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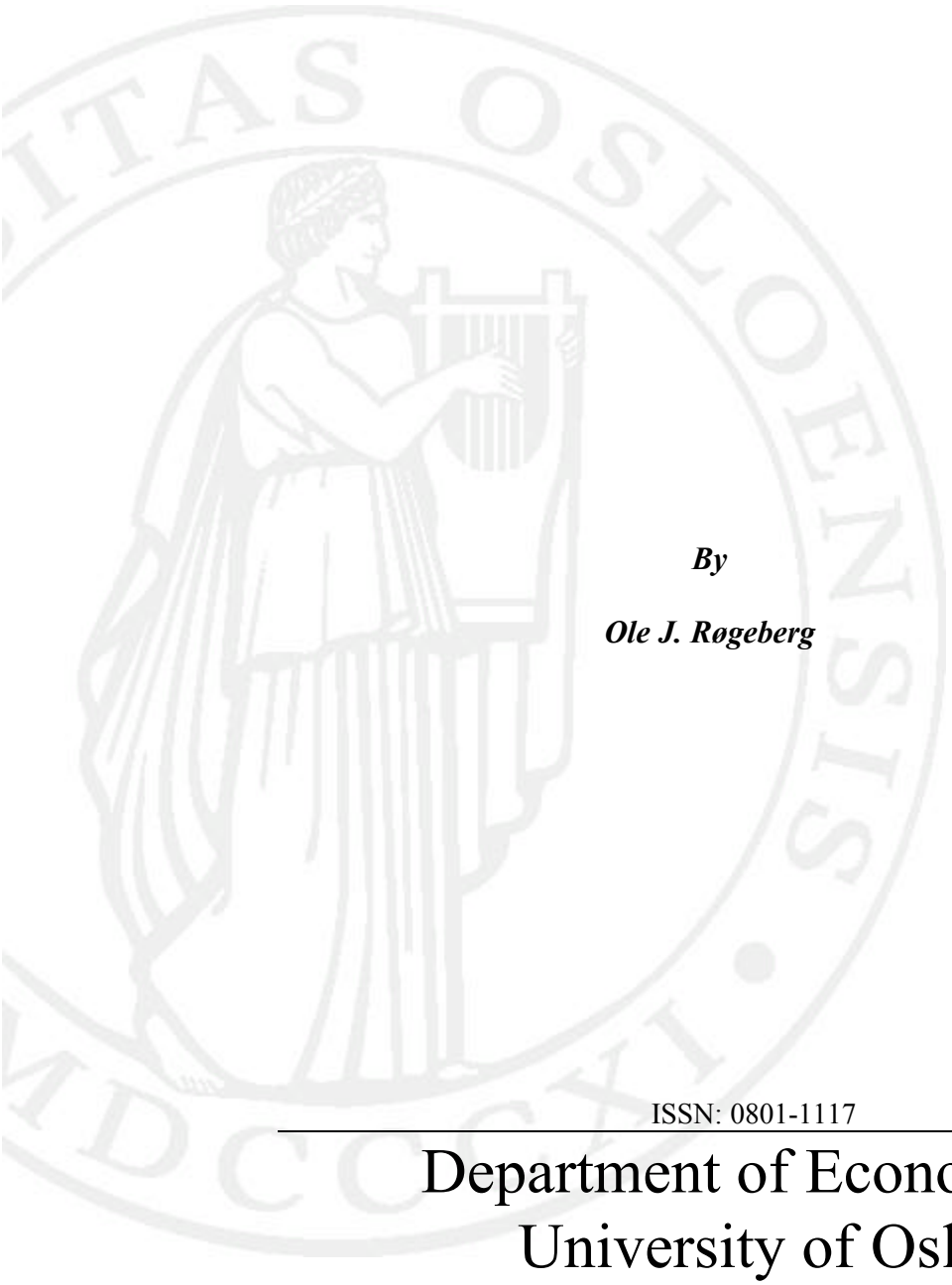
Married Men and Early Retirement under AFP Scheme



By

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No 37	Finn R. Førsund: Modelling The RAINS model approach. 33 p.
No 36	Brinch: Statistical Discrimination and the Returns to Human Capital and Credentials. 33 p.
	By Halvor Ove Moene and Torvik: Crime Induced Poverty Traps. 19 p.
	By Ove Wolfgang: Reflections on Abatement Modelling. 34 p.
	By Jon Strand: Effects of Progressive Taxes under Decentralized Bargaining and Heterogeneous
No 32	By Jakob Klette: Efficiency in the provision of municipal nursing – and home care services: The Norwegian experience. 28 p.
No 31	By Geir B. Asheim: Proper Consistency. 21 p.
No 30	By Geir B. Asheim: On the Epistemic Foundation for Backward Induction. 26 p.

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Married Men and Early Retirement Under the AFP Scheme

by

Ole J. Røgeberg

Foreword

The following thesis was written as part of a project conducted by Steinar Strøm and Erik Hernæs at the Frisch Centre (Ragnar Frisch Centre for Economic Research). The project was entitled "Pension schemes, work activity and retirement behaviour" , Steinar Strøm served as the project leader, and it was financed by the Norwegian Research Council.

I was employed as a Research Associate under Erik Hernæs and was responsible for much of the work done on the data sets used in the analysis in Haugen, Hernæs, et. al. (1999), which is presented in detail in this paper. In particular, I was responsible for most of the work described in chapter 3 in this thesis. Research Associates Fredrik Haugen and Zhiyang Jia, working under Steinar Strøm, did the other parts of the data work, more specifically the model estimation and prediction of income in different states. I was employed on the project part-time in the last half of 1998 and first half of 1999, full time in the summer of 1999 and part time in the last half of 1999, for at total of 500 paid hours in 1999.

For the data work I used the SAS system for Windows, release 6.12. The thesis was written with Microsoft Word 97, and Microsoft Excel 97 was used for some of the tables and diagrams not directly copied from SAS.

Several people should be thanked. My thesis adviser was Professor Steinar Strøm at the Economics Department of the University of Oslo, Norway, and he was most helpful with comments and other feedback and helped weed out some embarassing errors. Erik Hernæs provided a lot of needed guidance, help and support, and Fredrik Haugen answered dozens of questions relating to his part of the project in a patient and helpful manner.

Table of Contents

1 Introduction

1.1 Summary

The following thesis concerns itself with the labour supply of elderly married men eligible for early retirement under the AFP (AvtaleFestet Pensjonsordning) scheme.

Retirement behaviour is a theme of increasing importance as demographic changes lead to higher proportions of elderly individuals in the population, and as pay-as-you-go public pension systems threaten to become an increasingly heavy fiscal weight for the governments of many social democracies. The subject is one where Economics should be able to contribute, with its studies of incentives and behaviour, and it is one in which economists have shown a lot of interest. All the same, there are parts of this subject less examined than others, often because researchers have difficulties procuring good empirical data for analysis. One such part is the interplay between spouses in a household, a subject which may prove to be important as the cohorts with higher female labour force participation rates age. Using extensive register data, the project "Pension schemes, work activity and retirement behaviour" conducted at the Frisch Centre, hopes to be able to increase our understanding of the dynamics here at play. This paper serves as a documentation of the data underlying one of the papers published as a part of this project.

There are three main types of pensions, two of which are dealt with in this thesis:

- There is the public pension, introduced in 1967. The government pension available to many individuals working in the public sector is viewed in this paper as a type of public pension.
- Early Retirement Pension (AFP) enabling eligible individuals to retire early without (in most cases) reducing the earnings based component in their public pension from what it would have been had they worked until the age of 67.
- Various types of private and employer based pensions, for which data on accumulated rights are not available

The basis for the empirical work were various files with register data linked to an individual-specific number, allowing information from the various files to be linked. Information came from the labour market authorities, social security authorities, tax files and official registers containing demographic information. The goal was to create a file containing all married men becoming eligible for early retirement under the AFP scheme at some point in 1993 or 1994, and married to wives not so eligible. An

attempt was made to observe the labour market choices made by these couples during the first twelve months following the month the husband became eligible. In addition, information on wages, earned pension rights in the public system, demographic and other background variables were attached.

This allowed us to examine the take-out profile of those deciding to retire early, and this and other aspects of the sample studied are presented.

The section detailing the construction of the data set emphasise the way the variables in the register files and the variables constructed from these are approximations to the variables we would have liked to be able to observe. This is a theme that reappears at several points, from the construction of a list of firms with employees covered by the AFP-scheme, through the implementation of the individual criteria for AFP eligibility these individuals face and on to the construction of the variables used in the analysis.

An econometric model modelling the labour supply choices made in the first twelve months following the husband's eligibility was specified in two versions, one with an option term capturing the absorbing nature of retirement and one without such a term. The models were estimated by log-likelihood, and the results are presented and discussed.

The estimated model was then used for policy simulations and comparisons with earlier results, though these parts of the work are not covered in this thesis.

1.2 Background

Falling birthrates and higher life expectancies have changed the demographic composition of the population in many industrialised countries, with a growing proportion of the population consisting of the "consuming" elderly and a diminishing proportion consisting of the "producing" young. Economists have pointed out several problematic aspects of this change, among them the problems resulting from a "pay-as-you-go" public pension system when a dwindling number of workers are to support a growing number of pensioners.

In this connection, the Early Retirement Scheme (AFP) which was the result of a negotiation between employers and unions in 1988, is of great interest. Under this

scheme, a large proportion of workers today can decide to retire at the age of 62 instead of the ordinary 67, without (in most cases) receiving lower pensions than they would, had they worked to the age of 67. This development goes in the opposite direction of that recommended by most economists. If the scheme becomes firmly entrenched and if retiring early becomes the norm, it will imply a further shift of the balance between "those consuming and those producing." Not only do people live longer and healthier lives after the age of 67, but now even some of the years prior to the age of 67 are shifted into retirement. A shorter working-life is also bound to have further implications in its own right. For instance, the period of time in which society can recoup its investments in human capital is shortened, reducing the present value of subsidising higher education.

The present paper, however, is concerned with other aspects of the change. We used the introduction of the AFP scheme as an opportunity to study the retirement decision of elderly, married men and the responsiveness of that decision to the level of current earnings and potential. Also, we analysed the men as parts of a couple, enabling us to study the interdependence of the men's decision with the state and potential states of their wives. Blau, for instance, has found "strong associations between the labor force transition probabilities of one spouse and the labor force status of the other spouse." (Blau, 1998). Since the labour force status of females has been changing over the last fifty years, this implies that, as future cohorts with a larger proportion of working females approach retirement age, married males may respond to changes in incentives in a way different from what they have in the past. Also, higher labor force participation rates among females in a cohort means higher earned pension rights, changing the household budget constraint which again may (in a predictable manner) influence the decision of the male. And if there is a preference for common leisure, this too may cause the "average" wife's influence on the man's retirement decision to change, again, in a predictable manner.

Using extensive register data covering the period 1992-1995, we were able to follow the labour market decisions of a group of couples where the man, and only he, was eligible for AFP retirement, and estimate the importance of various factors on the decision.

The change in age requirements that took place during this period (from 65 to 64 years, a change implemented in October 1993) amounts to a further experiment, as it allowed us to see even more clearly how the behaviour of the elderly workers was changed by the AFP scheme.

1.3 General

In the present study, we analyse the retirement behaviour of married men who became eligible for early retirement under the AFP scheme during 1993 or 1994, and the labour supply of their wives. The sample includes a set of couples where the husband became eligible for early retirement during 1993 or 1994, and where the wife did not.

The unit of analysis is the couple rather than the individual, and we therefore consider the male's retirement decision as part of the couple's decision on the optimal labour supply option available to them as a couple. This means that the wife's characteristics may influence the husband's retirement decision, and that the options available to the husband may influence the wife's labour supply decision. However, the couple is not symmetric, since only the husband, in our sample, is eligible for early retirement under the AFP scheme.

Had labour force participation been similar across the genders, we would have been faced with two equally large groups: Eligible men married to women who tended to be too young to be eligible, and eligible women married to men who tended to be too old to be eligible (already retired etc.). However, since female labour force participation was less common than male in the cohorts studied, the situation with an eligible man and noneligible women is the most common situation that was (and still is) facing older couples nearing retirement age. Our sample and model reflect this.

1.4 A brief review of some earlier work in the same field

In the literature on retirement, the option value approach is usually identified with that of Stock and Wise (1990), which dealt with the case of salesmen in a large company

who could retire early or continue working, and who knew that working until a certain age would give them a bonus. "*Continuing to work preserves the option of retiring later, hence the terminology*." Their model also allowed the updating of information over time. Though their model was very influential there were shortcomings in their data in that, while they had detailed information on the pension plans, they lacked information on other important variables, such as health status, household composition and wealth. Also, they could only observe whether the person continued working in the company or not. If a person left the firm he became invisible, and though he may have retired, he may also have taken a job elsewhere.

Samwick (1998) used a data set linking economic and demographic information of households with details of their pension formulas. Estimating a version of the option value model of Stock and Wise (1990), he found that both the option value of retirement and the accrual in retirement wealth are statistically significant in reducing the probability of retirement. Also, simulations using the model found that the growth of pensions could account for a quarter of the decline in labour force participation in the early post-war period.

It may be of interest to clarify the use of the term "option value". Another use of the term, although in a different context, is that used by Raknerud (1999). Here, "option value" is used to denote the value of waiting for new information that may change the desirability of or the optimal timing of exit for a firm. That is to say, the value of not having to commit to a specific exit time but to leave the question open. This accords better with the term's used in Financial Economics.

