy	0,133	0,084	0.05
Netherlands	0,067	0,067	0.00
Portugal	0,095	0,092	0.00
Spain	0,138	0,068	0.07

consequence of training.

However, from the discussion in the previous section, we learned that many of the factors affecting the decision to participate in training of workers, also affect the exit decision (e.g. age). Consequently, we expect the training outcome not to be independent of the observed exit outcome, which previously gave us reason to use a selection model for the participation in training. In other words, workers are expected to self-select into training: older workers who are likely to continue working, are more likely to participate in training than workers who are likely to retire early. Consequently, we have reason to believe that participation in training is an endogenous regressor in the early retirement decision. If this is true, the incorporation of a training dummy into the exit equation as in the above model yields biased results that need to be treated with caution.

A possible way of dealing with the endogeneity of training is by estimating a bivariate probit model (Greene, 2000, p.849). The bivariate model is useful when two left-hand variables (i.e. exit and training) are interdependent, or when they depend on a common set of explanatory variables, as we suspect in our case. Both the training and retirement choice are expected to be affected by variables x and the random error terms are correlated, or more formally,

$$y_{1i}^{*} = \beta_0 + \beta_1 x_i + \epsilon_i \tag{7.2}$$

$$y_{2i}^{*} = \alpha_0 + \alpha_1 x_i + \mu_i \tag{7.3}$$

$$E(\epsilon_i) = E(\mu_{it}) = 0$$

$$Var(\epsilon_i) = Var(\mu_i) = 1$$

$$Cov(\epsilon_i, \mu_i) = \rho$$

where both y_{1i}^{*} and y_{2i}^{*} are unobserved latent variables that assume a positive value when

Table 7.4: Estimation results from various bivariate probit models for exit probability with endogenous training, ECHP 1994-2000

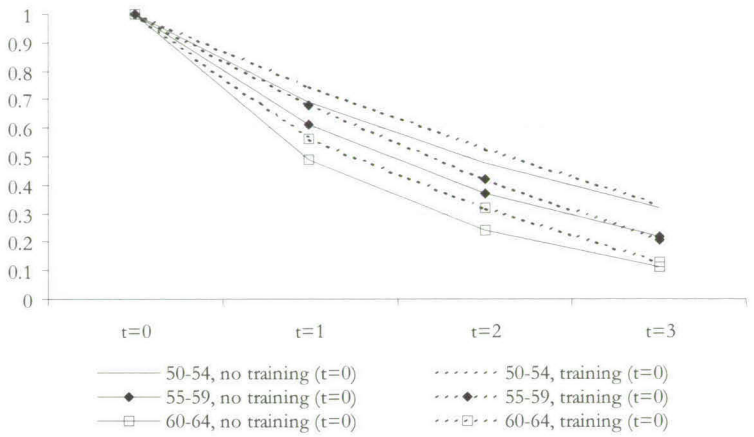
	Wald-statistic	p-value	p(exit, no training)	p(exit, training)	Δ p(exit)
Austria	15.023	0.000	0.113	0.022	0.09
Belgium	3.111	0.078	0.092	0.011	0.08
Britain	0.072	0.789	0.065	0.027	0.04
Denmark	2.783	0.095	0.049	0.033	0.02
Finland	4.711	0.030	0.058	0.035	0.02
France	0.030	0.863	0.071	0.005	0.07
Germany	0.985	0.321	0.141	0.018	0.12
Greece	0.365	0.546	0.119	0.003	0.12
Ireland	0.018	0.892	0.065	0.010	0.05
Italy	0.010	0.920	0.119	0.010	0.11
Netherlands	0.114	0.736	0.063	0.003	0.06
Portugal	0.017	0.895	0.091	0.004	0.09
Spain	0.980	0.322	0.121	0.008	0.11

the underlying observable indicator y_{ki} is equal to 1 and a negative value when y_{ki} is equal to 0, with $k = 1, 2$. $y_{1i} = 1$ if the individual is observed to move out of employment and 0 otherwise and $y_{2i} = 1$ if the individual is observed to participate in training and otherwise. x_i is the vector containing the common set of explanatory variables. In the Appendix of this chapter we show that this model is identified. After estimating the bivariate probit model, we can perform a Wald test for the null hypothesis that ρ is equal to zero.[8] If the null hypothesis was not rejected, the two equations in the bivariate probit model could have been estimated independently, implying that there is no significant evidence for the endogeneity of training. The Wald-test statistics and corresponding p-values are shown in Table 7.4. This table also shows the predicted probabilities for the joint probability that $p(\text{exit} = 1, \text{training} = 1)$ and compares this with the joint probability that $p(\text{exit} = 1, \text{training} = 0)$.

We find that the null hypothesis of zero correlation between the error terms of the two equations is rejected in Austria, Belgium, Denmark and Finland. These are all countries in which training was found to significantly reduce the exit probability (see tables 7.2 and 7.3). When we look at the joint predicted probabilities of exit and training (both either zero or one) for these countries, we still find strong differences between trained and untrained individuals for Austria and Belgium, while this differences is not as large anymore for Denmark and Finland (compared to the single-equation models in Table 7.2). Note that in Table 7.2 we reported predicted probabilities of leaving, conditional on receiving training resulting from a single-equation probit model, whereas in Table 7.3 we report the joint probabilities for exit and training resulting from the bivariate probit

[8] A number of procedures are available for testing endogeneity in simultaneous equation models with dichotomous dependent variables. For a review see Maddala (1995). However, for models in which the suspected endogenous variable is dichotomous too, testing procedures are limited. A discussion of the most common test procedures is given by Fabbri et al. (2004).

Figure 7.4: Employment rates of trained and untrained workers in several periods



Source: Own calculations, ECHP 1994-2000 pooled data

model.[9]

Until now we have only looked at the transition out of work one year after the training has taken place. It is interesting to see whether exit probabilities are also lower in subsequent years. To get a preliminary idea about this, we have plotted employment rates as a percentage of the number of workers at $t = 0$, by training and in Figure 7.4. For all age groups, we observe higher employment rates for trained workers until $t = 3$. Interestingly, the effect is strongest for the oldest group of workers. At $t = 2$ the exit rates of trained workers aged between 60 and 64 are about eight percentage points lower than those for untrained workers of the same age. For workers aged between 50 and 60, this difference is five percentage points. This is an important finding since it might indicate that the training of workers aged over 60 can lead to postponement of early retirement. A more thorough investigation of this by country and other worker characteristics is recommended

[9]Another variant of the bivariate probit model is the recursive bivariate probit model. "A system of equations is recursive rather than simultaneous if each of the endogenous variables can be determined sequentially rather than jointly" (Dixon, 2005). Since we look at the exit decision of an older worker after participation in a training programme, training affects the risk of exit out of employment and not vice versa. The conditions for identification are that either the error terms of both equations are independent ($\rho = 0$), or if there is at least one regressor in the reduced-form training equation, which is not included in the structural equation for exit out of labour (Maddala, 1983, p.120). Here we encountered some difficulties. First of all, we were looking for variables that affect the likelihood of participating in training, but not the exit decision. Such variables are difficult to find, but a suggestion would be to use a dummy for whether the employer provides training or not. This variable, however, is not available for Great Britain and Germany in the ECHP, two central countries in our analysis. Even when we used this variable as an instrumental variable for training, we found some unexpected results, which raised some serious doubts concerning the value of the instrument. For example, when workers are observed to participate in training, in only 79 percent of these cases does the employer provide such training. For the remaining 21 percent this is not the case, which supports the idea that the variable 'training provision by the employer' might not be the correct instrument.

for further research.

7.6 Concluding remarks

From theory we expect lower training probabilities for older workers compared to younger workers. Although this effect is found in all European countries, it is much weaker in Great Britain, Denmark and Finland. These are countries that, within a European perspective, put most emphasis on lifelong learning to enhance labour productivity and employment prospects. In addition to these age effects, we found some other interesting differences in older and younger workers characteristics' affecting their training probability. For example, education and job tenure are important predictors of the training probability of younger workers, whereas these are not of great importance for predicting older workers' training behaviour. With respect to job level, however, we find the opposite effects. Particularly older workers working in higher-level jobs participate in training. Moreover, we find that this is especially true for older workers in countries where status acquired by working careers matter most. The incentive for older workers to be trained is greater when training also contributes to an increase in their professional status. The finding that older workers in low-level jobs tend to be excluded from training is important, since this group of workers is most at risk of becoming unemployed rather than retiring early. Workers in low-level jobs are commonly in low pay and usually have no personal wealth that allows them to retire early. For them, the exclusion from training reduces their employment prospects.

Another important finding, which was also found by Arulampalam et al. (2004), is that workers on a temporary contract have a lower training probability. We find that this is particularly true for older workers. With a growing prevalence of temporary and flexible contracts in Europe, for workers of all ages, this reduced participation in training of workers on a temporary contract might lead to a reduced skill-level of the workforce (OECD, 1999). This might have adverse consequences for the productivity and economic growth. To prevent this from happening, labour market policy should focus on improving training prospects for workers on temporary and flexible contracts. And, taken from our earlier finding, policy should focus on an increased participation in training of low-paid workers in low-level jobs.