Thus, it seems that there are two uses of this term. One laying the emphasis on uncertainty and the value of reducing this before deciding on a course of action, the other laying the emphasis on the known ways in which the consequences of actions will be different if those actions are postponed into the future. Though Stock and Wise do allow updating of information, this does not seem to be the most important aspect of the term in their case, as illustrated by the quote above. In their case, it seems that the important thing is that continuing to work means you're able to retire tomorrow, or next year, and that this means you're in a position to retire at the future (known) date when retiring triggers a bonus payment. Similarly, in our case (see

model description below, chapter 5.2) the economic attributes of the different states are known beforehand and unexpected changes do not take place in, for instance, wages and pensions. As Samwick (1998) puts it, after conducting his analysis, "the option value of continued work developed by Stock and Wise [...] is shown to be a parsimonious but comprehensive measure of future retirement incentives […]."

Our study looked at the retirement decision in a household context, and we hope to follow up the study by using similar data sets to analyse the retirement decision of married females and single males and females as well. This will enable us to get comparable results for the different groups and to study the differences between the determinants of their retirement decisions. Although a lot of work has been done on the economics of retirement, the grounding of this in a household context and the study of the differences between these groups has been more unusual. In Hurd's 1990 Journal of Economic Literature overview of the field he stated that the "great majority of the research on retirement has been on the retirement of single men and husbands", and that the research on women seemed to indicate that single women's retirement had determinants not much different from those of men, while the retirement decision of married women was more complicated, depending on husband's retirement status and retirement income.

Pozzebon and Mitchell (1989) examined the economic and family determinants of the retirement behaviour of married women. Their analysis, testing a life cycle model empirically, indicates that family considerations are more important in wives' retirement decisions than own economic opportunities. However, as they themselves caution, this should be viewed as a preliminary finding, since their sample consisted of only 139 women, followed over a period of ten years.

Zweimüller, Winter-Ebmer, Falkinger (1996) likewise lament the lack of empirical studies analysing the interdepence of the retirement decisions of spouses. They discuss three different models of households. There is what they call the "traditional labour supply model" as used by Hurd (1990), where the retirement ages of the husband and wife results from the maximisation of a family utility function subject to the family budget. They then go on to the "more modern analysis of couples [...] based on individual decisions of the respective partners." The second model views

family labour supply as the outcome of a non co-operative game. The third model views family labour supply as the outcome of a co-operative (Pareto efficient) game. None of the models yield definite predictions, and the more precise nature of the interdepencies is therefore an empirical question. Zweimüller, Winter-Ebmer, Falkinger use cross-section data on 1886 couples to estimate a bivariate probit approach. Their main results were that they found an interdependence between the spouses with an asymmetry: Raising wives' legal minimum retirement age caused a reaction from the man almost half as large as the direct effect on the women, while wives didn't react vice versa.

Blau (1998) analyses the dynamics of joint labour force behaviour of older couples in the U.S., and finds strong associations between the labour force transition probabilities of one spouse and the labour force status of the other spouse, which he feels may partly be caused by a strong preference for common leisure. However, his data are quite old (from the 1960s and 1970s) and he himself stresses that an important task for future research will be to see if the patterns he has found are still prevalent, or whether new patterns may have developed.

Hurd (1997) concerns itself with the joint decision of couples. His main finding is that husbands and wives tend to retire at the same time. He himself describes the hypothesis as follows: "The joint retirement hypothesis implies that as the age difference [wife's age subtracted from husband's age] increases the probability that the husband retires at an early age decreases; that is, the entire distribution of retirement ages shifts towards greater ages." He also attempts an empirical examination of the degree to which this can be attributed to observable economic variables, and to find evidence of compensated cross-equation effects. He finds that some of the results can be interpreted to mean that the retirement of spouse is a complementary good to one's own retirement. The evidence that one spouse's economic variables influence the retirement age of the other is weaker, though this is understandable since the weakness of the direct effect would make it surprising if an effect on the spouse had shown up strongly. However, as he himself makes clear, the correlation does not necessarily have to be explained by complementarity in the utility function. It could also be due to neglected economic variables (for instance wealth) or

assortative mating (if people marry others with tastes similar to their own, this may cause a correlation between their future behaviours in and of itself).

Baker (1999) uses the introduction of a policy change in Canada as an opportunity to compare two groups of married couples, those where the wife was eligible for a "Spouse's Allowance" and those where she was not. The results were that the allowance seemed to cause an increase in the NLF (Not in Labour Force) rate of the man, while the wives did not share the rising labour market participation rate of their counterparts in the control group. The changes in labour market opportunities were concentrated among individuals with limited labour market opportunities, and there seemed to be an increase in joint absence from labour market and decrease in joint employment among the couples with eligible wives.

Finally, in a different vein altogether, O'Donoghue and Rabin (1998) is an interesting paper dealing with procrastination and retirement. They argue that many people do a poor job of investing for retirement even though this is one of the more important tasks in a person's life, and that this, to a large extent, may be due to procrastination. Different models and calibration exercises are used to show how procrastination may result from time-inconsistent preferences even when the benefits of an action are enormously larger than the costs, and even when the agent is aware of the present-biased preferences but underestimates the magnitude of the bias.

2 The pension system and the AFP scheme

2.1 Public pension

A public, mandatory, defined benefit pension system, where a major component is earnings related, was introduced in Norway in 1967 and covers all permanent residents. General eligibility for the public pension system is at age 70, but pension can be taken out at age 67 without reduction (apart from the loss of the opportunity to accrue extra pension rights for those not already at the limit). Suppose the youngest workers in 1967 were about 15 years of age at the time. The last workers whose working-life began when the system was introduced will then be eligible for ordinary

age-pension in the year 2019, when they turn 67. After this date, all workers will have begun their working life after the introduction of the public pension system. This date can therefore be viewed as the last possible date for the conclusion of the "phasing in" of the system. However, for practical purposes this limit is of little interest. Assuming an ordinary working life of 40 years, the phasing in of the system can be considered finished in 2007. Having worked more than forty years does not influence the pension level in and of itself, and a post-2007 worker will only be treated differently from those born later in two cases: If he has had less than forty years of work since 1967 but more than forty in his complete work history, and if some of his twenty "best" years of income (measured in relation to the basic pension) were before 1967.

The description below is of the structure in 1992, but the basic features have not been changed up to the time of writing. Because we study the retirement decision given accumulated rights, the description below focuses on the regulations determining the benefits. Regarding the financing of the system, we will just mention that contributions to the system are levied on employers and employees as percentages of total earnings and on self-employed as a percentage of their income, as part of the income tax system. Although there is a central pension fund, it is not required that this should meet future net expected obligations, and the system is based on yearly contributions from the government.

The benefits consist of three main components:

1. A basic pension paid to all persons permanently residing in the country, equaling 1G for unmarried and 0,75G for married individuals. With less than 40 years of residence, the basic pension is reduced proportionally. This reduction mainly applies to immigrants, of which there are very few in the sample, and we will not pay any attention to this feature of the system in the following.
2. An earnings based pension, based on an individual's earnings history, more specifically, on the ratio of wage (and some other) incomes to the basic pension in the years since 1967. This component is received in full if one has had forty years with incomes above 1G. If not, it is reduced proportionally. Its level is a function of the twenty years with the highest ratios of income to basic pension.
3. Supplementary pensions which, for instance, boosts pension income for those with no or a very low earnings based component, or which boosts pension income for

those individuals who have been the sole providers of their families. The extra compensations in place because the system is still being "phased in" might also be categorised in this group.

A crucial parameter in the system, used for defining contributions as well as benefits, is the basic pension. The average basic pension (the size of the basic pension is sometimes changed in the middle of a year, in which case the average is used in defining contributions) in the years most relevant to this paper:

- 1992 – 36 167 NOK
- 1993 – 37 033 NOK
- 1994 – 37 820 NOK
- 1995 – 38 847 NOK

The earnings based pension of the public pension system, in the private sector (those in the public sector have alternative pensions, coordinated so that benefits will be the maximum of the public and the government pension), depends on the basic pension and the individual earnings history in several ways. Each year, earnings above the basic pension is divided by the basic pension to give pension 'points' for that year.

The following formulas show how earnings counted in units of the basic pension (G) translated into earned pension points during various periods in the past.

Period	*Income*	*Formula*
1967-1970	$G \leq Y \leq 8G$	$PP = \frac{Y-G}{G}$
	$8G \leq Y$	$PP = 7$
1971-1991	$G \leq Y \leq 8G$	$PP = Y/G - 1$
	$8G \leq Y \leq 12G$	$PP = 13/3 + Y/3G$
	$12G \leq Y$	$PP = 8{,}33$
1992-	$G \leq Y \leq 6G$	$PP = Y/G - 1$
	$6G \leq Y \leq 12G$	$PP = 3 + Y/3G$
	$12G \leq Y$	$PP = 7$

These points multiplied by the basic pension give the earnings based component, and adding the basic pension gives the total public pension. If a person has had less than 40 years with earnings above the basic pension, the earnings based pension is reduced proportionally.

The public pension system also has a number of additional regulations, which are briefly recounted below (see p. 15).

State and local government employees have alternative pensions, coordinated so that benefits will be the maximum of the public and the government pension. The government pension is calculated in much the same way as the public pension, but with some important distinctions. First, it is based on the earnings level immediately prior to retirement and not on the previous earnings history. Secondly, the reduction in accrued pension points starts at 8 times the basic pension, allowing the maximum employer-based public sector pension to be 6.16 times the basic pension in the public system. Define the replacement ratio as the relation between after tax income and after tax pension, in the case where a person earned the same number of pension points he did in the last year of his working life, every year of his working life. Then, in 1992, an unmarried individual receiving the maximum government pension (i.e. an individual whose previous income was 12G) would have a replacement ratio of 0,67, while a similar individual receiving the ordinary public pension would have a ratio of 0,52. (Haugen 1999).

Up to January 1 1997 (that is, in our observation period but not any more) the pension from the public system for those aged 67 to 70 was also conditioned on earnings. Firstly, 50 per cent of labor income above the basic pension – when aged 67 to 70 – was deducted from the pension. Secondly, the sum of pension and earnings were capped to the level of previous earnings.

2.2 Private and employer-based pension

In addition to the public pension, there has recently been a surge in *employer-based and private* (supplementary) pensions (tax deductible and widespread). There is little information available on accumulated rights to these types of pension. They can be observed in the tax files when received, but are difficult to predict for those who have not yet retired. In an earlier study, received total pensions were regressed on predicted public pension, revealing a strong correlation between the two. In this study we disregarded these private pension types.

2.3 AFP

Finally, in 1989, unions and employers negotiated an *early retirement scheme*, AFP (AvtaleFestet Pensjonsordning), covering a substantial and increasing proportion of all employees. The proportion has been increasing since 1990 both as a result of more companies joining the scheme and as a result of changes in the age requirements. The scheme covers the whole public sector (40 per cent of all employees in the country in 1992) and private companies employing about 43 per cent of all employees in the private sector. Self-employed are not included.

The scheme allows those employed in covered companies, and meeting individual requirements, to retire at an earlier age than 67. The minimum age was 66 from January 1 1989, lowered to 65 from January 1 1990, lowered to 64 from October 1 1994, to 63 from October 1 1997, and to 62 from March 1 1998. The pension level received is as it would have been from age 67, had the person continued till that age in the job they held at the time of early retirement. Like the public pension, the AFP pension is contingent on income. Should income reach a level forcing the AFP pension down to zero, it is viewed as "dormant" and revived if the income falls again.

In the AFP companies, all employees attaining the required age are eligible if they:

- Have been employed in the firm the last 3 years or been covered by the AFP-scheme for the last five years
- have earnings (of the type earning pension points) at a level at least corresponding to the basic pension (G) the year AFP is taken up
- had earnings at least equal to the basic pension (G) the year before
- are not receiving pensions or similar payments from employer, not requiring work effort in return
- have had at least 10 years since the age of 50 in which earnings were at least equal to the basic pension
- have an earnings-history such that the average earnings in the 10 "best" years since 1967 was at least two times the basic pension

Other changes in the scheme have broadened its scope. For instance, since 1. October 1997 the scheme has also supported part retirement, i.e. 60% and 80% jobs in AFP firms. Because this, in some cases, left the pension recipient better off economically than if he had worked full time, these rules were later changed.

2.4 The pension level

For a 67 year old retiring under the ordinary regime, the rules are relatively straightforward:

The key figure is what we can call the "endpoints". For individuals with 40 or more years with earnings above the basic pension, this is the average of the yearly points over the best 20 years. If a person has had less than 40 years with earnings above the basic pension, the average is reduced proportionally. If he has less than 20 years with earnings above the basic pension, the average is calculated on the basis of the years with non-zero points. That is, a person with ten years of non-zero pension points has the average of these ten years as the initial average, which is then reduced to one quarter, since he has only had earnings above 1G in 10 years instead of 40.

Since the pension system is still being phased in, there is an 'overcompensation' rule for incomes up to five times the basic pension, which is in operation for individuals

born before 1928. Secondly, there is a supplementary pension for those without any earnings based pension component, giving a minimum pension level of 1.605 times the basic pension. This means that income below 2.344 times the minimum pension does not influence the public pension. In other words, a person earning 2,3G in the best 20 years of his working life will end up receiving the same pension as a person who has not worked at all. Only income above 2,344G influences the pension actually received. Thirdly, there is a co-ordination of the pensions for married couples, mainly reducing their joint pension compared to the sum for two single persons. The two latter of these features have been taken into account when we calculated potential pension.

Matters are complicated somewhat more for early retirees. Your pension under the AFP scheme is meant to be what it would have been had you continued working. Since you retire early, the earnings you would have had in the years leading up to your "normal" retirement age will never be realised. Instead, these future pension points (FPP) are set as the maximum of the following:

- The mean of the pension points earned in the last three years
- The mean of the pension points the individual earned in his best 20 years (or the mean of the years with more than 1G if there are less than twenty of these).

In other words: The income you would have earned had you continued working instead of retiring early will be assumed to be approximately what it has been recently, unless this income level is unusually low, in which case your future earnings will be assumed to be at the level of the mean (relative to the basic pension) of your best twenty years.

This means that if your earnings are expected to rise beyond the level calculated by these rules if you were to continue working, then your pension level could be permanently lower if you decide to retire early.

The number of years with positive pension points includes these "future" years.

Finally, there are also special tax rules, which apply to retirement benefits. These are described in detail in a related paper from the same project (Haugen 1999).

2.5 Early retirement companies

In this paper I will distinguish between what I call "firm" and "company". With "firm" I will mean the unit of a company that is located and operating in a certain geographical area. A company may be a larger entity than a firm in the sense that a company may include several different firms, while a firm is a part of a company.

For an increasing proportion of the labour force, presently about 60 % of all employees, an early retirement scheme (AFP) has been implemented as part of the wage settlements between employers and employees. This scheme operates on the level of the firm, covering most of the private and the whole public sector. Due to lack of precise data we had to construct a list of companies operating the AFP scheme (see chapter 3.2.1). There are two problems with this: All the firms in a company do not have to be a part of the AFP scheme just because some of them are. Also: Whereas the companies thus identified can safely be assumed to be participating in the AFP scheme, there may be companies not identified, simply because no employees took out AFP during the observation period. This is especially a problem with small companies in the private sector.

A rough check of our procedure's accuracy can be performed as follows: Of the roughly 1.9 million individuals registered with at least one work record in the records of the labour market authorities in 1993-94, approximately 56% were registered with a work record in one of the companies our procedure identified as participating in the AFP-scheme. The proportion of the labour force working in AFP-participating companies is currently (1999) estimated at 60%. Since the proportion covered has been growing, these figures seem to be quite consistent with each other.

3 Constructing the Data-set

3.1 Data sources

The basis for the analysis is register files held by Statistics Norway. The files are all based on a personal identification number that allows linking of files with different kinds of information and covering different periods in time.

The data that was available was imperfect in that we didn't have all relevant vintages of all the different register files. For the file containing demographic variables, for example, only the 1993-vintage was available. This means that if someone included in our study dies in 1994 or 1995, then the individual's death will not be directly observable to us. In the case of death, of course, there are repercussions on the other files. For one thing, corpses do not need to bother with tax returns. In other cases, the information we lose is more difficult to deduce from what we have. For instance if an identified couple decides to get a divorce.

Also, not all individuals alive in the population were included in the register files. The files contained all individuals from (and including) age 16 up to (and including) age 69. Since this study concerned itself with couples where both spouses could be identified from the 1993 register-files, this means that couples where the non-eligible spouse was born earlier than 1924 were "invisible" and would not be included in our sample. However, as can be seen from table 3.1 below, a female more than fifty years old married to a male several years her junior is rather more unusual than the opposite case, so this should not be considered a big data-problem. On the other hand, it does restrict the possible types of observations, although it is difficult to come up with a precise estimate of this problem's magnitude. One way of estimating it roughly is to look at conditional (on the husband's age) distributions of the wives' ages. Assuming the proportion of "invisible" females married to men in the 55-59 age bracket to be negligible, and assuming the conditional distribution of the wives' ages to be the same in the next two rows of the table, we can use this "men 55-59" row of the table to calculate as follows:

The proportion of the couples where the husband is between 65 and 70 years made "invisible" by the wife's age is

$$\frac{3720+462}{48+652+10757+30411+25760+3720+462} \approx 0,058$$

Proportion where the husband is between 60 and 65 years made "invisible" by the wife's age is

$$\frac{462}{48+652+10757+30411+25760+3720+462} \approx 0,006$$

Table 3-1 Two-way age distribution of couples where at least one spouse is 55 or older.

		Age of female in couple						
		20	30	40	50	55	60	65
Age of male in couple	20	0	0	0	0	0	0	0
	30	0	0	0	0	28	4	0
	40	0	0	0	0	740	98	20
	50	0	0	0	0	4148	401	74
	55	48	652	10757	30411	25760	3720	462
	60	18	211	2633	9186	28247	25459	4762
	65	9	70	780	2308	9068	27220	25258

The fact that our register files only contained those within a specific age-span, does, however, have further effects: Since people age, the actual individuals who happen to be in the 16-69 year age range are not constant (those turning 69 in 1993 turn 70 in 1994 and are thus not included in the register files for 1994, and so on). This means that a female spouse of age 68 in 1993 whose husband becomes eligible in 1994, cannot be observed in any of the data files in 1995. Since the females we actually did observe in few cases changed their labour market behaviour, since the individuals we are here talking about are beyond the normal retirement age, and since, as we have seen, most wives are their husband's junior, this problem, too, seems of little importance.

With these general caveats we can turn to the different data sources used. The variables used in the model are defined in detail in chapter 3.2.4, but they were all constructed in some way from the information described here.

Demographic variables

Vintage available: 1993 only.
Information:

- Date of birth
- Gender
- Marital status and the identification number of spouse
- Educational qualifications

From the labour market authorities

Vintages available: 1992, 1993, 1994, 1995

Information:

- Start and stop dates for any periods of registered unemployment
- As reported by employer:
    - Start and stop dates for spells of employment, with identification of employer
    - Job-type (Full-/Part-time)
    - Industry

It should be mentioned that there are no strong incentives for exact and timely updating by the employer of this information. The stop dates for spells of employment, for instance, are often left to run to the end of the year, even when a work relationship terminated in the first half of the year. Also, it seems that the job-type is reported accurately when the work relationship is first registered, but that later changes are often not reported at all.

Also, this file is created by Statistics Norway by matching work records from two sources. Only if they are able to make this match will a work record appear in this file. Other files with the unmatched records (from both sources) are available, but the matched ones are more reliable and a lot of "strange" records in the other files would require a lot of work to weed out.

Finally, whenever these matched work records were used, all observations with recordings of 0 in wages earned and all observations of one or two day duration were removed. These are typically payments of "feriepenger" ("holiday money").

From the tax-files

Vintages available: 1992, 1993, 1994, 1995

Information:

- Wage-earnings
- Earnings from other sources

From the social security authorities

The information from this source came in three different types of files.

From one of them came:

- The complete series of earned pension points since 1967 (up to and including 1995)

From another came:

- Start dates in 1993, 1994 and 1995 for early retirement with information on whether the individual received private or public pension

From the third file (vintages available: 1992, 1993, 1994, 1995):

- Received benefits from the early retirement scheme

3.2 Construction of the data set

We wanted a data set containing all couples such that the husband became eligible for early retirement under the AFP scheme during either 1993 or 1994, while the wife did not become so eligible. The couples were to be classified according to which state the husband chose (Immediate (early) Retirement, Delayed (early) Retirement, Full Time Work or Part Time Work) and which state the wife chose (Full Time Work, Part Time Work, Out of Labour Force). For each state, we wanted to calculate a potential income resulting from the choice of that state. We also wanted to know what initial states the individuals inhabited, and to include various assorted variables with information of interest.

We had files, for most purposes, covering the period 1992-1995. The 1992 files were used to identify AFP companies and observe the values of different variables for the year prior to eligibility for those eligible in 1993. The 1995 files were used to observe those individuals becoming eligible in 1994 for at least one year after becoming eligible. This left us with the individuals becoming eligible in 1993 and 1994, covering (because of the lowered age requirements October 1 1993) three birth cohorts: 1928 –1930. Figure 3.1 shows the birth date of the individuals on one axis and the years we could observe them on the other axis. As can be seen, the longest "post-eligibility" observational window occurs for those born early 1928. These individuals become eligible in the beginning of 1993, and can be observed over three years (though they reach 67, qualifying for normal public pension, in the last of these years). There is a jump in October 1993, when the age requirement was lowered and all those born between October 1928 and October 1929 were plunged into eligibility. These can all be observed for two years and three months after their eligibility. Finally, those born late 1930 can be observed only over one year. To make the different observations equivalent, the states we constructed only took into consideration the events occurring in the first twelve months following an individual's eligibility.

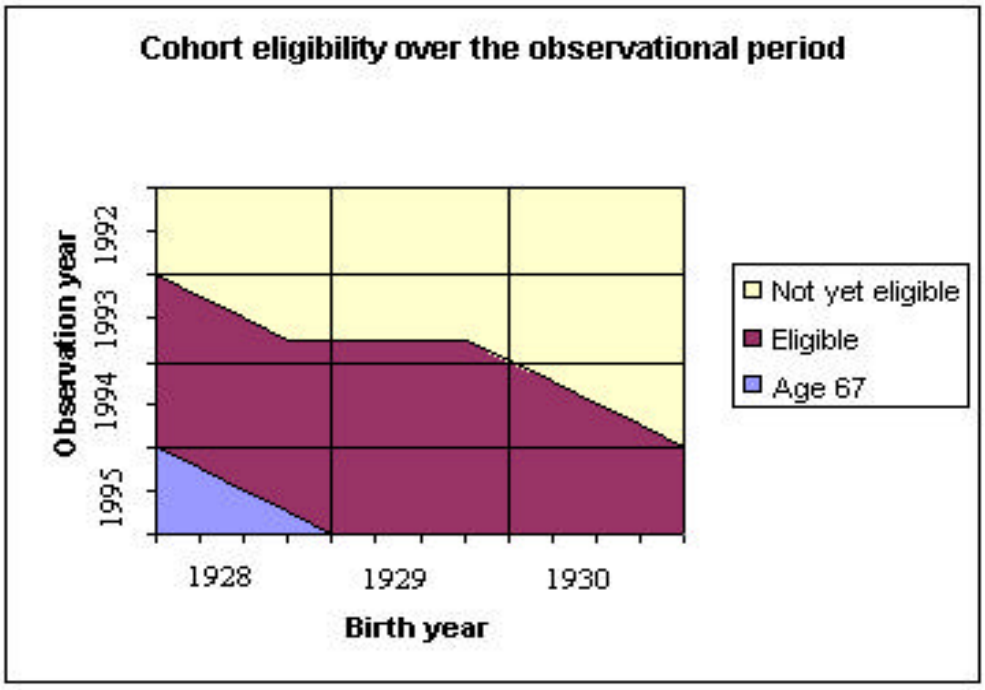

Figure 3-1

Because we only took into consideration the events occurring during the first twelve months after the eligibility date of the individual, and since the individuals usually become eligible the month after their birth-month, this means that some individuals will be followed from January one year to January the next, while others will be followed from June to June or August to August. This introduces a problem when it comes to classification into states, since the dating on the register files we use is not always perfect. The dating on the take-up dates of AFP retirement are thought to be quite reliable and seem reasonable when checked against our calculated eligibility dates (see chapter 4.2). However, the work-records are a different matter. The dating here is rather shoddy, so what we did was merely to check whether an individual had a work record the year he became eligible, and if so, whether this job was registered as part time or full time (as noted above, changes occurring in work status are probably not well reported). Constructing monthly records using the dating in the register files may be attempted in a follow up study, but was not felt to be a promising avenue in this round.

The distinction between person-year and calendar-year also complicated the precise observation of states. If an individual A becomes eligible in February 1993 and

refrains from taking out early retirement, it would make sense to look at his work records for 1993 to see what job he held the year after he became eligible. But if an individual B becomes eligible in November 1993 and refrains from early retirement take out, it would perhaps make more sense to look at the 1994 vintage of his work records. Since elderly workers seem to be quite stable in their labour market attachment, we chose to look at the work records of the year they became eligible. Using the "post-eligibility" vintage seemed to require a lot of preparatory work before it would be useful, since disability pensions and/or other phenomena complicated matters. Sometimes people would even disappear from the files all together. A lot of these "strange" individuals were thrown out at later stages, but to simplify matters we used the "eligibility year" vintage for identification of part-time/full-time work states.

3.2.1 Identifying firms participating in the AFP-scheme

In my opinion it is a bit surprising and blameworthy that no records have been kept detailing which firms joined the scheme, and when they did. The AFP-scheme changed the economic incentives confronting elderly workers, and one would have thought that *especially* the people who were behind the scheme would be interested in the effects resulting from the change. Yet, only in 1995 was work on records of this nature initiated, and then only detailing changes from that point.

We therefore had to construct a list of companies in a somewhat roundabout way:

Any individual retiring early under the AFP scheme would have to have been previously employed by a company participating in the scheme. The companies can therefore be identified by identifying the previous employers of identified AFP recipients.

This was done by creating a list of individuals registered as recipients of early retirement benefits, without having been so registered in the previous year, in one of the years 1993-1995. We then looked at the work-records of these individuals for the year immediately prior to their early retirement. If there was more than one work-

record in the previous year, we discarded the observation rather then attempt to guess which of the work-records had spawned the early retirement payments. Since multiple work-records are relatively rare for these elderly individuals, this was a minor problem. If there was only one work-record, this provided the number identifying the employer.