Apart from the analysis of differences in training between younger and older workers, we investigated to what extent training reduces early retirement. Most European policy reports presume that by offering more training opportunities to older workers, the early retirement decision might be postponed. We indeed find support for this assumption, yet with large differences between countries. The strongest effects are found in Austria, Belgium, Denmark, Finland, Italy, Greece and Spain, with a reduction in the exit probability of at least five percentage points as a consequence of training. Interestingly, these

are countries with differing early retirement schemes, as explained in Chapter 4. It seems that the clustering is not applicable here. The modelling of the effect of training on early retirement is complicated as a result of endogeneity problems between training and exit. We show that, when corrected for the endogeneity bias, exit probabilities remain significantly lower for trained workers compared to untrained workers. In some cases, for example in Denmark and Finland, the effect becomes less strong due to the correction for endogeneity bias.

Finally, we showed that the reduction in exit probability as a result of training is likely to have a more permanent effect. In our models we focussed on the exit decision one year after the training had taken place, yet by performing some descriptive analyses we show that exit rates for trained workers are lower in subsequent years as well, compared to untrained workers. This seems especially true for the oldest group of older worker, those aged over 60. This finding suggests that the creation of more opportunities for the training of older workers might be a valuable tool in postponing the early retirement decision.

Appendix

Tables

Table A1: Estimation results of probit selection models for participation in training (interaction effects with country)

	Bri	Aus	Bel	Den	Fin	Fra	Ger	Gre	Ire	Ita	Net	Por	Spa
Aged 25-34	ref	0.13***	-0.18***	0.72***	0.62***	-0.58***	-0.49***	-0.90***	-0.28***	-0.51***	-0.54***	-0.63***	-0.11***
		(3.70)	(4.43)	(19.11)	(16.36)	(17.79)	(17.48)	(21.03)	(7.32)	(14.31)	(16.27)	(16.92)	(3.15)
Age 35-44	0.01	-0.20***	-0.12**	-0.02	-0.01	-0.09**	-0.15***	-0.22***	-0.08	-0.09**	-0.29***	-0.27***	-0.14***
	(0.36)	(4.05)	(2.20)	(0.40)	(0.12)	(2.00)	(4.00)	(3.73)	(1.50)	(2.04)	(6.27)	(4.83)	(3.23)
Age 45-54	-0.01	-0.26***	-0.32***	-0.07	-0.02	-0.24***	-0.19***	-0.31***	-0.19***	-0.25***	-0.64***	-0.34***	-0.31***
	(0.35)	(4.63)	(4.98)	(1.17)	(0.36)	(4.67)	(4.63)	(4.25)	(3.08)	(4.77)	(11.62)	(5.35)	(6.23)
Age 55-64	-0.13**	-0.35***	-0.33***	-0.15**	-0.14*	-0.52***	-0.11**	-0.55***	-0.24***	-0.47***	-0.78***	-0.52***	-0.65***
	(2.10)	(4.20)	(2.93)	(2.00)	(1.70)	(5.85)	(1.98)	(3.98)	(2.65)	(5.55)	(8.53)	(5.46)	(8.54)
Male	ref	-0.02	-0.25***	0.69***	0.59***	-0.65***	-0.44***	-1.02***	-0.43***	-0.65***	-0.81***	-0.82***	-0.29***
		(0.63)	(7.05)	(22.20)	(19.02)	(22.70)	(19.00)	(25.58)	(11.93)	(21.56)	(27.87)	(23.03)	(10.15)
Female	0.12***	-0.00	-0.14***	0.01	0.06	-0.10**	-0.34***	-0.10*	0.13**	0.07	-0.03	-0.02	0.09**
	-3.41	(0.09)	(2.92)	(0.18)	(1.31)	(2.42)	(10.18)	(1.86)	(2.53)	(1.58)	(0.70)	(0.45)	(2.20)
Bad hlth	-0.01	-0.04	-0.08	-0.14	-0.13	-0.21**	-0.04	-0.59*	-0.44*	-0.05	0.05	-0.02	-0.20*
	(0.14)	(0.38)	(0.53)	(1.11)	(1.17)	(2.27)	(0.62)	(1.92)	(1.80)	(0.49)	(0.38)	(0.20)	(1.87)
Fair hlth	ref	-0.22***	-0.41***	0.67***	0.56***	-0.66***	-0.61***	-0.99***	-0.37***	-0.59***	-0.91***	-0.82***	-0.39***
		(4.40)	(6.91)	(13.03)	(13.48)	(17.96)	(19.08)	(10.98)	(5.38)	(14.10)	(19.19)	(18.76)	(8.63)
Good hlth	0.01	0.24***	0.11*	0.04	0.08*	-0.05	0.03	-0.08	-0.00	-0.06	0.10*	-0.01	0.15***
	(0.20)	(4.54)	(1.81)	(0.65)	(1.75)	(1.17)	(0.89)	(0.83)	(0.02)	(1.40)	(1.93)	(0.12)	(3.57)
Low educ	-0.29***	-0.25***	-0.05	-0.06	-0.03	0.05	0.21***	-0.48***	-0.19***	-0.37***	-0.05	-0.32***	-0.39***
	(6.52)	(3.50)	(0.71)	(0.93)	(0.46)	(0.91)	(4.35)	(4.34)	(2.83)	(6.61)	(0.78)	(4.78)	(6.89)
Med educ	ref	-0.06	-0.37***	0.63***	0.49***	-0.71***	-0.61***	-1.07***	-0.43***	-0.60***	-0.76***	-0.70***	-0.23***
		(1.33)	(7.00)	(13.90)	(10.76)	(16.30)	(15.63)	(19.14)	(8.71)	(13.51)	(17.71)	(12.30)	(4.62)
High educ	0.19***	0.38***	0.13**	0.24***	0.34***	0.03	-0.17***	0.11*	0.22***	0.14**	-0.13**	0.01	0.13**
	(4.63)	(5.63)	(2.15)	(4.26)	(6.17)	(0.53)	(3.49)	(1.67)	(3.62)	(2.41)	(2.55)	(0.15)	(2.49)
Short dur	ref	0.19***	-0.04	0.68***	0.65***	-0.50***	-0.63***	-0.99***	-0.18***	-0.49***	-0.62***	-0.52***	-0.14***
		(4.56)	(0.86)	(18.19)	(17.28)	(13.09)	(18.71)	(19.93)	(4.31)	(12.19)	(17.33)	(12.19)	(3.96)
Med dur	0.01	-0.31***	-0.40***	-0.06	-0.20***	-0.31***	0.01	-0.19***	-0.29***	-0.24***	-0.19***	-0.43***	-0.21***
	(0.58)	(6.40)	(6.82)	(1.24)	(4.42)	(6.77)	(0.23)	(3.09)	(5.59)	(5.14)	(4.43)	(8.06)	(5.48)
Long dur	-0.00	-0.28***	-0.35***	0.01	0.01	-0.26***	-0.01	-0.12*	-0.27***	-0.19***	-0.45***	-0.41***	-0.18***
	(0.07)	(4.85)	(5.31)	(0.19)	(0.15)	(4.62)	(0.17)	(1.72)	(4.37)	(3.45)	(7.92)	(6.58)	(3.58)

* indicates $p < 0.10$, *indicates $p < 0.05$, *** indicates $p < 0.01$.

Table A1, continued

	Bri	Aus	Bel	Den	Fin	Fra	Ger	Gre	Ire	Ita	Net	Por	Spa
Hours work	0.01***	0.00**	0.01***	0.00	-0.00	0.00	0.02***	-0.00	-0.01***	-0.01***	-0.00	-0.00	-0.01***
	(3.23)	(2.08)	(3.25)	(1.01)	(0.48)	(0.04)	(12.97)	(0.35)	(3.53)	(3.99)	(1.58)	(1.53)	(4.85)
Hrly wage	0.02***	0.01**	-0.00	-0.00	0.01**	-0.03***	-0.01***	0.00	-0.00	-0.01*	-0.04***	-0.01	0.00
	(6.36)	(2.46)	(0.68)	(0.63)	(2.05)	(6.32)	(3.36)	(0.66)	(0.64)	(1.67)	(5.89)	(0.88)	(0.53)
No un hist	ref	-0.01	-0.35***	0.76***	0.69***	-0.73***	-0.60***	-1.06***	-0.40***	-0.63***	-0.88***	-0.87***	-0.28***
		(0.49)	(10.68)	(26.51)	(25.02)	(28.72)	(28.36)	(26.48)	(11.99)	(20.77)	(34.31)	(28.41)	(9.15)
Unemp hist	-0.12***	-0.05	0.10**	-0.16***	-0.20***	0.12***	0.04	-0.05	0.07	0.02	0.19***	0.15***	0.04
	(3.88)	(0.99)	(1.97)	(3.49)	(4.29)	(2.81)	(1.17)	(0.81)	(1.31)	(0.37)	(3.97)	(2.70)	(0.91)
industry	ref	-0.15***	-0.27***	0.62***	0.63***	-0.57***	-0.42***	-0.94***	-0.41***	-0.72***	-0.76***	-0.92***	-0.36***
		(3.61)	(5.71)	(14.45)	(16.07)	(14.72)	(13.64)	(14.85)	(8.56)	(17.73)	(18.30)	(19.68)	(9.29)
services	0.15***	0.18***	-0.05	0.12**	-0.01	-0.16***	-0.29***	-0.17**	0.05	0.13***	-0.09*	0.12**	0.14***
	(4.90)	(3.95)	(1.00)	(2.34)	(0.21)	(3.73)	(7.95)	(2.57)	(0.98)	(2.83)	(1.87)	(2.26)	(3.25)
perm contr	ref	-0.03	-0.33***	0.70***	0.62***	-0.72***	-0.60***	-1.07***	-0.40***	-0.64***	-0.86***	-0.87***	-0.27***
		(1.37)	(11.50)	(29.52)	(25.93)	(32.34)	(31.80)	(29.89)	(13.43)	(23.80)	(37.56)	(31.24)	(10.03)
Temp contr	-0.29***	0.21***	0.28***	0.04	0.15**	0.42***	0.23***	0.11	0.34***	0.26***	0.46***	0.47***	0.24***
	(5.15)	(2.76)	(3.42)	(0.54)	(2.11)	(5.79)	(3.30)	(1.37)	(4.47)	(3.80)	(6.44)	(6.45)	(3.83)
Priv sect	ref	-0.01	-0.23***	0.69***	0.60***	-0.62***	-0.50***	-1.00***	-0.37***	-0.62***	-0.69***	-0.85***	-0.25***
		(0.25)	(6.90)	(24.15)	(21.27)	(24.07)	(24.01)	(23.09)	(11.28)	(20.91)	(27.25)	(26.88)	(8.95)
Pub sector	0.35***	-0.07	-0.26***	-0.03	0.01	-0.22***	-0.31***	-0.20***	-0.04	-0.07	-0.43***	0.01	-0.06
	(11.77)	(1.45)	(5.11)	(0.70)	(0.27)	(5.23)	(8.47)	(3.61)	(0.80)	(1.64)	(9.72)	(0.26)	(1.58)
Non-superv	-0.22***	-0.15***	0.04	0.19***	0.01	0.18***	0.28***	-0.31***	-0.03	-0.14***	0.16***	-0.07	0.01
	(6.69)	(3.33)	(0.74)	(3.47)	(0.25)	(3.99)	(6.59)	(4.52)	(0.54)	(2.97)	(3.21)	(0.99)	(0.13)
Intermed	ref	0.02	-0.39***	0.54***	0.58***	-0.83***	-0.73***	-0.87***	-0.38***	-0.56***	-0.93***	-0.79***	-0.30***
		(0.54)	(7.86)	(10.91)	(12.34)	(20.77)	(21.94)	(12.85)	(7.62)	(12.87)	(20.90)	(12.31)	(7.26)
Supervis	0.00	0.24***	0.22***	0.13**	0.13**	0.12**	0.25***	0.12	0.07	0.01	-0.07	0.09	0.10*
	(0.01)	(3.82)	(3.08)	(1.97)	(2.03)	(2.19)	(5.73)	(1.20)	(1.05)	(0.09)	(1.10)	(0.83)	(1.75)

* indicates $p < 0.10$, *indicates $p < 0.05$, *** indicates $p < 0.01$.

Table A2: Estimation results of probit selection model for interaction effects between age and covariates on the likelihood of participating in training, ECHP 1994-2000

	25-34 years		35-44 years		45-54 years		55-64 years	
Male	reference		-0.160***	(11.50)	-0.309***	(19.72)	-0.306***	(6.60)
Female	0.154***	(4.80)	0.044**	(2.22)	0.155***	(7.00)	0.229***	(6.48)
Bad health	0.056	(1.03)	-0.109*	(1.81)	-0.021	(0.36)	0.001	(0.01)
Fair health	reference		-0.101***	(4.13)	-0.225***	(9.29)	-0.264***	(3.94)
Good health	0.031	(1.43)	-0.032	(1.31)	-0.018	(0.69)	-0.039	(1.08)
Low edu	-0.362***	(12.07)	0.024	(0.91)	0.065**	(2.33)	0.048	(1.17)
Med edu	reference		-0.126***	(7.46)	-0.241***	(13.36)	-0.235***	(3.69)
High edu	0.257***	(10.99)	-0.036	(1.57)	-0.046*	(1.77)	-0.131***	(3.24)
< 1 yr	reference		-0.258***	(13.01)	-0.374***	(14.66)	-0.514***	(6.70)
2-9 yrs	-0.222***	(15.33)	0.145***	(6.32)	0.134***	(4.45)	0.290***	(4.85)
> 10 yrs	-0.320***	(14.51)	0.246***	(8.81)	0.247***	(7.50)	0.299***	(5.06)
Hours worked	0.01***	(3.43)	0.002**	(2.01)	0.002*	(1.66)	0.005***	(2.91)
Hourly wage	0.01***	(4.64)	0.009***	(4.61)	0.004**	(1.99)	0.007***	(2.75)
Perm contr	reference		-0.095***	(7.39)	-0.201***	(15.58)	-0.263***	(4.72)
Temp contr	0.089***	(5.12)	-0.232***	(8.30)	-0.324***	(8.87)	-0.418***	(6.27)
Industry	reference		-0.099***	(5.12)	-0.205***	(9.87)	-0.253***	(4.17)
Services	0.170***	(11.03)	-0.042**	(1.98)	-0.051**	(2.12)	-0.079**	(2.19)
Private sector	reference		-0.128***	(9.06)	-0.231***	(15.70)	-0.278***	(4.67)
Public sector	0.238***	(14.80)	-0.009	(0.41)	-0.028	(1.20)	-0.067**	(2.02)
Non-superv	-0.167***	(10.35)	-0.031	(1.38)	0.000	(0.00)	0.002	(0.04)
Intermediate	reference		-0.115***	(5.52)	-0.250***	(11.45)	-0.320***	(4.94)
Supervisory	0.071***	(3.37)	0.034	(1.16)	0.061**	(1.99)	0.077*	(1.73)

Coefficients reported, absolute value of z statistics in parentheses. * points to significance at 10% level, ** to significance at 5% level and *** to significance at 1% level.

Model identification

Consider the bivariate probit model used in our study of the simultaneous decision of participation in training at older ages and exit out of the labour force (with the i and t dropped for a moment),

$$y_1 = \beta_0 + \beta_1 x + \epsilon \tag{7.4}$$

$$y_2 = \alpha_0 + \alpha_1 x + \mu \tag{7.5}$$

or in matrix form,

$$\begin{pmatrix} 1 \\ x \\ y_1 \\ y_2 \end{pmatrix} \begin{pmatrix} \beta_0 & \alpha_0 \\ \beta_1 & \alpha_1 \\ 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} \epsilon & \mu \end{pmatrix}$$

then the reduced-form coefficient matrix (BT, with B referring to the second matrix in the above notation) is equal to (Greene, 2000)

$$\begin{pmatrix} \beta_0 t_{11} + \alpha_0 t_{21} & \beta_0 t_{12} + \alpha_0 t_{22} \\ \beta_1 t_{11} + \alpha_1 t_{21} & \beta_1 t_{12} + \alpha_1 t_{22} \\ t_{11} & t_{12} \\ t_{21} & t_{22} \end{pmatrix}$$

In the case that $T = I$, this matrix is equal to our original model. This means that there is a unique solution and the model is identified without any further exclusion restrictions are needed, i.e. identification is based solely on the functional form in this case.

Chapter 8

Summary and discussion

Summary

The main focus of this thesis is on explaining the retirement decisions of older workers. Retirement is viewed in a broad sense. It encompasses exit from the labour market in a variety of ways through early retirement, through being laid off and moving into unemployment, or through exiting into disability or into inactivity. Similar to earlier studies in the field, we consider the retirement decision within a life-cycle perspective and therefore view it as a dynamic process that can only be studied properly by using longitudinal data. Particular attention is devoted to the role of institutional factors that might explain why retirement patterns across countries appear to be dissimilar. For this reason, we used national and European socio-economic panel studies, which allow us to perform comparative analysis for a number of European countries.

We consider the retirement decision primarily from an economic perspective. Older workers who are thinking about retiring early, make this decision by comparing the costs and the benefits over the remaining lifetime associated with this retirement decision. These costs and benefits are influenced by both the conditions on the labour market in terms of job opportunities and pay systems, and the conditions in the pension and social security systems in terms of the flexibility and generosity of the entitlement conditions of the benefits concerned. It is believed that these conditions are strongly affected by the institutional design and constraints of the welfare state, whereby the focus is on the role of pension and social security systems. It is exactly the aim of this research to analyse these determinants and explain differences in early retirement behaviour across individuals and across countries.

The main research questions for this study, divided into three themes, are the following:

- Modelling the retirement decision. Which economic models can be used to analyse an individual's early retirement decision? Which predictions about the determinants of early retirement behaviour can be derived from mainstream economic theory?

- Early retirement systems in Europe. To what extent are European countries different in their early retirement systems in general and their level of flexibility and generosity in particular? Can we cluster early retirement systems in some way, using the level of flexibility and generosity as the main dimensions?
- Early retirement patterns in Europe. To what extent are predicted effects of background characteristics, human capital indicators, family status and employment status on early retirement behaviour supported empirically by our comparative data? To what extent do the flexibility and generosity characteristics of the various early retirement schemes affect the exit behaviour of various groups of the working population in a similar or different way?.