Obviously, there are shortcomings to this method. Not all individuals eligible for early retirement decide to retire early. Even if we assume that all eligible individuals are equally likely to take out early retirement, this means that small companies are less likely to be identified as participating in the AFP-scheme with our identification procedure. If a high proportion of the eligible individuals are employed in small companies, this means that our sample will be skewed. To illustrate with an extreme example: Suppose that all firms employed exactly one eligible person. Only the firms where a person decides to take out AFP will be observed. Furthermore, when we, at a later stage, make a list of eligible individuals, only the individuals employed in the identified AFP-participating firms will be included. And, of course, all of these would be observed as taking out early retirement. No matter what the real take-out rate was, the one we would observe would be 100%.

Added to this, it may be the case that the probabilities of take-out differ with the kind of company one is employed in. For instance, in a small company workers may be more vary of how their retirement will influence the company, whose workers and bosses they know personally, than would be the case in a large company.

There is little we can do to rectify this problem. We could exclude all firms under a certain size (and this is a solution we plan to attempt in a later study), but this would reduce the scope of the sample and the generality of any findings. Of course, if the results from the sample with a broader scope are biased by the identification procedure, this reduced sample might still be preferable.

It is difficult to know how problematic the identification bias is. We might gain some feel for the probable magnitude of the problem by using some simple probability maths. Assuming a uniform take-up probability of about 30%, the magnitude of which is not of unreasonable size empirically, the probability of a small firm not being

observed is 70% if it has a single eligible employee, falling to less than 50% if it has two, 35% if it has three, and so on. This means that, even if there are only a few eligible employees, say four or five, chances are about 80% that we will identify the company.

Also, as mentioned above, the proportion of the work force with a work record in one of our identified AFP companies seems to concur well with the official number.

Another problem with our identification procedure is that what we identify in this way is companies, not firms (cf. comment on this distinction above on p. 17), and we assume, when creating a list of eligible individuals, that all firms in a company where at least one firm participates in the AFP-scheme, participate in the AFP-scheme. Though a company may be comprised of several firms, and though not all firms in a single company necessarily have to introduce the early retirement scheme in concert, the conditions where this ”common-policy” assumption does not hold are rather particular and the rule holds as an approximation.

Another problem which should be mentioned concerns the “when” of the AFP-scheme participation. Since we observe firms when someone eligible decides to take out early retirement, we are unable to determine with any precision the time at which a company began participating in the AFP-scheme. We have therefore made the simplifying assumption that any company observed with a take-out with our procedure, participated in the AFP-scheme in both 1993 and 1994.

3.2.2 Identifying individuals eligible for early retirement under the AFP-scheme

To identify eligible individuals, we begun by identifying all individuals who had at least one work-record in one of the early retirement identified companies in at least one of the years 1993-1995. We then proceeded to remove, from these, those failing, in *both* 1993 *and* 1994, to meet those of the individual requirements that we were able to implement.

The individual criteria we were able to implement were:

Age

Since we had the birth-year of all individuals, this was easily accomplished.

Work- and earnings-history

- *Earnings at least equal to the basic pension in the year before*

  To implement this we simply looked at the number of pension points earned the year before. If these were 0, then earnings were too low.

- *The mean of the best ten years of earnings since 1967 were at least twice the basic pension*

  Implemented by using the pension points series.

- *In at least 10 years since the age of fifty, the individual should have had earnings of at least the basic pension*

  Implemented by demanding nonzero pension points earned in at least ten of the years since the year the individual turned fifty.

- *Employed in the company the last 3 years, or employed in another company also operating the AFP scheme last 5 years.*

  This criterion was more difficult to implement. What we ended up doing was as follows:

  To be included in the set we were working on at this stage, an individual had to have had a work-record with an AFP company in one of the three years. The identification number of that employer was "remembered". If a person had a work record with several AFP companies only one of the companies was remembered, and which of them it was was selected arbitrarily. Finally: To be viewed as AFP-eligible in a year (T), the individual had to have a work record with the company that was "remembered," the year before, i.e. (T-1). Since multiple work records are relatively rare in this age group, and since it would also have to be the case that the other record was in an AFP company, *and* that it was this other, not "remembered", company that the individual was employed in the year before he became eligible, this implementation shouldn't introduce too many false negatives. We might have a case or two where a company, because of a merger or for some other reason, change their identification number, but all in all, I would think that false

positives might be a bigger problem with our procedure. However, since the employees we are looking at have relatively stable jobs and work-records, the number of false positives shouldn't be too large either.

The second thing we did to implement this criterion was removing those with a spell of unemployment at some time in the period 1992-95.

We were unable to implement the criteria that earnings should be equal to at least basic pension in the year of eligibility, since only realised earnings can be observed in our data-material, and the dating of the work-records as reported by employers was not considered reliable, thus making it difficult to use wages received for employment in part of a year for estimating a "potential" annual wage for that year. Neither were we able to implement the criteria stating that the individual should not receive pensions or other payments not requiring work effort in return.

For every eligible individual we recorded the date from which they became eligible. In most cases, this was the month after their birthday in the year they began fulfilling the age requirement. In some cases, though, their work-history was insufficient and only became sufficient to qualify them the year after. In that case, they were recorded as eligible from the January the year in question. To simplify calculation, dates were converted to a decimal number, so that October 1974, for instance, became 74 + 10/12.

3.2.3 Creating the sample.

Our sample was to include couples where the husband was eligible for early retirement under the AFP scheme in at least one of the years 1993, 1994, and where the wife was not eligible for early retirement under the AFP-scheme in any of these years. To create a list of the husbands in the sample from the list of AFP-eligible individuals, we removed:

- Females
- Those not "reciprocally married" to an identified person. Either because they were
  - Not married
  - Registered as married, but missing the identification number of a spouse

- Registered as married, but the identification number of their spouse was not found in the register files (dead, too old or other)
- Not ”reciprocally married” (Individual A registered as married to B, but B registered as married to C or to no-one at all)

3.2.4 The Variables

To this set of men and their identified wives we affixed information on wage earnings, types of job (full-/part-time, industry, private/public), age, educational level, pension-rights and work history, as well as state inhabited by individual, and, for those who took out AFP, time waited from eligibility to take-out.

Variables referring to the year of eligibility refer to the year of the husband's eligibility in the case of the wives.

The "main work relationship" referred to, is the work record with the highest basis for payroll tax of the records in the highest employment category (4-19 hours per week, 20- 29 hours per week, 30+) the individual had the year prior to eligibility.

The variables attached to each individual were as follows:

age: Age in the year of eligibility.

dkjonn – A dummy for Gender.

serv – A dummy for whether or not the person worked in the service sector. This dummy provided only a very rough indication. The industry-classification is hierarchic in the sense that the first digit provides a first, rough classification, the second digit provides a classification within these first categories and so on. Our service dummy was created using one of the first digit categories, which meant that it included workers clearly a part of the service sector, such as teachers and administrative workers in state and municipal offices, but also workers who in some ways are more similar to those working in other sectors, for instance auto-mechanics

and cleaning staff. However, it was still felt that it provided a rough indication of the type of work involved.

edu – Educational level, with five levels.

- Missing
- "Folkeskole" (Seven years of compulsory schooling)
- Secondary schooling (short)
- Secondary schooling (completed)
- Higher education

This variable was transformed by the estimation program into four dummies.

elig93 – Dummy. Eligibility year 1993? Yes or no.

elig94 – Dummy. Eligibility year 1994? Yes or no:

inclig2 – Wage income in the year of eligibility, from the tax files.

incprv2 – Wage income in the year prior to eligibility, from the tax files.

inc94 and inc95 – Wage income for 1994 and 1995, from the tax files.

workyrs – Number of years in which the pension points earned were different from zero (i.e. where the income was higher than the basic pension).

workhrs - categorization based on the main work record year before eligibility. Part time (4-29 hours per week) and Full Time (30+ hours per week).

down – A work history variable constructed from the series of pension points, counting the number of years in which the pension points earned were below the pension points earned the year immediately before.

priv – Dummy, separating firms into those in the public and those in the private sector. This separation was necessary because the type of pensions an employee is eligible for varies according to the type of company he is employed in, as detailed above. From the social security authorities, we had a list of early retirement start-dates in 1993-1995, and whether these recipients had received a private or public pension. We then found their work records for the previous year, threw out (for this purpose, not from the sample) those with more than one work-record, and classified the companies of the remaining individuals according to the type of pension these workers went on to receive. Whatever pension type the majority of those who had worked in any given company went on to receive, determined the classification of the company, and thus the type of pension those working in the company and AFP-eligible were eligible for. This was necessary because some of those working in the public sector will not fulfill the criteria necessary to qualify for the more generous government pension, and in the private sector, those who have previously worked in the public sector for a period of time long enough to qualify for the government pension will qualify for government pension. Also, in all cases where someone qualifies for the government pension, he will only receive this if it is larger than the public.

endpnt – The rules for calculating endpoints were detailed above. We opted for a somewhat rough implementation of these rules. A more detailed implementation is planned in the continuation of the work.

To calculate endpoints, we simply made a list of the best twenty years of earned pension points. If a person had less than twenty non-zero years, the "remaining" years were given the value zero. The endpoints were set as the mean of these. The rules for overcompensation and for calculation of FPP were not used. However, the rules for pension in married couples and the rules for "minimum pension" were fully implemented.

state - There were five states, all in all. Two were possible states for both husbands and wives, two possible only for the men, and one possible only for the women.

Since the different classification criteria were not, in themselves, mutually exclusive, the categorisation was made in a sequence. Only if you didn't fit into the first category were you checked for the second. Only if not the second, the third, and so on.

The following classification-criteria were used for the men, i.e. for all (and every) eligible individuals in our sample:

Immediate Retirement: If the waiting time (time from eligibility to take-out) was less than two months (that is, if it was 0 or 1 month). A few individuals were observed with negative waiting times, probably revealing the fact that the implementation of eligibility criteria and the records of the take up dates were both imperfect. These individuals were classified as immediate retirement, but their low number means that their inclusion or exclusion would not affect the estimation much in any case.

Delayed Retirement: If the individual waited two months or more (up to 11).

Full Time Work: If the person, in the eligibility year, is observed with a job classified as 30+ hours a week, the classification is 'full time worker.'

Part Time Work: If the person, in the eligibility year, is observed with a job classified as between four and 29 hours a week.

Choosing which year to check for full-time/part-time work status was problematic, since we only trust the work-records to be correctly dated on years, not on months and days (cf. comments above on p. 20). We used the work record from the year the man became eligible for AFP retirement. A few of the individuals not observed taking out retirement were not found with a work record either, and were ejected from the set. This could be because they had a job that Statistics Norway had been unable to match from the two data sources used to create the work record file. It could also be that they had gone on some other type of pension or died.

Since the wives of the eligible men necessarily (due to the way our sample was constructed) were non-eligible for early retirement under the AFP scheme, the two

retirement categories were non-applicable. Instead they had three possible states: Full Time Work, Part Time Work, and Out of Labour Force, where out of labour force included everyone not in full or part-time work.

It turned out that some of the women thus classified as Out of the Labour Force were observed with wage income in the tax files. Since they actually were missing from the (matched) work records file (i.e. it wasn't the result of a programming error), this might mean that their jobs would be found in one or both of the files with unmatched work records. However, since the number was quite small, the classification as Out of Labour Force was kept for these individuals.

Two variables applying to the couple:

Agediff Age difference between husband and wife.

frstyear Dummy for whether husband qualified in 1993 or 1994

3.2.5 Destination States and Economic Attributes in the Alternatives

Initially, the eligible individuals (husbands) find themselves in one of two states: Full Time Work, or Part Time Work. The non-eligible individuals (wives) find themselves in one of three states: Full Time Work, Part Time Work, or Out of Labour Force.

The destination states for those who qualify are set out in Tables 3-2 and 3-3 below, which include also the principles for pre-tax economic characterisation of the states. Those taking out early retirement were divided in two, immediate and delayed, a distinction suggested by the sharp drop in AFP take-up after the first months (see chapter 4.2). We also include a state for part-time work. The procedures for calculating before-tax income are described below.

Table 3-2 Classification of men's states

Destination state	Classification principles for destination state		Principles for pre-tax potential income over next 12 months	Frequency observed in our sample
	Waiting time between eligibility and start of AFP	Weekly hours worked		
1.FT work	More than 12 months (including no AFP)	30 or more (in the job held in the year eligibility occurs	Predicted earnings, see below	5358
2. Part-time work	More than 12 months (including no AFP)	4-29 (in the job held in the year eligibility occurs)	Predicted earnings (see below)	635
3. Delayed retirement	2-12 months	-	6 months earnings (see below) followed by 6 months pension	1500
4. Immediate retirement	0-1 months	-	Predicted pension (see below)	1170

Table 3-3 Classification of women's states

Destination state	Classification principles for destination state	Principles for pre-tax potential income over next 12 months	Frequency observed in our sample
	Weekly hours worked		
1.FT work	30 or more (in the job held in the year eligibility occurs	Predicted earnings, see below	1934
2. Part-time work	4-29 (in the job held in the year eligibility occurs)	Predicted earnings, see below	2659
5. Out of labor force		Benefits	4070

3.2.5.1 Full-time Work and Part-time Work

Potential earnings the twelve months following the husband's eligibility was estimated in two different ways.