Modelling the retirement decision

When reviewing the literature on retirement models, we find that the majority of models build on the neo-classical theory of the consumption-leisure choice. Especially the later so-called life-cycle models of retirement are of interest, because these specifically account for both the dynamics and uncertainty associated with the retirement decision (Burtless & Moffit, 1984; Fields & Mitchell, 1984; Gustman & Steinmeier, 1984; Rust, 1989). The individual's retirement decision process is, by definition, a dynamic process. For example, neither earnings nor pension benefits are independent of the age at which people retire. Current employment status has consequences for both the short run and the long run, e.g. on the productivity, and on the level of wages and pensions, which all affect the retirement decision. In addition, the individual is faced with several sources of uncertainty, including demographic, economic, political, institutional and personal uncertainties. The life-cycle model of retirement is very useful in showing differences in the optimal retirement age for different individuals, or in showing the effect of changes in the budget constraint on the retirement age.

An alternative way of analysing individual labour market transitions in an uncertain and dynamic environment is to use search theory (developed by McCall (1970) and Mortensen (1970)). Like the life-cycle models, search theory is based on the conceptual framework of neo-classical economic theory, and the timing or age-dependence of the retirement decision is the main ingredient of the model. The search model was originally designed for the analysis of the job search behaviour of the unemployed, but we have converted it into a retirement search model for older workers. At each age, the individual might receive different, both expected and spontaneous, early retirement offers he has to evaluate. The individual's optimal strategy in evaluating such offers is characterised by the reservation wage property. The individual defines an acceptance set (i.e. a minimum acceptable retirement offer) and his search for the optimal retirement time and pathway continues as long as offers fall short of this acceptance set. Because multiple retirement pathways exist, the optimal retirement offer is characterised by two properties: the offer's

expected utility flow has to be at least as great as the individual's reservation utility, and the offer has to be preferred over its alternatives.

An attractive feature of this approach is the ability to explicitly account for differences in entitlement conditions of the various retirement pathways at different ages. Apart from earnings and pension benefits, the entitlement conditions for the various early retirement pathways are also age-dependent. These these might be different across individuals because of differences in background characteristics, such as age, sex, education, type of job, etc. In addition, entitlement conditions are different across countries, according to the different institutions. By explicitly including them, the search model allows the analysis of early retirement in a comparative perspective. Another attractive feature of the model is that differences in the level of generosity of retirement offers are accounted for, as in the life-cycle models. In sum, the search model permits the analysis of individual characteristics (including household characteristics and job characteristics) as well as institutional characteristics on both the entitlement conditions and the generosity level of early retirement offers.

With regard to the expected effects of this broad set of indicators on individual early retirement patterns, we not only used the job search theory, but also other theories, including human capital theory (Becker, 1964). In short, it is derived that, among other things, age, a bad state of health, and working in the public sector increase the transition probability into retirement, while being a female, being self-employed and having previously been unemployed reduce the exit probability. For other characteristics, including higher human capital endowments or having a working spouse, however, no ambiguous effects can be derived from theory. In addition, when accounting for the institutional differences between countries, we find that some of the predicted effects are stronger in countries with more generous early retirement benefits. Before moving to the empirical results, we first comment on the findings concerning the European early retirement systems.

Early retirement systems in Europe

Roughly two types of pension systems can be distinguished in Europe. In some countries, mainly the Scandinavian and Anglosaxon ones, the systems were set up from a Beveridgean tradition, where basic pensions are provided for the whole population. The provision of supplementary pensions is left in the hands of the individual or the employer. In other countries, systems were set up from a Bismarckian tradition, where both basic pensions and supplementary pensions are provided for the working population only. Earnings-related pension are granted, to ensure the maintenance of the living standard that workers acquired during their working life. This distinction also has consequences for the provision of early retirement pensions. While these are integrated in the first or public pension pillar in the Bismarckian countries, these are left to the second or third

pillar in the Beveridgean countries. Within this latter group of countries, however, we find that participation in second pillar pension schemes is quasi-mandatory, mainly as a result of the collective bargaining between the employers' and employees' associations at sectoral level.

With regard to the entitlement conditions, we find a great deal of variation across European systems. The most flexible retirement schemes only require a minimum age, or minimum contribution period, such as in Finland, Italy and Sweden. The most common schemes in Europe allow early retirement from a certain age in tandem with the requirement of a minimum contribution period. In countries such as Greece, Italy and Portugal early retirement through these schemes is possible at relatively young' ages (around 55) with a relatively short contribution period (25 to 30 years), whereas in Austria and Germany the schemes are generally restricted to workers age over 60 with at least 35 years of contribution.

In addition, we have to look at the generosity of the schemes, which is crucial for the evaluation of the early retirement offer, as the theoretical model showed. We again find large differences across European countries. Early retirement schemes in Austria, Italy, Luxembourg and the Netherlands, seem to be most generous with replacement rates varying from 80 to 100 percent or with implicit taxes on continued work around 60 percent. In other countries, incentives are more modest, especially in Finland, Portugal, Spain and Sweden, where implicit taxes on continued work remain below 30 percent. The occupational and private early retirement schemes in the Anglo-Saxon countries also seem to provide only modest incentives to retire early, with replacement rates of about 60 to 70 percent, notwithstanding large differences between people within these countries.

Finally, to get a complete assessment of a country's early retirement system, it is important to account for the early retirement opportunities embedded in the various social security arrangements. In the majority of European countries, relaxed conditions for older workers apply with respect to disability or unemployment arrangements. These relaxed conditions vary from leaner medical criteria in disability schemes, to non-required job search or extended duration of benefits in unemployment schemes. As a result, the social security arrangements might act as a substitute pathway for the specially designed early retirement routes as discussed before. These arrangements might also be used as a pre-early retirement stage, facilitating early retirement even before the minimum early retirement age. For employers too, the routes can be used as a way to lay off the older workers, either to create employment opportunities for younger workers, or to rationalise the firm's labour force. With respect to the generosity of these early retirement opportunities, unemployment benefits are generally less generous than disability benefits. This is likely to be related to the general belief that work-related disability is treated as a social or collective risk, whereas unemployment is treated more as a risk in which personal choice and 'moral hazard' is involved. In addition, we find that the generosity

is largely determined by the type of benefits. In the case of flat-rate benefits, average replacement rates are usually lower than with earnings-related benefits. The Netherlands has earnings-related benefits in both disability and unemployment routes, with above average replacement rates. Greece, Ireland, Italy and the United Kingdom have below average replacement rates, with Ireland and the United Kingdom having flat-rate benefits.

Notwithstanding these differences between the countries' early retirement systems, it is possible to cluster the countries based on the similarities of their early retirement systems. We created our own index, because we found that existing typologies either used rather outdated data or focussed on the receipt of pension income after the official retirement age only. Taking the flexibility and generosity as the starting point, we classified countries into four different early retirement clusters: (1) ungenerous and moderately flexible early retirement schemes -Ireland and Great Britain; (2) moderately generous and moderately flexible early retirement schemes - France, Greece, Portugal and Spain; (3) moderately generous and very flexible early retirement schemes - Finland, Denmark, Italy and Sweden; and (4) very generous and moderately flexible early retirement schemes - Austria, Belgium, Germany and the Netherlands. When we compare our retirement policy index to that of the leading typology of Esping-Andersen (1990), we find some similarities. In general, we find that in the liberal regimes, where both decommodification and stratification are low, early retirement possibilities are least flexible and generous. By contrast, in the social-democratic regimes, where decommodification is high and stratification is low, early retirement possibilities are most flexible, yet moderately generous. Because of this latter, labour participation is still encouraged. In between these two categories, we find the corporatist regimes, where decommodification is modest but stratification is high, and where early retirement depends on the status acquired during the working life. Withing this group of countries we find a contrast between countries with very generous early retirement systems for older workers with long service and countries with moderately generous systems that are still very much in development. These latter countries are the southern regimes of Ferrera (1996b).

Our retirement policy index is created using macro economic evidence on early retirement schemes, but in the second part of this dissertation, this policy index is tested empirically using micro economic data.

Early retirement patterns in Europe

In the empirical part of this study, we test whether the theoretical predictions derived in the first part are supported or not. The analysis is targeted at the explanation of the determinants of early retirement patterns, the differences across individuals, and the way in which the flexibility and generosity of a country's early retirement system affects these determinants. By using different data sets and different modelling techniques, we are able to examine whether the obtained results are likely to be robust or not. We summarise

only the main results here.

Exit rates out of employment increase with age from the age of 50 onwards in all European countries. This age dependence is positively related to both the level of flexibility and the level of generosity of the early retirement system, with the highest exit rates found in Austria, Belgium, Germany and the Netherlands. In many countries, the hazard rates into the various early retirement destinations show spikes at ages that mark entitlement to the schemes. In addition, a substitution effect between social security and retirement exits seems to exist, especially in countries with the most generous and flexible early retirement systems. This effect particularly exists from the age of 60, when the hazard into retirement shows a rapidly increase, whereas the hazard into social security remains stable or shows a slight decrease. In the case where early retirement is most flexible and generous, there is no 'need to retire' through the social security gateway. These findings suggest 'pull effects' into early retirement arising from the country's early retirement institutions, and other variables also point into this direction. In the discussion, we make a distinction between variables related to the entitlement conditions and those related to the generosity of the schemes.