Observed and predicted

Initially, all males are in either Full Time or Part Time Work, while females may be in either of these or Out of the Labour Force. Some individuals will choose to continue inhabiting the state they are in. In that case their potential income in that state for the twelve months following the husband's eligibility is estimated by the income we observe to be earned in the calendar year the husband became eligible. If an individual becomes eligible in January, this means that we estimate his income by the (to him unknown) income he actually did earn the next twelve months, as if he forecasted this perfectly. If an individual becomes eligible in December, we estimate his income for the next twelve months by the income in the past year, as if he expects to continue earning the same as he did this year. For the work state other than the initial state, we use the results from the income regression described below for estimation. Potential income in the immediate retirement state is calculated from the work history as described below, and in the delayed retirement state we calculated half the income from the initial state alternative and half the income from the immediate retirement state alternative.

Predicted

For those individuals who do not continue in their initial state, their income in both work states is estimated with the results from the income regression. Analogously with above, potential income in the immediate retirement state is calculated from the work history, and in the delayed retirement state we calculated half the income from the initial state alternative and half the income from the immediate retirement state alternative.

The income regressions function

Gross annual labour income, r_s, s=M,F, if working full-time or part-time is predicted from the estimated annual income function given below:

(13) $$\ln r_s = X_s\lambda_s + \tau_s \text{ where } s = M, F$$

where τ_s is a normal distributed error term. The covariates entering the X-vector are:

1) Working full time=1, Working part-time=0,
2) Age,
3) Education, with 15 years of education or more as a reference category, otherwise three categories: less than 8 years of education, less than 10 years of education, less than 15 years of education,
4) Working in private sector=1, =0 otherwise,
5) Number of years before the observation period with less than full-time work.

We observe that the income function is allowed to differ across gender and that annual gross income as a part-timer is measured as an impact of a covariate on income. Full Time Work is defined to be equal to 46x37.5 hours a year, while part-time work is the half of this working load.

The reward from continued work is assumed to be only earnings. It is conceivable that an individual could accrue rights to a higher public pension by working one or two more years, but the conditions that would have to hold are rather restrictive.

3.2.5.2 Immediate Retirement

Potential pension was calculated as follows:

For those entitled to the public pension, the endpoints calculated in the data set (see chapter 3.2.4) were used, and forty years of pension points earned were assumed.

For those entitled to the government pension, the key variable is present wage-level. Those working in what we identified as the public sector were assumed to have been working there for a period of time long enough to qualify them for this pension scheme. Furthermore, there is an age-requirement, in that AFP retirees qualifying for the government pension receive the ordinary public pension until age 65, at which time they begin receiving the (more generous) government pension.

The fact that the pensions calculated are not total pensions (which include private and employer based pensions), but are strongly correlated with total pensions, may cause a problem in that income from different sources is treated in the same way in the utility function used in the models estimated. To illustrate, suppose there was a perfect linear correlation: Each NOK in public pension meant that the person had also received one NOK in private and employer based pensions. Thus, each NOK included as income in our retirement states would actually represent two. I am not certain how this would affect estimation results. My guess is that it might influence the weight given to leisure, though this is just based on an intuitive guess.

3.2.5.3 Delayed Retirement

Based on the observed take-up profile, we predict 6 more months of work and 6 months of retirement within the year we are modeling. Again, since that year is not a calendar year, and thus does not coincide completely with the tax year, this is an approximation.

3.2.5.4 *Out of Labour Force*

Wife's income when she is out the labour force is zero.

3.2.5.5 Additional comments

<u>After-tax income (“consumption”)</u>

After estimating the gross incomes described above, a detailed implementation of tax rules was conducted, described in detail in an accompanying paper (Haugen, F (1999)).

Second year income

Income in the different states was also calculated for the second year after AFP eligibility. Except in the case of those whose age allowed them to receive the government pension in the second year but not in the first, these incomes were assumed to be the same as in the first year, before tax. However, the changes taking place in the tax regime were implemented, leading to differences in after-tax disposable income.

3.2.6 Imposing requirements on estimated potential income in states

Before estimation was run we also imposed the requirement that

Full Time Workers, $r \geq 140000$
Part Time Workers $r \geq 50000$

where r is gross wage earnings.

Couples where this was not the case were ejected from the sample. Since the earnings were estimated in two different ways, this led to two slightly different samples.

4 The Sample

During the course of the project we ran analyses on several different samples, but the basic set, which the others were subsets of, is presented here.

4.1 Sample size and distribution over states

The sample size was 6142, which means we had information on 12284 individuals. Tables 4-1 and 4-2 display the distribution of the men and women over the states chosen. Diagram 4-1 below displays the two-way distribution of the couples over the states.

Table 4-1 Distribution of men over states

State	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
Full Time Work	3853	62,7	3853	62,7
Part Time Work	467	7,6	4320	70,3
Immediate Retirement	785	12,8	5105	83,1
Delayed Retirement	1037	16,9	6142	100

Table 4-2 Distribution of women over states

State	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
Full Time Work	1677	27,3	1677	27,3
Part Time Work	2015	32,8	3692	60,1
Out of Labour Force	2450	39,9	6142	100

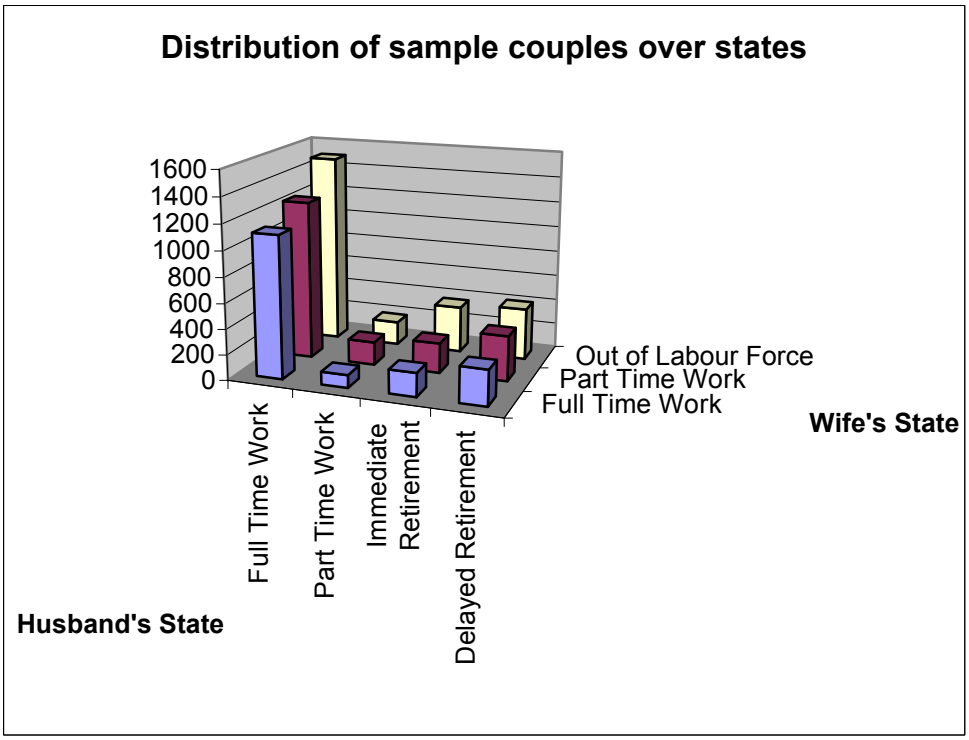

Figure 4-1

4.2 The AFP take-up profile

The take-up date for early retirement is constructed from a new database (FDTrygd). The total take-up rate for the sample when using a one-year cut-off point is 29,7% If we do not use the one-year cut-off point we are only able to use some of the observations, since the period of time we can observe an individual varies with his eligibility date (see figure 3-1 and accompanying text). Using a one-and-a-half year cut-off point on those observations observed for this long brings the take-up rate up to 37%. Using a two year cut-off point brings it up to 39,2%. The rather sharp increase in the take-up rate when extending the window from one to one and a half years is probably due to a combination of two things: The "untidy" cohort thrust into eligibility with the change in the age-requirements (see figure 4-3 below), and the "birthday effect" discussed below.

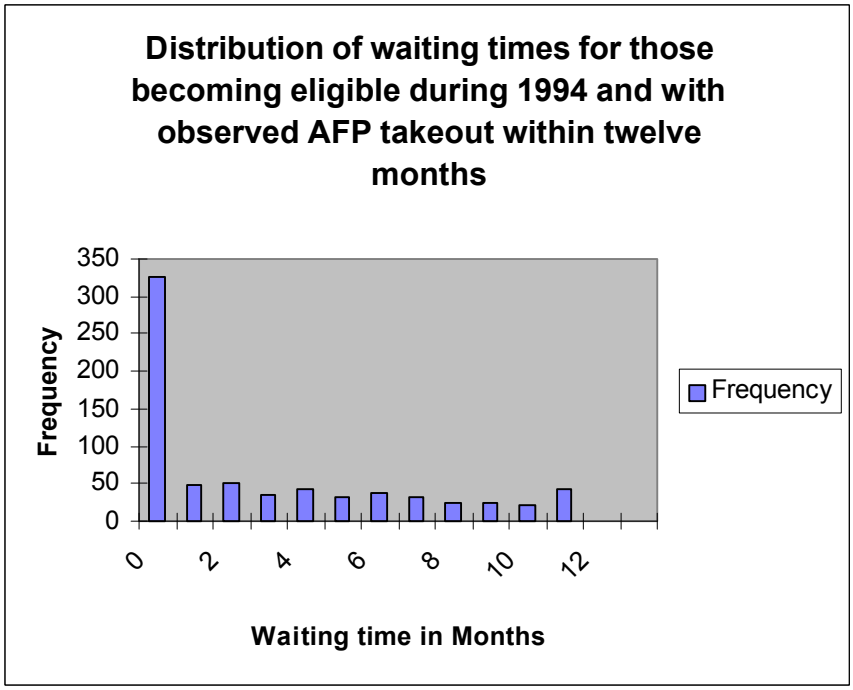

Figure 4-2

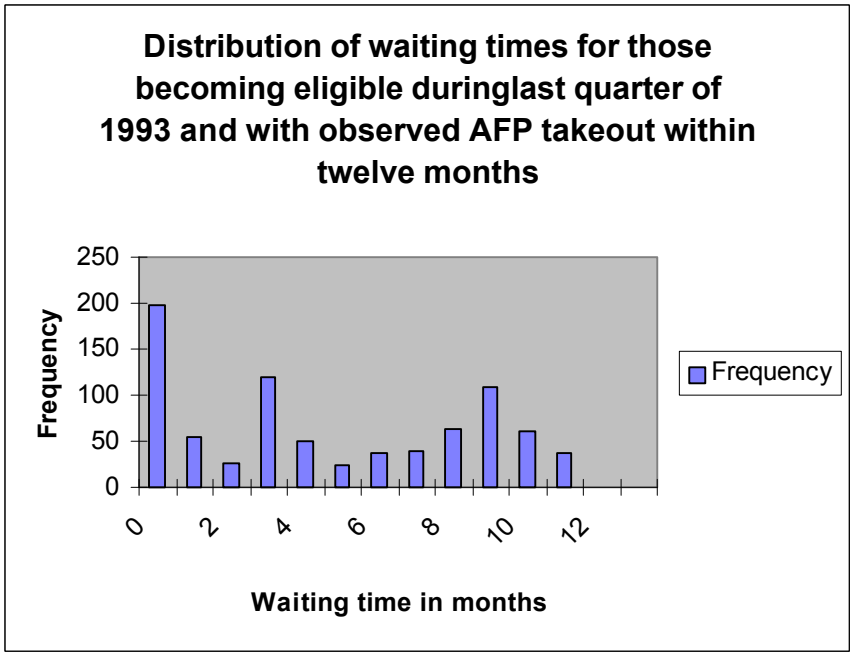

Figure 4-3

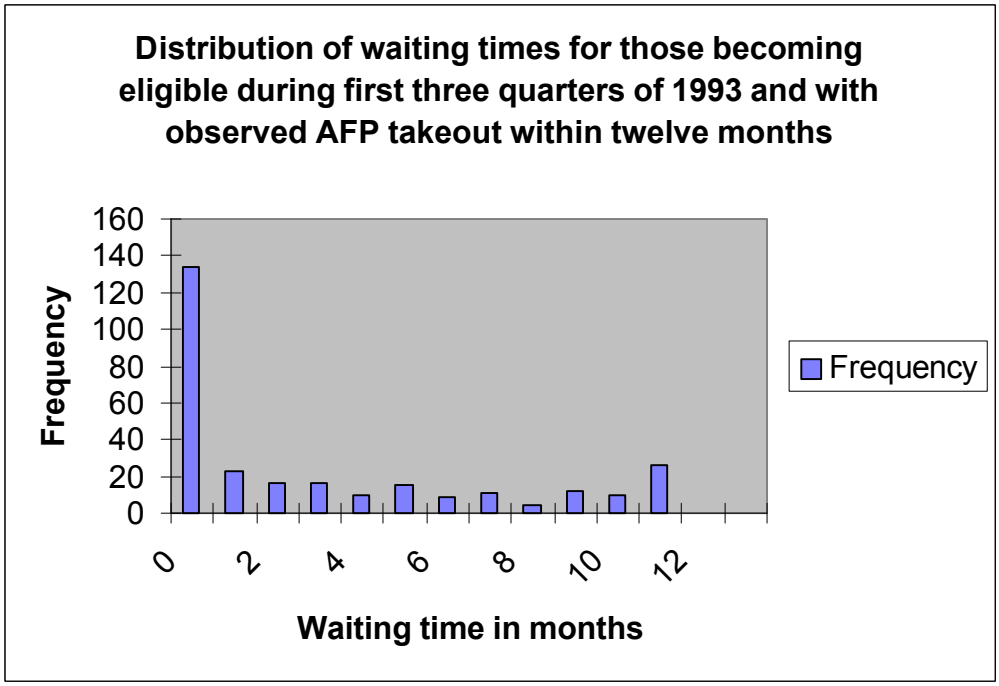

Figure 4-4

Figures 4-1, 4-2 and 4-3 show the distribution of waiting times for those observed with AFP-takeout within twelve months of becoming eligible. Both the panel for those turning eligible during the first three quarters of 1993 and the panel for those turning eligible in 1994 show a sharp drop after the first couple of months. This seems to be the most "common" pattern. The reason for the more jumbled picture in the middle panel is probably the change in the age-requirements. In October 1993 the age requirement was dropped from 65 to 64, which meant that a whole cohort became eligible all at once. It could be argued that these individuals had had less time to plan and ponder the decision of whether or not to retire, and that this is the reason for the change.

Apart from this middle panel, the graphs shown seem to show a sharp drop after the first month, and then a permanently lower rate. However, if we extend the observation window a little, it turns out that there is something which at first sight seems to be an anomaly. There is a second peak exactly one year after eligibility. Two things seem particularly worth mentioning about this: It is stronger after the change in age-requirements in October 1993, and it is stronger among those employed in the public

sector. This can be illustrated with the following waiting time distributions from an earlier sample which was somewhat wider than the sample actually used. The first diagram shows the distribution for those eligible during the first three quarters of 1993.

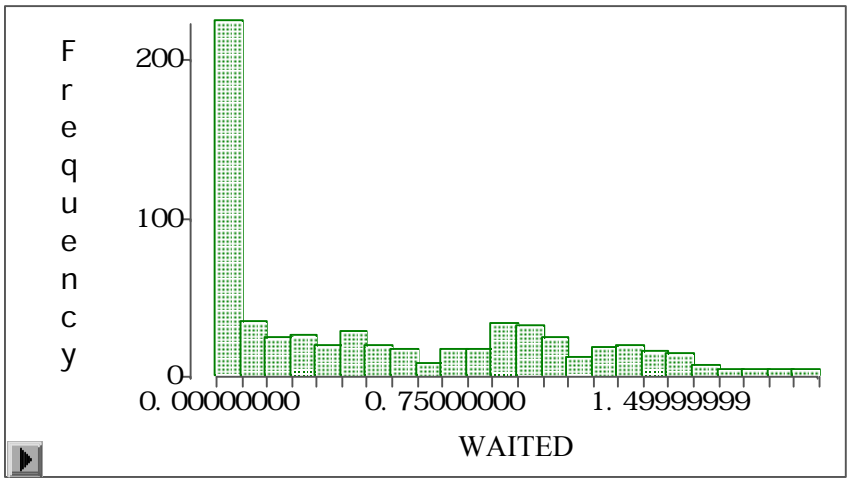

Figure 4-5 Distribution of waiting times in years for those qualifying in first three quarters of 1993 and observed taking out AFP

As can be seen, there is a slight hump around one year after the original eligibility date. This can be contrasted with the next diagram, which shows the distribution for those qualifying in 1994. Since these people could qualify for AFP at any point in time in 1994, while we observe them only until the end of 1995, the tail of the distribution should probably be a bit thicker, but even so, there is a clear second peak.

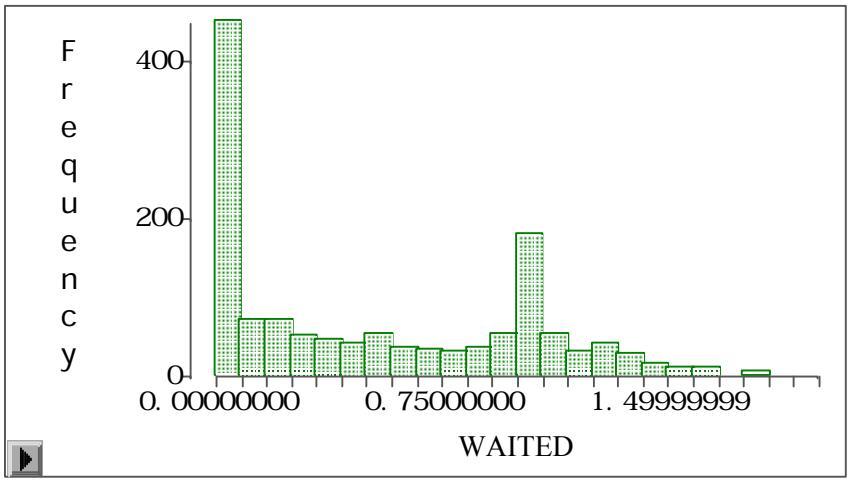

Figure 4-6 Distribution of waiting times in years for those qualifying in 1994 and observed taking out AFP

As for the second distinction, between those in the public and those in the private sector, the following is the distribution of those in the private sector becoming eligible in 1995:

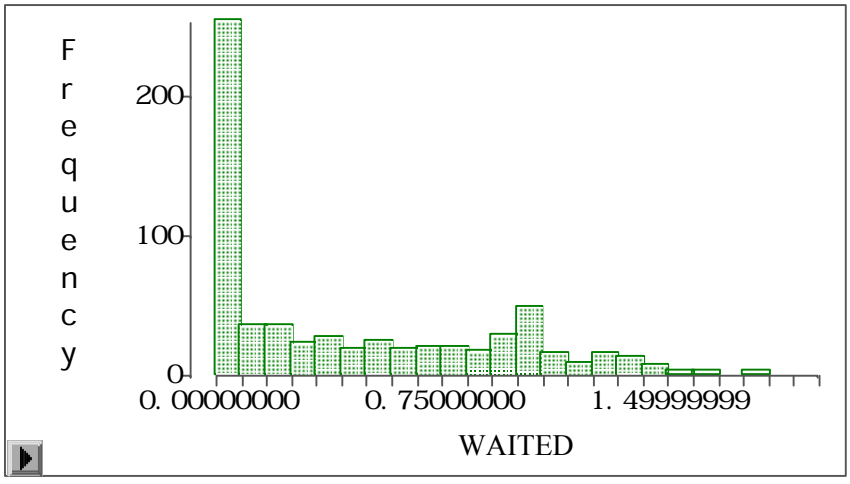

Figure 4-7 Distribution of waiting times in years for those in private sector qualifying in 1995 and observed taking out AFP

While the distribution for those in the public sector becoming eligible in 1995 with its more prominent peak is as follows:

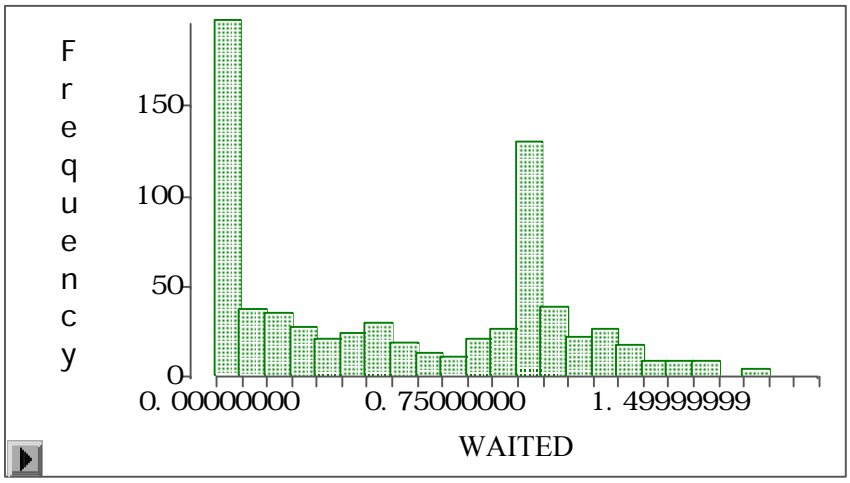

Figure 4-8 Distribution of waiting times in years for those in public sector qualifying in 1995 and observed taking out AFP

The reasons for this effect, which one could call the "birthday effect" since it seems to take place quite exactly twelve months after eligibility, may be a result of several factors:

- For individuals who are in the public sector and who qualify for the more generous public pension type, the public pension does not begin to take effect until age 65. If they take out early retirement from age 64, they therefore receive public pensions until they turn 65, at which point they begin to receive the government pension. Thus, retiring at 64 means they will have to endure a sharper dip in 'income the first year of their retirement', then would be the case if they waited a year. Factors such as liquidity constraints and myopia may combine to make this problematic.

  As shown, the "birthday effect" does seem a lot more marked for those in public companies than it does for those in private, though a small remnant of the effect remains for those in private companies. This may be because our procedure for the classification of companies into private and public is imperfect. However, the remaining effect may also be an indication that this is a compound phenomenon.
- Another, more psychological, reason for the birthday effect, may be that some individuals use special occasions such as their birthday or the coming of a new year as an occasion for implementing major, planned changes, perhaps as a

personal strategy against procrastination or as a way of making an already special day take on added significance.

4.3 Wages and other income

Since there is a difference between the calendar year and the "year following eligibility", we are unable to measure accurately the income distribution in the previous or next twelve months for those continuing to work. The following figures show the wage-income distribution for those in the sample, for the calendar year before the year they became eligible for AFP and for the calendar year they became eligible in.

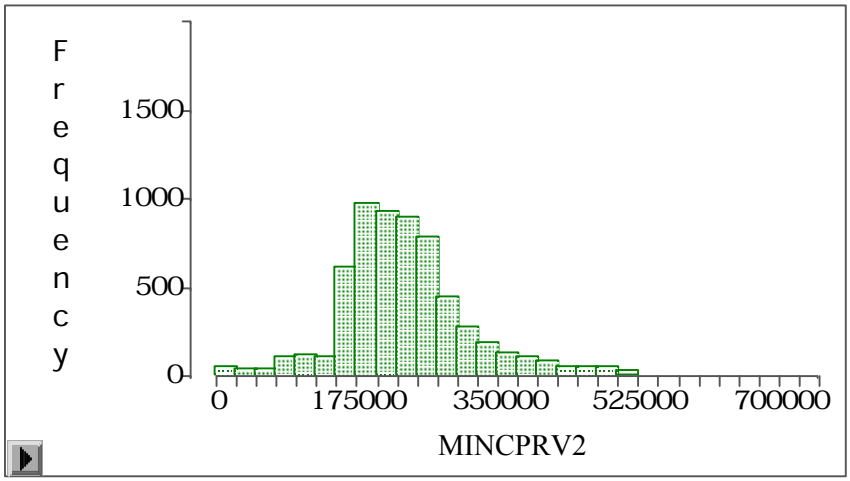

Figure 4-9 Male income year before year of eligibility

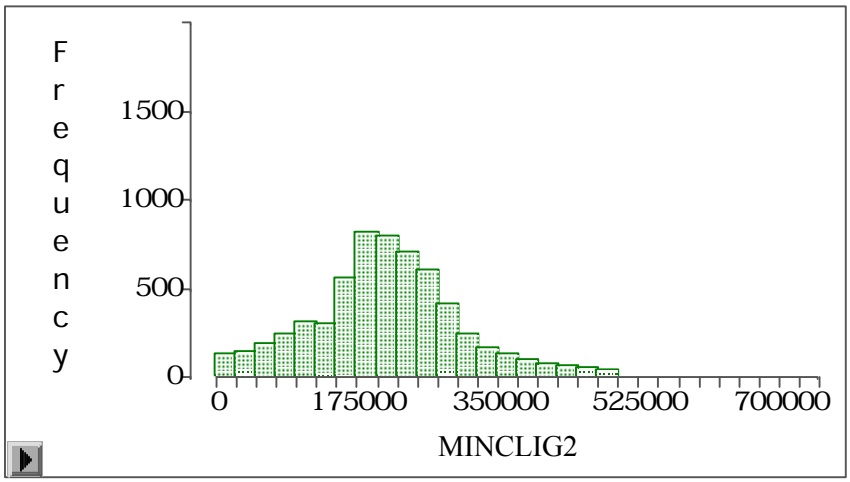

Figure 4-10 Male income year of eligibility

As can be seen, the distribution for the year in which they became eligible (which, for some individuals, was 1993, and, for others, 1994) has a thicker tail on the left side. An individual becoming eligible in January 1993 and taking out AFP in, for instance, March, would earn wages in only two of the twelve months. He would thus be placed in the lower part of the distribution. On the other hand, there will be people taking out early retirement in the later parts of the year, or not at all in this calendar year, who will have earned income from a full year's employment.

Similar distributions for the females gives the wage distributions in the year before the year their husband became eligible and the year he became eligible.