With regard to the entitlement conditions, we further find that the age effects are most significant for men, which is explained by the dissimilar labour market careers of men and women. Interestingly in this respect is the finding that in Scandinavian countries, where female labour participation is highest, retirement patterns of women are similar to those of men. Women in these countries have no problems in meeting the requirements of the schemes in terms of anciennity or work experience, since they have already been working nearly full time for decades. Additionally, in countries with relaxed entitlement conditions for women, such as in Great Britain or Germany, the gender difference is also not significant.

In the case of early exit through disability we find that tight entitlement conditions prevent this route from being used as a substitute pathway. In countries with a modest required minimum incapacity to work (e.g. the Netherlands), we find that older workers who are in a relatively good state of health, use the pathways as a means to retire early from the labour force. In countries with the highest required minimum incapacity to work (e.g. Great Britain), such workers are not able to use disability as a route into early retirement and are observed to continue working - conditional on the fact that they are not eligible for other early retirement benefits. Furthermore, the self-employed have the highest probability of remaining employed at older ages, which is likely to be, at least partially, explained by the exclusion or non-entitlement to public early retirement and social security benefits. We observe that this effect is least strong when the self-employed are covered by the public social security schemes on a voluntary basis. Finally, in countries where social security benefits are means-tested or offering maximum benefit thresholds (i.e. Great Britain and Ireland), older workers with additional income sources (e.g. wealth

or income from working spouse) are significantly less likely to move into social security compared to such workers in countries with universal, non-means tested benefits.

The effects that operate through the entitlement conditions are only part of the story, the generosity of the early retirement schemes is of major importance in the individual early retirement decision. In general, the more generous the schemes are, the less selective early retirement is. In countries with most ungenerous early retirement provision (i.e. Great Britain and Ireland), only high-educated workers, workers with highest incomes, or workers with additional sources of income (e.g. household wealth or income from a working spouse) can afford to retire early. This stratifying effect is not found in countries with most generous early retirement benefits, where post-retirement income is closer to previous earnings, such as in Austria, Belgium, Germany and the Netherlands. A similar difference is found between public and private sector workers. It is especially in countries with ungenerous early retirement benefits where public sector workers have a higher probability of retiring early. Compared to private sector workers, they have more generous early retirement schemes. We acknowledge that this effect might also operate through the earlier mentioned entitlement conditions, which are commonly less tight in public sector schemes.

The retirement policy index constructed in this dissertation is largely based on macro economic evidence on early retirement replacement rates. To get a more in-depth view on this, we examined whether the replacement rates are different when looking at micro economic evidence. The analysis is performed for Germany, Great Britain and the Netherlands. The lowest replacement rates are indeed found in Great Britain, a country where early retirement schemes were predicted to be most ungenerous. The highest replacement rates are found in Germany and the Netherlands, both countries where early retirement schemes were predicted to be most generous. In addition, replacement rates associated with social security are lower compared to those linked to the retirement exit. This difference is largest in Great Britain, where social security schemes are most targeted at those in need. The difference is smallest in the Netherlands, where, for financial reasons, it does not seem to matter that much whether one exits work through the early retirement route or the social security route. Furthermore, replacement rates increase with age, explaining why the hazards increase with age. These observed differences indicate that the institutions and social security policies indeed play a role in explaining older workers' retirement behaviour across countries. It also suggest that the constructed retirement policy index is appropriate for this analysis.

In the final chapter of this dissertation, we examined the participation in formal on-the-job training of older workers compared to younger workers, and the relationship between participation in training at older ages and early retirement. In all countries, participation in formal training is lower for older workers compared to younger workers. In Great Britain, Denmark and Finland this effect is smallest, and we expect there are different

reasons for this. In the Scandinavian countries, governments put strong emphasis on lifelong learning to enhance labour productivity and employment prospects. Labour participation is strongly stimulated in these countries to maintain solidarity within society, and to keep the extensive social security system affordable. In Great-Britain, however, the increased participation in training by older workers is more likely to be initiated by the worker himself. Early retirement schemes are commonly ungenerous, which increases the need for older workers to participate in training to remain employable. The decline of participation in training with age is strongest in the Netherlands, which is most likely be explained by the fact that early retirement is extremely common, preventing both employers and older workers from investing in training.

In addition, we tested whether training reduces the likelihood of retiring early. In the majority of countries, support is found for this. The effect is most significant in countries where governments are actively trying to reduce early retirement, such as Austria, Belgium, France, Germany and the Netherlands). Interestingly, these are mainly countries with very generous early retirement systems, however, these are also countries in which seniority wages and experience rating exist. By participating in training, older workers might be able to raise their earnings in their final years of employment, which also improves their retirement income.

Discussion with respect to policy and further research

The issue of early retirement as it is covered in this study is at the heart of the current debate on reshaping the welfare state. The low participation rates of the elderly, together with the ageing process are putting social security expenditures and pension liabilities of European welfare states under strain. Consequently, the discussion centres around the burden this brings to the individual (younger) worker and taxpayer as well as to the national government budgets. Central in the debate is the incentive structure of most early retirement systems in Europe, with respect to both the level of flexibility and the level of generosity. Many welfare states have quite generous opportunities for early retirement, which seem to pull people out of the labour force. The less tight entitlement conditions for receiving an early retirement pension, specified in terms of age, previous work experience, or contribution record, increase the level of flexibility and exert a disincentive effect for the older worker to stay in the labour market.

It is, however, not only the attractiveness of the retirement system which is at stake here. It is also the rapidly changing economic context, the deep recessions and employment consequences that some countries are facing, and the role of in-firm human resources practices and organisation and work contexts that might be of relevance in explaining the low participation rates of older workers. We could not account for the demand side factors involved in the retirement process due to the fact that we used only labour supply

data. However, we find some evidence for the role played by the health condition of the worker which partly refers to the work place, the business cycle, in particular the level of unemployment in a country, and the role played by a lack of investment on the part of the employer as well as the older workers as far as their enrolment in training is concerned. These issues will be dealt with below, since they reveal some interesting points for policy reforms in European early retirement systems, as well as for further research.

Substitution between the various pathways

Our research points to an interesting relationship between retirement systems and the social security system. They seem to act as 'communicating vessels'. What happens in one domain has immediate consequences for the other. We believe that this study provides some evidence for the fact that, even in the absence of generous or flexible early retirement schemes in some countries, older workers tend to retire early from the labour market, by using alternative gateways that provide similar incentives, like the ones embedded in the social security system. The substitution effects we found between early retirement and social security exit support this. Furthermore, we found that in the case where countries offer very generous and flexible early retirement schemes, e.g. the Netherlands, the social security benefit schemes allow even earlier retirement from the labour force. At ages where entitlement to the early retirement schemes is still restricted, for example at ages between 50 and 58, we find an increased number of older workers transiting into the social security pathways. At the age of entitlement to the early retirement scheme, these workers change from the social security scheme to the early retirement scheme. In the end, however, this implies that the relatively easy to meet entitlement conditions of the social security schemes, in combination with their relatively high generosity, enables older workers to retire at very early ages. Consequently, we argue that reforms of the early retirement system should not only focus on the early retirement schemes but also on the social security pathways.

In addition, we found that in countries where early retirement, regardless of the route used, is restricted to pre-defined ages, the incentives to retire at these ages are presumably high, since the hazard shows clear spikes. In other countries, where such pre-defined ages do not exist, but where early retirement is allowed from a certain age onwards, the hazard shows a more gradual increase. In both cases, however, the existence of early retirement reduces the labour participation of older workers. In this respect, the proposed transition to systems with flexible retirement ages, as is the case in Sweden, for example, might not yield the desired solution, unless the generosity of the schemes is also significantly reduced.

Another aspect dealt with in our research, related to this, is the impact of health conditions, which is a characteristic of the person involved, but which also reflects the work and organisational context. Proper practices at the workplace could stimulate the

worker with a (relatively) bad state of health to function properly and could prevent his exit from the work place. Apart from the effects of a bad state of health on the early exit to social security (mainly disability), the findings confirm that participation in work of older workers in good health is more stable. This is obviously explained by the fact that older workers in good health might still function properly and therefore will experience all the issues their younger colleagues also experience, such as wage and productivity increases, thereby raising the opportunity costs of not working. In addition, because of their higher productivity compared to older workers in a bad state of health, they have a lower risk of being laid off involuntarily. An interesting aspect in addition to this is our finding that the disincentive effect on the transition into retirement for workers in good health is significantly smallest in countries with very flexible and generous early retirement schemes. A likely explanation is that the high flexibility and generosity of the early retirement schemes pull the healthy older workers out of employment. This suggest that active labour market policies for the elderly and health policies cannot be seen separately. A change of health policy without reducing the incentive effects of early retirement is not likely to yield the desired results.