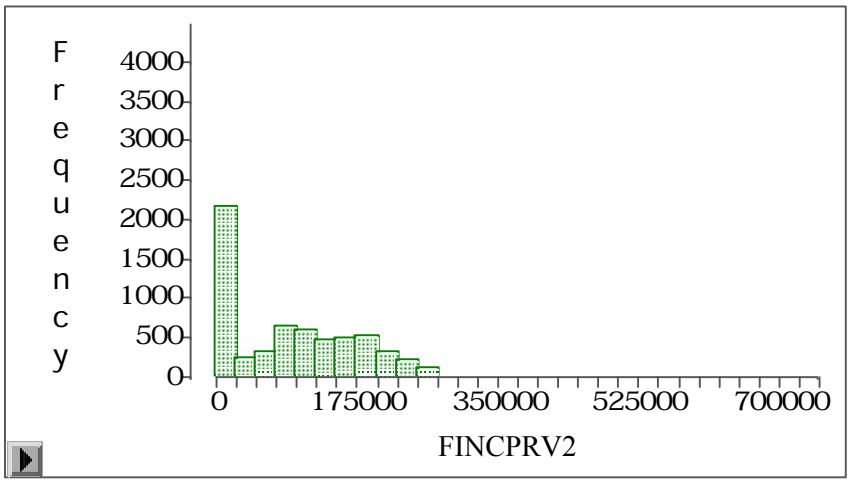

Figure 4-11 Female income year before year of husband's eligibility

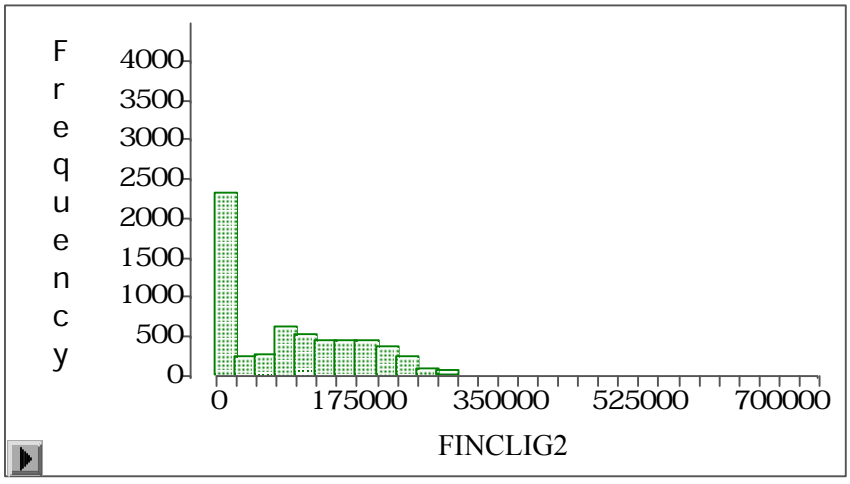

Figure 4-12 Female income year of husband's eligibility

As can be seen, these have a high proportion of zero or very low incomes, due to the number of wives who were out of the labour force.

Splitting the sample into two groups, according to whether the husband continued working or took out early retirement, gives us the following figures for average earnings split into its different components. These figures show quite clearly that taking out early retirement reduces the average total income, but that the pension component expands to take up the loss of wage income.

That the husband receives pensions in the couples where he is not observed taking out Early Retirement pension may be due to several factors. In the "year after eligibility" it may be because he takes out Early Retirement, but more than twelve months after he became eligible. Also, the "pensions" category in the tax files contains more than old age pensions and early retirement pensions. Some people may receive disability payments, others may stop working. Our procedures make sure that the individuals are observed with a work record the year they become eligible, but if they stop working, for instance because of illness, during the year, this may not be enough to have them thrown out of the sample as it would be difficult to observe.

(It should be mentioned that the average pension income for year before husband became eligible is based on a smaller sample than the other components for this and the other years are. This is because the pension income was not included in the register file from the tax authorities in the 1992 vintage. Thus, the only "pension income in the year before husband's eligibility" that was observable was for those in couples where the man qualified in 1994.)

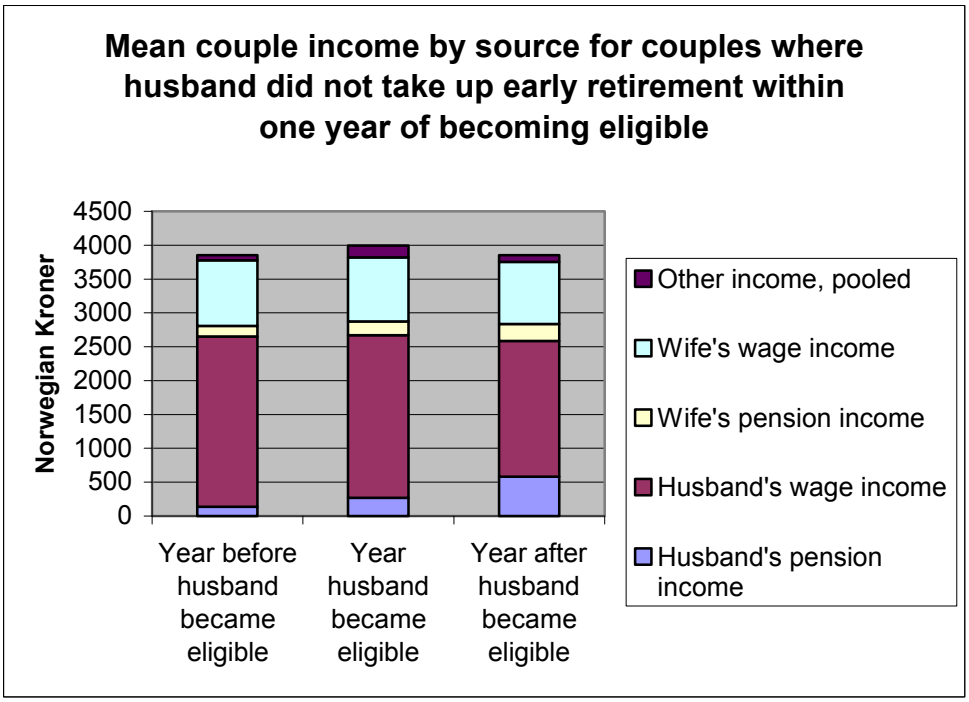

Figure 4-13

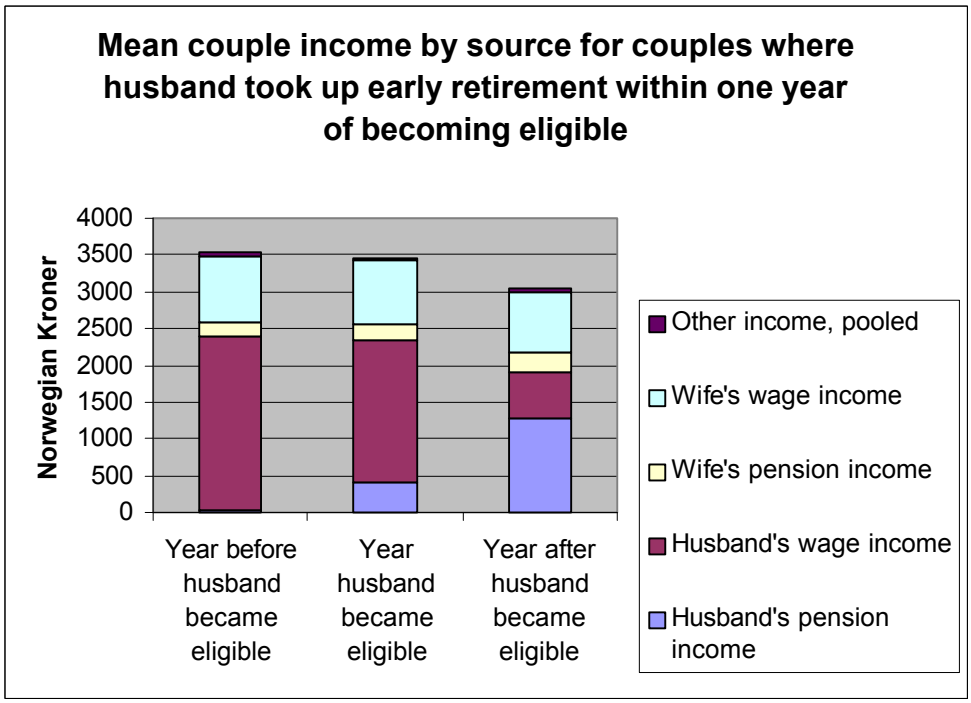

Figure 4-14

Finally, there is the empirical question of whether people could improve their pensions by continuing to work instead of taking out Early Retirement. The rules were

described above (see page 16), but depend on the difference between the pension points one would actually have earned had one continued working, and the pension points one is given under the AFP scheme for the years spent in early retirement. The following figures show us the distribution of the differences in pension points earned from one year to the other. The sample used is not the exact same one used in the final analysis, but an earlier one containing some additional individuals later thrown out.

As can be seen, the improvements are rather small, and most people continue earning approximately the same points.

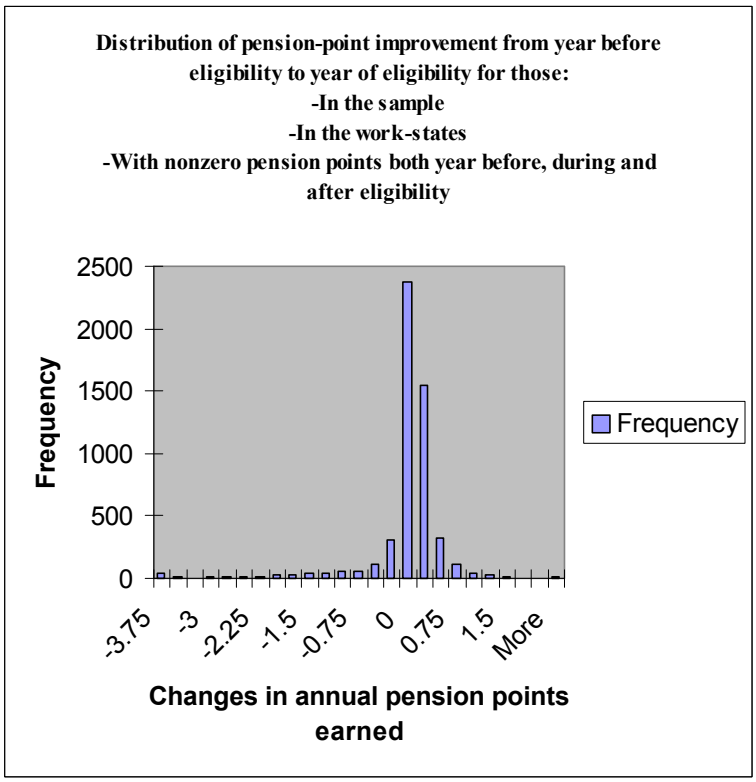

Figure 4-15

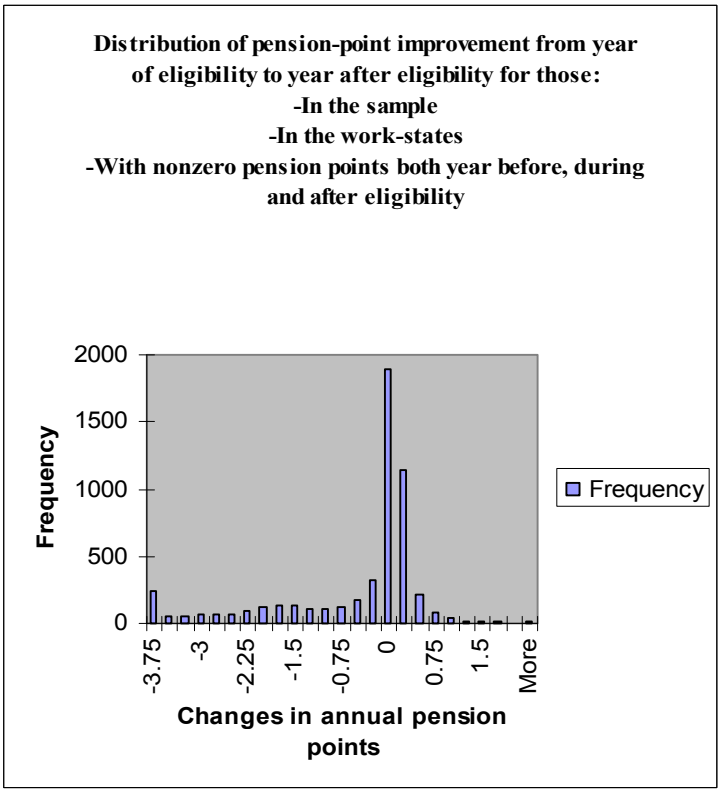

Figure 4-16

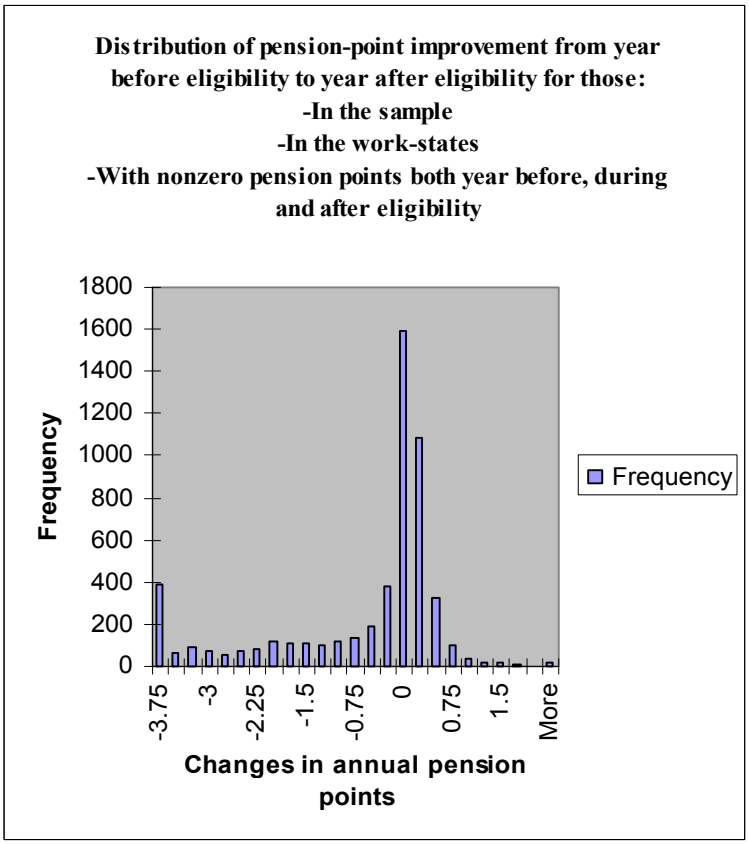

Figure 4-17

4.4 Variables and descriptive statistics

The following is a table containing all the variables used and descriptive statistics. The estimated potential income in the different states is given by the last fortyeight variables. C12 is income (wage income estimated using the income regression) in year of husband's eligibility when the husband is in state one and the wife in state 2 and so on. Cx12 is the same for the calendar year after the husband's eligibility.