We acknowledge the fact that in our analysis, we basically rely on the 'derived effects of incentive effects'. In other words, we measured the incentive effects by looking at individual and household characteristics and by looking at institutional indicators from countries. The econometric models we used, among which the multinomial logit model and the competing risks duration model, suffer from the assumption of independence of the competing exit routes. The trade-off between the various early retirement routes, however, can be made more specific, and a next step would be to allow for dependence between the competing risks, by using other modelling techniques, or by including indicators for the eligibility for the alternative pathways. Other modelling techniques that can be used for this type of analysis are the nested logit models or multiprobit models. With the growth of the number of panel data sets, such models become more widely available in the statistical software, however, this domain is still very much in development.

Another point for further research in this respect is the analysis of income consequences of early retirement. In this dissertation we only looked at the replacement income in the year after the transition out of work. It would be interesting, however, to show incomes over subsequent years of retirement and to see how this differs across individuals and across countries. In addition to this, it would be interesting to see whether the drop in income might cause a re-entry into employment after the initial early retirement decision. Together with such an analysis of the impact of income on the re-entry into employment at older ages, one might investigate other determinants, including the effect of institutional factors, on the re-entry decision.

Human capital investments in the older worker

The results we found for older workers' participation in training might be of significant interest for policy-makers. It suggests that the creation of more opportunities for the training of older workers might be a valuable tool when trying to postpone the early retirement decision. The findings that the incentives for older workers to be trained are higher when training also contributes to an increase of their professional status are of particular significance here. We find that older workers in low-level jobs tend to be excluded from training, while this is the same group of older workers who have the least opportunities to retire early on generous conditions. This gives rise to the idea that this group should be encouraged more to participate in training since it increases their future employment prospects and prevents them from becoming unemployed. In the light of rising unemployment rates in a great number of European countries, this is particularly important, especially since we found evidence that the level of unemployment in a country constitutes a barrier for older workers to stay employed. Policies to stimulate the employment of older workers might profit from the investment in the human capital of older workers, as it raises the productivity of the labour force in general and consequently stimulates potential economic and employment growth. In particular, in a knowledge-based economy, as many European economies are, a policy mix of stimulating investments in older workers to keep them at work, and of reducing the burden of generous retirement or social security exit benefits that generate work disincentives for older workers, might succeed in retaining the older workers in employment.

In addition to this, we found some evidence for the existence of unobserved heterogeneity, which might point to factors such as motivation, effort and ability having an impact on the retirement decision. These are, in a way, unobserved human capital factors just like attained education level is an observed human capital factor. The models that included a correction for these unobserved factors show a slightly higher fit measure compared to models without such a correction, which suggests that unobserved heterogeneity might be relevant. We further found that some of the observed factors included in the model become somewhat modified in size and significance when correcting for this unobserved factor, which indicates some correlation between the observed factors and the unobserved factor. We found that such a correlation exists with respect to having a higher education level, being self-employed, or working in non-commercial services. For example, the suggestion is that people with higher education levels have more of this unknown factor, say higher motivation and higher abilities, that increase their likelihood of continuing to work at older ages. The effect is particularly evident in workers aged over 60. Furthermore, when analysing the effect of participation in training on the early retirement decision, we tested for a possible endogeneity bias of training in the exit equation. We learned that many of the factors affecting the training participation of workers (e.g. age), affect the exit decision as well. Consequently, the group of trained older workers is likely to be a

selective group in that older workers who are likely to continue working are more likely to participate in training than workers who are likely to retire early. We show that such an endogeneity bias is significantly present in Austria, Belgium, Denmark and Finland, and we properly correct for it by using a bivariate probit model in which the decision to participate in training and the decision to retire early are jointly estimated. All this supports the idea that human capital factors are important for the postponement of the retirement decision and that policies to promote investment in education, training and capabilities might be a useful way to improve the labour market participation of older workers.

For the analysis of unobserved heterogeneity we adopted a non-parametric approach, allowing people with similar unobserved characteristics, with respect to their transitions to the different states, to be part of the same latent class. However, in our approach, unobserved heterogeneity is only allowed for in the destination-specific baseline hazards, i.e. in the marginal distributions. In more complex models, one could account for unobserved heterogeneity in the joint distributions. In addition, one might allow the unobserved characteristics to be correlated with the covariates of interest. Surely, interpreting such models can be difficult, but it allows the researcher to get a more in-depth analysis of the role of unobserved heterogeneity. Controlling for potential selective attrition is a related issue. Early retirees might be more likely to drop out of the sample due to unobserved factors, despite the fact that this is not supported by the literature. One could estimate simultaneous models for the early retirement transition and the attrition process, i.e. accounting for the potential correlation of unobserved characteristics.

Nederlandse samenvatting

In het huidige debat rondom de aanpassingen van de Europese welvaartsstaten, staat de discussie rondom vervroegde pensionering van oudere werknemers centraal. De lage participatiegraden van ouderen in combinatie met een vergrijzende bevolking, zet de Europese welvaartsstaten onder druk. Met name de betaalbaarheid van het stelsel van sociale zekerheid, en die van het pensioensysteem in het bijzonder, staat ter discussie. Speciale aandacht gaat uit naar de prikkels vanuit het stelsel van sociale zekerheid die de arbeids- participatie van ouderen negatief beïnvloeden. Middels deze studie worden de patronen van vervroegde pensionering van oudere werknemers verklaard. Een vergelijking van de verschillende Europese pensioensystemen en de invloed die daarvan uitgaat op het individuele arbeidsmarktgedrag staat daarbij centraal.

Vervroegde pensionering wordt op een brede manier geïnterpreteerd. Niet alleen worden vervroegde pensioenregelingen zoals de VUT en het prepensioen bedoeld, ook werkloosheid- en arbeidsongeschiktheidsregelingen worden als mogelijke uittredingsroute beschouwd. De individuele beslissing om vervroegd met pensioen te gaan, wordt vanuit een economisch perspectief benaderd. Oudere werknemers moeten voor elke potentiële arbeidsmarkttransitie de kosten en baten over de resterende levensjaren afwegen. Factoren die van invloed zijn op het uittredingsgedrag van oudere werknemers zijn persoonlijke achtergrondkenmerken, huishoudsituatie, baankenmerken, maar ook institutionele kenmerken zoals de toelatingscriteria en de financiële aantrekkelijkheid van de verschillende uittredingsroutes. Het doel van dit onderzoek is om de determinanten van het uittredingsproces te analyseren en de verschillen in het uittredingsgedrag tussen individuen en tussen landen te verklaren. Daarom wordt gebruik gemaakt van nationale en Europese socio-economische panel data, die een dergelijke vergelijkende, dynamische studie van individuele uittredingspatronen mogelijk maken.

Modelleren van de uittredingsbeslissing

Hoofdstuk 2 laat middels een overzicht van de literatuur zien dat het merendeel van de studies op dit terrein de individuele uittredingsbeslissing modelleert met behulp van een neoklassiek arbeidsaanbodmodel. Deze theorie gaat ervan uit dat oudere werknemers bij hun pensioenbeslissing een afweging maken tussen arbeid (= inkomen) en vrije

tijd. In de dynamische 'life-cycle modellen' wordt deze beslissing over de hele levensloop bekeken, en moet de werknemer een keuze maken tussen het aantal arbeidsjaren en het aantal pensioenjaren. Met name deze 'life-cycle modellen' zijn nuttig, omdat daarin specifiek aandacht wordt besteed aan de dynamiek en onzekerheid van het uittredingsproces (Burtless en Moffit, 1984; Fields en Mitchell, 1984; Gustman en Steinmeier, 1984; Rust, 1989). De uittredingsbeslissing is per definitie een dynamisch proces. De huidige arbeidsmarktstatus en het daarbij behorend inkomen hebben gevolgen voor de korte, maar ook voor de lange termijn, bijvoorbeeld voor de productiviteit, de loonontwikkeling en het pensioeninkomen. Ook moet de werknemer rekening houden met diverse bronnen van onzekerheid, waaronder demografische, economische, politieke en individuele onzekerheid.

Een alternatieve manier om individuele arbeidsmarkttransities, en met name de transitie van werk naar pensioen, in een dynamische en onzekere omgeving te analyseren is de 'job search theory' (McCall, 1970; Mortensen, 1970). Net als de 'life-cycle -modellen', is ook deze theorie gebaseerd op neoklassieke grondslagen, en ook is de leeftijdsafhankelijkheid van de uittredingsbeslissing een van de belangrijkste ingrediënten van het model. Het model is aanvankelijk ontwikkeld om het zoekgedrag van werklozen en hun kans op het vinden naar werk te verklaren, maar het kan ook worden toegepast om de transitie van werk naar pensioen te verklaren. Op elke leeftijd kan de oudere werknemer een aanbod krijgen om vervroegd uit te treden, zowel verwacht als onverwacht. De optimale besluitvormingsstrategie van de oudere werknemer bij de evaluatie van zijn mogelijkheden is gebaseerd op het reserveringsnut, een vooraf bepaald minimaal te accepteren nut. Zijn zoektocht naar de optimale manier om met pensioen te gaan, zowel qua leeftijd als wat betreft de te kiezen route, zal doorgaan zolang het nut van de aanbiedingen lager is dan zijn reserveringsnut. Omdat er sprake is van meerdere uittredingsroutes, moet de optimale pensioenmogelijkheid voldoen aan een tweetal eisen: het nut moet hoger zijn dan het reserveringsnut, en het nut moet hoger zijn dan eventuele andere aanbiedingen die de oudere werknemer op dat moment heeft.

Een aantrekkelijk kenmerk van deze benadering is de expliciete opname van de verschillen in toelatingscriteria van de diverse uittredingsregelingen op verschillende leeftijden. Naast inkomen en pensioen, zijn ook de toelatingscriteria voor de verscheidene uittredingsregelingen leeftijdsafhankelijk. Verder zijn deze verschillend tussen individuen door variatie in achtergrondkenmerken (bijvoorbeeld baankenmerken, geslacht of opleidingsniveau). Tot slot zijn de toelatingscriteria verschillend tussen Europese landen en zoals gezegd grotendeels afhankelijk van het institutionele design van de welvaartsstaat. De expliciete opname van de verschillen in de toelatingscriteria en financiële aantrekkelijkheid van de verschillende uittredingsroutes, alsook de erkenning dat een oudere werknemer op alle leeftijden pensioenaanbiedingen kan krijgen, maken het 'job search model' geschikt om de vervroegde uittredingsbeslissing in een comparatief perspectief te analyseren.

De verwachte effecten van deze brede set kenmerken op individuele uittredingspatro-

nen, worden afgeleid uit de 'job search theory' maar ook uit andere theorieën, waaronder die van het menselijk kapitaal (Becker, 1964). In hoofdstuk 3 worden deze verwachtingen geformuleerd en in het kort verwachten we dat leeftijd, een slechte gezondheid en werken in de publieke sector de kans op vervroegde uittreding verhogen, terwijl deze kans lager zal zijn voor vrouwen, zelfstandigen en ex-werklozen. Voor andere factoren, zoals het hebben van een hoger menselijk kapitaal of een werkende partner, worden vanuit de theorie geen eenduidige voorspellingen gevonden. In sommige landen zijn de voorspelde effecten naar verwachting sterker of zwakker, met name als gevolg van de flexibiliteit en financiële vergoeding van de pensioenregelingen. Alvorens naar de empirische resultaten te gaan, wordt eerst een overzicht geschetst van deze regelingen in de Europese landen.

Vervroegde uittredingssystemen in Europa

Hoofdstuk 4 laat de verschillen en overeenkomsten tussen de Europese vervroegde uittredingsregelingen zien. Grofweg kunnen er twee typen pensioensystemen worden onderscheiden in Europa. In een aantal landen, zoals de Scandinavische en de Angelsaksische landen, zijn de systemen gebaseerd op de Beveridgiaanse traditie, waarbij de publieke pensioenen een minimum inkomen garanderen voor de hele populatie en waarbij de organisatie van aanvullende pensioenen worden overgelaten aan de werkgever of de werknemer. In andere landen, de continentale landen, zijn de systemen gebaseerd op een Bismarckiaanse traditie, waarbij de pensioenen alleen gegarandeerd worden voor mensen met een werkhistorie. De pensioenen in deze laatste groep landen zijn veelal gericht op het handhaven van de levensstandaard die de werknemer tijdens zijn werk heeft verkregen. Dit uit zich in inkomensafhankelijke publieke pensioenen, in tegenstelling tot de vaste pensioeninkomens ('flat rate') in de eerste groep landen.

Dit onderscheid heeft ook gevolgen voor de organisatie van vervroegde pensionering. In de Bismarckiaanse pensioensystemen zijn de vervroegde pensioenregelingen onderdeel van de publieke pilaar. In de andere landen is vervroegde uittreding geregeld in de tweede en derde pilaar van het pensioensystemen, in de bedrijfs- of private pensioenen. De aanvullende pensioenen in deze laatste groep landen zijn toch quasi-verplicht. Terwijl de verplichting in de Bismarckiaanse landen het gevolg is van overheidsinmenging, is het in deze laatste groep landen veelal het gevolg van de collectieve onderhandelingen tussen werkgevers en werknemers.

Wat betreft de flexibiliteit, gemeten door de toelatingscriteria van de uittredingsregelingen, vinden we aanzienlijke variatie tussen de landen. De meest flexibele regelingen, zoals die in Finland, Italië en Zweden, vereisen enkel een minimum leeftijd of een minimum contributieperiode. Het merendeel van de Europese vervroegde uittredingsregelingen kent echter een combinatie van deze twee criteria. Deze zogeheten senioriteitsregelingen belonen de oudere werknemer voor een lange staat van dienst. In landen als Griekenland, Italië en Portugal is uittreding via deze regelingen al mogelijk op een relatief jonge leeftijd

(grofweg 55 jaar) met een relatief korte contributieperiode (25 tot 30 jaar), terwijl dit in Oostenrijk en Duitsland doorgaans pas mogelijk is op een leeftijd van 60 met minimaal 35 jaar aan contributie. Wat betreft de uitkeringen van de vervroegde uittredingsregelingen vinden we eveneens grote variatie. De vervroegde uittredingsregelingen in Italië, Nederland en Oostenrijk blijken het meest aantrekkelijk, waarbij het pensioen ongeveer 80 tot 100 procent van het voorgaande looninkomen bedraagt.

Om een compleet te krijgen van de vervroegde uittredingsregelingen in een land, moeten ook de routes die zijn ingebed in de sociale zekerheid worden meegenomen. In nagenoeg alle Europese landen zijn de toelatingscriteria voor arbeidsongeschiktheid en werkloosheid minder streng voor oudere werknemers. Het gaat hierbij om minder strenge medische criteria, een opheffing van de sollicitatieplicht, of een langere duur van de uitkeringen. Hierdoor kunnen deze regelingen als een substituut voor de eerder genoemde uittredingsregelingen functioneren, met name in landen waar deze laatste niet of nauwelijks aanwezig zijn. Ook maken de sociale zekerheidsarrangementen uittreding mogelijk nog voor de minimumleeftijd in de vervroegde uittredingsregelingen. Tot slot bieden deze regelingen voor werkgevers een gelegenheid om oudere werknemers af te laten vloeien. Net als bij de vervroegde pensioenregelingen vinden we grote diversiteit in de hoogte van de uitkeringen. Over het algemeen zijn de werkloosheidsregelingen minder aantrekkelijk dan de arbeidsongeschiktheidsregelingen. Verder wordt de financiële aantrekkelijkheid grotendeels bepaald door het type uitkering: niet-inkomensafhankelijke uitkeringen zijn minder aantrekkelijk dan inkomensafhankelijke uitkeringen. Nederland, bijvoorbeeld kent voor zowel de werkloosheid als de arbeidsongeschiktheidsregelingen inkomensafhankelijke uitkeringen, waardoor de hoogte van de uitkeringen ver boven het Europese gemiddeld ligt.

Hoofdstuk 4 laat verder zien dat het, ondanks deze verschillen in de pensioensystemen tussen de Europese landen, mogelijk is om de landen te clusteren op basis van gemeenschappelijke kenmerken van hun vervroegde uittredingsregelingen. Startpunt van deze index is de flexibiliteit en financiële aantrekkelijkheid van de verschillende regelingen. Er worden een viertal clusters van landen onderscheiden:

1. ongenereuze, matig flexibele systemen - Groot-Brittannië en Ierland;
2. relatief genereuze, matig flexibele systemen - Frankrijk, Griekenland, Portugal en Spanje;
3. relatief genereuze, zeer flexibele systemen - Denemarken, Finland, Italë en Zweden;
4. zeer genereuze, matig flexibele systemen - Belgi, Duitsland, Nederland en Oostenrijk.

Een vergelijking van deze 'vervroegde pensioen index' met een van de leidende typologieën op dit terrein, die van Esping-Andersen (1990), laat enkele belangrijke overeenkomsten zien. In de liberale regimes, waar zowel decommodificatie als stratificatie laag zijn,

is vervroegde uittreding minst flexibel en minst genereus. In de sociaal-democratische regimes, waar decommodificatie hoog en stratificatie laag is, blijkt vervroegde uittreding meest flexibel, doch slechts matig genereus. De arbeidsparticipatie in het algemeen, en die van ouderen in het bijzonder, wordt nog zoveel mogelijk gestimuleerd in deze landen. Tussen deze twee groepen in vinden we de corporatistische regimes, met een matige decommodificatie maar hoge stratificatie, waar vervroegde uittreding sterk gerelateerd is aan 'status'. Binnen deze groep onderscheiden we twee typen pensioenstelsels: de genereuze systemen met zeer aantrekkelijke vervroegde uittredingsregelingen voor oudere werknemers met een lange staat van dienst en de matig genereuze systemen waarbij deze regelingen nog in ontwikkeling zijn. Deze laatste groep bestaat uit de zuidelijke regimes van Ferrera (1996b).

Vervroegde uittredingspatronen in Europa

De hoofdstukken 5 tot en met 8 beslaan het empirisch onderzoek, waarin de verwachtingen, afgeleid in het theoretisch deel, worden getoetst. Vanaf een leeftijd van 50 jaar neemt de transitiekans van oudere werknemers toe, voor alle uittredingsroutes. Dit effect blijkt positief gerelateerd aan de mate van flexibiliteit en de financiële aantrekkelijkheid van de vervroegde pensioenregelingen, met de hoogste transitiekansen in België, Duitsland, Nederland en Oostenrijk. Ook lijkt er een substitutie-effect te bestaan tussen vervroegde uittreding via sociale zekerheid en via de speciale pensioenregelingen te bestaan, met name in landen waar deze laatste regelingen financieel het aantrekkelijkste zijn. In deze landen maken ouderen minder gebruik van de sociale zekerheidsarrangementen, omdat het niet 'nodig' is. In landen waar de vervroegde pensioenregelingen minder attractief of flexibel blijken, is de transitiekans naar sociale zekerheid hoger voor oudere werknemers. Dit suggereert een 'pull effect' vanuit het pensioensysteem en ook andere resultaten wijzen in deze richting. We maken bij de discussie van deze resultaten onderscheid tussen effecten gerelateerd aan de toelatingscriteria en die gerelateerd aan de financile aantrekkelijkheid van de regelingen.

Met betrekking tot de toelatingscriteria zien we, onder andere, dat de leeftijdseffecten sterker zijn voor mannen. Dit wordt meest waarschijnlijk verklaard door de afwijkende arbeidsmarktpatronen van vrouwen wat betreft aantal gewerkte uren en jaren. Opvallend in dit kader is dat in de Scandinavische landen, waar de arbeidsparticipatie van vrouwen het hoogste is, de uittredingspatronen van vrouwen nagenoeg gelijk zijn aan die van mannen. Vanwege hun langere arbeidsmarktparticipatie hebben vrouwen in deze landen geen problemen om aan de criteria van de vervroegde uittredingsregelingen te voldoen. Ook zien we dat in landen waar voor vrouwen minder strenge toelatingscriteria gelden, het sekse verschil niet wordt gevonden.

De transities naar arbeidsongeschiktheid laten zien dat strenge toelatingscriteria voorkomen dat deze routes als een substituut voor vervroegde pensioenregelingen worden

gebruikt. In landen waar slechts een minimaal verlies aan verdienvermogen nodig is om een uitkering te claimen, maken oudere werknemers die nog in relatief goede gezondheid verkeren, gebruik van deze route als vervroegde uittreding. Vergelijkbare werknemers in landen met strenge eisen kunnen dit echter niet en blijven langer doorwerken. Verder laat de analyse zien dat zelfstandigen, die in de meeste gevallen niet mee verzekerd zijn voor sociale zekerheid en die hun pensioenregelingen zelf moeten regelen, langer blijven werken dan hun leeftijdgenoten die in loondienst werken. In landen waar de zelfstandigen op vrijwillige basis meeverzekerd zijn in de nationale of sectorale regelingen, is dit effect beduidend kleiner. Tot slot, met betrekking tot de toelatingscriteria, wordt een effect van looninkomen, huishoudinkomen en het hebben van een werkende partner gevonden. In landen waar de sociale zekerheid een inkomenstoets betreft of maximum uitkeringen (zoals bijvoorbeeld Groot-Brittannië en Ierland), maken oudere werknemers met additionele bronnen van inkomen (vermogen, werkende partner) significant minder gebruik van deze routes als vervroegde uittredingsmogelijkheid dan vergelijkbare werknemers in landen met universele uitkeringen (zoals bijvoorbeeld Nederland).

De effecten die opereren via de toelatingscriteria van de diverse regelingen, zijn slechts een deel van de analyse. Een belangrijke rol in het individuele besluitvormingsproces omtrent vervroegde uittreding is weggelegd voor de hoogte van de uitkeringen. In het algemeen geldt dat hoe genereuzer de uittredingsregelingen in een land zijn, hoe kleiner het onderscheid tussen mensen ten aanzien van vervroegde uittreding. In landen met de minst genereuze regelingen, zoals Groot-Brittannië en Ierland, zien we dat alleen hoogopgeleide werknemers, werknemers met hoge lonen, of werknemers met additionele bronnen van inkomen (zoals vermogen of inkomen van een werkende partner) zich kunnen veroorloven om vervroegd uit te treden. Dit selectie-effect wordt niet gevonden in landen waar de vervangingsgraad van het pensioeninkomen hoger is, zoals in België, Duitsland, Nederland en Oostenrijk. Het selectie-effect wordt niet alleen gevonden met betrekking tot het inkomen, maar ook met betrekking tot de sector waar de werknemer werkzaam is. In de landen met de minst genereuze regelingen zijn het met name de publieke sector werknemers die vervroegd kunnen uittreden. Vergeleken met de private sector, zijn de publieke regelingen financieel vaak aantrekkelijker. Een deel van dit effect loopt echter ook via de toelatingscriteria, die in de publieke sector veelal minder streng zijn.

Hoofdstuk 6 toont de inkomensgevolgen van vervroegde uittreding op basis van micro economische data. De analyse betreft Duitsland, Groot-Brittannië en Nederland. De laagste vervangingsinkomens bij pensionering worden gevonden in Groot-Brittannië. De inkomens bij uittreding via sociale zekerheid zijn lager dan die bij uittreding via de speciaal ontworpen pensioenregelingen. Dit verschil is het grootste in Groot-Brittannië, waar sociale zekerheid het meest op armoedepreventie is gericht. Het verschil is het kleinste in Nederland, waar het, wat betreft de financiële gevolgen, niet veel uit lijkt te maken welke route een oudere werknemer neemt om vervroegd uit te treden. Deze resultaten wekken

de suggestie dat de instituties en het sociaal zekerheidsstelsel een grote rol spelen in de verklaring van verschillen in vervroegde uittredingspatronen in Europa.

Hoofdstuk 7 betreft een analyse van de participatie in werkgerelateerde training van oudere werknemers en de mogelijke relatie met vervroegde uittreding. De participatie in werkgerelateerde training is in alle landen lager voor oudere werknemers, vergeleken met jongere werknemers. Dit effect is het kleinste in Denemarken, Finland en Groot-Brittannië, maar de redenen hiervoor verschillen. In de Scandinavische landen stimuleert de overheid 'lifelong learning' activiteiten om de arbeidsproductiviteit te vergroten. Arbeidsparticipatie staat hoog op de agenda in deze landen om de solidariteit onder de bevolking te behouden en het extensieve welvaartssysteem betaalbaar te houden. In Groot-Brittannië, daarentegen, wordt de hogere participatie in werkgerelateerde training meer vanuit de oudere werknemer zelf verklaard. De uitkeringen bij vervroegde uittreding zijn over het algemeen laag hetgeen de noodzaak tot werken, en daarmee de noodzaak tot participatie in training om aan het werk blijven, verhoogt. De daling van de participatie in training met leeftijd is het sterkste in Nederland, waar vervroegde uittredingsregelingen meest aantrekkelijk zijn. Dit neemt voor zowel de werkgever als de werknemer de prikkel weg om te investeren in de training van de oudere werknemer. Er lijkt een negatieve relatie te bestaan tussen de aantrekkelijkheid van vervroegde uittreding en de participatie in training.

Andersom wordt ook een negatief effect gevonden van de participatie in training op oudere leeftijd op de kans op vervroegde uittreding. Dit effect is het grootste in landen waar de overheid actief bezig is om de vervroegde pensionering terug te dringen, zoals in België, Duitsland, Frankrijk, Nederland en Oostenrijk. Interessant is dat deze landen juist die landen zijn met zeer genereuze vervroegde uittredingsregelingen. Het zijn echter ook landen waarin de lonen stijgen lonen met leeftijd. Door te participeren in training, proberen de oudere werknemers hun loon in de laatste jaren van hun werkende leven te doen toenemen, hetgeen ook een positief effect zal hebben op hun pensioeninkomen.

Onze bevindingen op al deze terreinen suggereren dat het vergroten van de arbeidsparticipatie van ouderen niet louter bewerkstelligd kan worden door het veranderen van het beleid op een enkel punt. Een goed beleid dient een mix te zijn van, onder andere, een vergroting van de participatie in training, het opheffen van de substitutie-effecten tussen de diverse onderdelen van de sociale zekerheid, het bevorderen van een goede gezondheid bij ouderen, het verhogen van de toelatingscritiria van de vervroegde uittredingsregelingen en het verlagen van de daarbij behorende uitkeringen.

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The issue of early retirement is at the heart of the current debate on reshaping the welfare states in Europe. The debate focuses on retaining older workers in the labour market and central to this debate is the incentive structure of most European social security systems. How do European welfare states differ in providing such incentives and pulling older workers out of the labour market? The research in this dissertation is targeted at revealing the similarities and differences in European early retirement institutions, including unemployment and disability schemes. In addition, using longitudinal data from a large number of European countries, the determinants of early retirement decisions are analysed empirically and the role played by institutions is surveyed. This research shows that both less tight entitlement conditions and high generosity of early retirement schemes exert a disincentive effect on staying in work for the older worker. This study also reveals some interesting relations between the several parts of the early retirement system, which suggest that policies to retain older workers in the labour market not only concern a reform of the pension system, but also of other parts of the welfare state.

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