The digit 2 in front of a variable indicates that it comes from the dataset using observed and predicted income. Only the variables actually used in the estimation of the model are repeated for this sample.

Table 4-3

Variable-name	*No. of observations*	*Minimum value*	*Maximum value*	*Mean*	*Std. error*
MINC94	6142	0	1351200	182425.7	1713.82
MINC95	6142	0	1533400	121113.4	1788.3
MAGE	6142	64	67	64.41745	0.007167
MWORKYRS	6142	10	27	26.20677	0.013719
MENDPNT	6142	0.952924	8.328125	5.67557	0.018124
MDOWN	6142	0	19	11.28395	0.037126
MELIG93	6142	0	1	0.610876	0.006222
MELIG94	6142	0	1	0.389124	0.006222
MNONELIG	6142	0	0	0	0
MEDU	6142	0	4	2.812113	0.014187
MINCLIG2	6142	0	1338300	221689.2	1437.97
MINCPRV2	6142	0	1355500	241856.1	1266.73
MSTATE	6142	1	4	1.838164	0.015122
FINC94	6142	0	509100	88948.21	1129.32
FINC95	6142	0	581900	85242.28	1149.86
FAGE	6142	24	68	59.70775	0.056948
FWORKYRS	6142	0	27	15.95002	0.106671
FENDPNT	6142	0	8.328125	1.890925	0.020269
FDOWN	6142	0	18	6.482091	0.048729
FELIG93	6142	0	0	0	0
FELIG94	6142	0	0	0	0
FNONELIG	6142	1	1	1	0
FEDU	6142	0	4	2.531586	0.011112
FINCLIG2	6140	0	509100	90944.74	1112.05
FINCPRV2	6142	0	535800	93338.29	1083.48
FSTATE	6142	1	5	2.923641	0.022139
FRSTYEAR	6142	0	1	0.610876	0.006222

AGEDIFF	6142	-4	40	4.709704	0.056809
MPRIV	6142	0	1	0.401172	0.006255
FPRIV	6142	0	1	0.609899	0.006224
MFULLTME	6142	0	1	0.917942	0.003502
FFULLTME	6142	0	1	0.288994	0.005784
MPARTTME	6142	0	1	0.082058	0.003502
FPARTTME	6142	0	1	0.34435	0.006063
MSERVICE	6142	0	1	0.470042	0.006369
FSERVICE	6142	0	1	0.413383	0.006284
C11	6142	216061.4	448606.1	283744.6	532.4355
C12	6142	159609.5	393887.3	229211.8	505.5477
C15	6142	110807.2	292031.1	160336.1	428.6502
C21	6142	154098.5	310865.8	203336.8	413.4795
C22	6142	97865.2	258681.1	148804	387.5008
C25	6142	49062.88	154290.7	79928.27	290.635
C31	6142	158683.8	350094.5	250718.8	354.15
C32	6142	105757.6	303365.9	196185.9	333.7363
C35	6142	59438	200845.6	133294.9	221.7935
C41	6142	209960.1	391669.5	272982.9	366.4048
C42	6142	153508.1	350204.8	218450.1	341.2892
C45	6142	108467.4	234562.5	151826.3	249.3057
CX11	6142	216633.5	450007.1	284458.6	535.7473
CX12	6142	159944.8	395188.3	229720.5	507.9254
CX15	6142	111030.4	292884.1	160770.6	431.247
CX21	6142	154574.5	311581.8	203768	414.7689
CX22	6142	98201.2	259297.1	149029.8	387.7058
CX25	6142	49286.88	154458.7	80079.99	290.8587
CX31	6142	180402	362087	264490.8	378.7977
CX32	6142	127430.1	319969.4	209752.7	357.2687
CX35	6142	74157	205346.3	146595.4	252.5169
CX41	6142	207445.8	398318.9	278914.9	384.973
CX42	6142	152050.8	351230.4	224176.8	358.5237
CX45	6142	119352.8	245581.5	157916.1	263.8731
2C11	5529	211384.8	578760.5	294165.4	629.1136
2C12	5529	112102.8	456904	238955.2	628.8738
2C15	5529	108610.6	409073.9	170892.1	542.907
2C21	5529	149598.3	448460.7	206618.3	490.3535
2C22	5529	54978.66	404420.4	151408.1	502.0938
2C25	5529	42915.33	309582.8	83344.98	391.4247
2C31	5529	158679.5	462646.1	251624.3	426.1668
2C32	5529	78820.25	367964.7	196606.7	436.2903
2C35	5529	59438	330442.8	134198.8	289.9703
2C41	5529	191777.2	522227.3	277883.6	461.7908
2C42	5529	127026.9	415206.1	222740.9	471.0583
2C45	5529	98429.35	378687.1	156872.9	354.9041
2CX11	5529	211610.8	580714.5	294963	633.1849
2CX12	5529	112153.2	458858	239540.4	631.9319
2CX15	5529	108862.6	410379.9	171413.9	546.4332
2CX21	5529	149921.4	450141.7	207062.5	492.2163
2CX22	5529	55202.66	405721.4	151639.9	502.9369
2CX25	5529	43027.33	310235.8	83513.42	392.5419
2CX31	5529	180397.8	481205.9	265790.3	449.1863
2CX32	5529	99417	385221.1	210546.9	456.7564
2CX35	5529	74157	361409.3	147878.5	317.5611
2CX41	5529	200318.9	531162.4	284076.7	480.6349

2CX42	5529	116040.4	423566.7	228725.3	487.1917
2CX45	5529	104724.7	375552.7	163174.4	369.806
2MEDU	5529	0	4	2.791102	0.015012
2FEDU	5529	0	4	2.498282	0.011936
2MAGE	5529	64	66	64.40441	0.007471
2FAGE	5529	24	68	59.73558	0.059259
2MSTATE	5529	1	4	1.901067	0.016336
2FSTATE	5529	1	5	2.92675	0.023237
2MPRIV	5529	0	1	0.396998	0.006581
2FPRIV	5529	0	1	0.602279	0.006583
2FRSTYEAR	5529	0	1	0.604811	0.006576
2AGEDIFF	5529	-4	40	4.668837	0.059037
2MSERVICE	5529	0	1	0.47694	0.006718
2FSERVICE	5529	0	1	0.418521	0.006635

5 The Model

5.1 Simplifying the problem

The retirement decision can be analysed using the standard microeconomic apparatus and viewing the agents as constrained maximisers, but the optimisation problem turns out to be a highly complex one due to the size of the choice set and the introduction of time and uncertainty.

Take the choice set. The retirement decision is not just a question of whether or not to retire, but also a question of timing. Working is not just a question of working or not working, but of how much to work. The complete characteristics of the different elements in the choice set are not known with certainty making them difficult to compare. Working full time for yet another year may in some cases change the pension level received at retirement, in particular if working in the public sector. Retiring now may make it harder to get a job next year should wages be raised more than expected and make a job next year preferable to pension next year. Illness may strike making it impossible to work no matter what one initially decided to do. The different choices all have uncertain consequences in the future. There are the usual problems arising from risk and possible time-inconsistency in the preferences of the choosing individual.

The problem can be simplified in one respect by taking account of some empirical findings in labour economics. According to Haugen, Hernæs, et al (1999), the labour supply literature demonstrates that there are not always jobs available with a continuum of working hours, and that people are rationed with respect to offered hours in the market. Thus, in our model, we assume that people face a set of discrete alternatives, Full Time Work, Part Time Work, and no work at all.

The problem can be simplified further. For instance, in our case, retirement was made an absorbing state, although, in reality, it is possible to start working again after having retired early under the AFP-scheme. Empirically, however, this is a rare occurrence. We also assume that the job options and job earnings available are constant and do not change. Thus, the major change in the situation facing our agents is that they become eligible for early retirement. The problem of timing was simplified in two ways: We only consider whether or not the individual retires within one year of becoming eligible. As explained above (chapter 4.2), the take-out rate does not really peter out at this time, but the sharp peak right after eligibility means that the majority of those deciding to take out AFP decide to do so within this time. The peak drops sharply after the first month, and as a result of this we also decided to split retirement into immediate and delayed retirement, defined as follows:

Immediate retirement includes those retiring within the first two months possible (month 0 or month 1), **delayed** includes those retiring from the beginning of month 2 to the end of month 11 after eligibility.

The pensions received after age 67 are assumed to be the same whether or not you retired early. As explained above (see page 16), this is usually the case, although there may be exceptions.

With these simplifications, the problem is reduced to finding the best way of traversing the years remaining until retirement, and the available paths are different only up to the age of 67. Also, our model only looks at the choice of paths in the first 12 months after eligibility, and the number of choices open are (depending on initial state) three or four. The dynamic aspect enters because our absorption assumption means that the retirement option reduces the options available for choice next year.

Our assumptions also imply that a full time worker choosing to work part time is unable to reverse this decision next year, although we don't have data enabling us to accurately observe such transitions and this property of the part time state is not an important part of the model in any case.

5.2 Presentation of the model

The unit of analysis is the household (couple), and the arguments in the deterministic part of their joint utility function are consumption (i.e. after-tax income) and leisure. We define the following symbols:

C_{ij} = Consumption of a couple where the man is in state i and the woman in state j, equal to household disposable income. For details on the construction of these values, see chapter 3.2.5

L_{Mi} = The man's leisure when in state i

L_{Fj} = The women's leisure when in state j

Let $V_{ij} = \mu(c_{ij}, L_{Mi}, L_{Fj}) + \sigma e_{ij}$ be the utility associated with period t when the male chooses state i and the female state j. $\mu(.)$ is the deterministic part, e_{ij} is an extreme value distributed iid random variable capturing variables known to the households but unobservable for the analyst, and σ is the standard deviation of e_{ij}

The econometric model attempts to analyse the labour supply of these couples during the 12 months following the husband's eligibility for AFP early retirement. Since different males have different eligibility dates the observation period will vary across the couples. We denote the observation period by t and the twelve months following it by t+1.

In period t the couple choose a state i for the man and a state j for the woman. Because retirement is an absorbing state, this choice determines the options i available

for choice in period t+1. The possible values the subscripts i and j can have in the different periods, and their interpretation, are set out in tables 5-1, 5-2 and 5-3.

Table 5-1 Possible male states in t, the first year after AFP-eligibility

Male state i	*State*
1	Full Time Work
2	Part Time Work
3	Immediate Retirement
4	Delayed Retirement

Table 5-2 Possible male states in t+1, the second year after AFP-eligibility

Male State in period t	*Male state i*	*State*
i=1 Full Time Work	1	Full Time Work
or	2	Part Time Work
i=2 Part Time Work	4	Delayed Retirement
i=3 Immediate Retirement		
or	4	Delayed Retirement
i=4 Delayed Retirement		

Table 5-3 Possible female states, irrespective of year or choice made by husband

Female state j	*State*
1	Full Time Work
2	Part Time Work
5	Out of Labour Force

The model has two versions, henceforth called Model A and Model B.

The difference between the two is that the individuals in Model A only take into consideration the values of the states the first year after eligibility, while in Model B, the individuals take into consideration that the choices made in the first year has consequences for the male's choice set the next year.

Note that although terms for both periods are included in Model B, the model does not attempt to explain choices made in the second period. We are only attempting to model the choice made in period t.

Intuitively the difference between these two models can be explained with the following rough analogy: Individuals from the two models are about to go on a three day long hike in the mountains. The individuals in model A, when deciding on the first day hike, would choose the paths that in and of themselves were the most pleasant and optimal in terms of scenery along the way, strenuousness and so on. The individuals in model B would judge the pleasantness of each possible path in the same way, but they would also take into consideration how pleasant and nice the best second day hike possible from each of the possible first day end points would be.

5.2.1 Model A

Let $v_{ij} = \psi(c_{ij}, L_{Mi}, L_{Fj}) / s$

This means that the size of the coefficients in ψ are non-identifiable, while the marginal rates of substitutions are identifiable since the standard deviation term here can be canceled out. Thus both the first and second derivatives of the deterministic part of the utility function present in the model which will be estimated depends on σ. The reason why is of course that we are only able to estimate an ordinal utility function, and hence the marginal utility of consumption and the marginal utilities of leisure cannot be recovered from the data that we use.

We let π_{ij} denote the choice probabilities. The functional form of these probabilities follows from the assumption that the stochastic part, of the utility function is extreme value distributed.

$$\pi_{ij}^{A} = \frac{e^{v_{ij}(t)}}{\sum_{k=1,2,3,4} \sum_{s=1,2,5} e^{v_{ks}(t)}}$$; i=1,2,3,4 j=1,2,5 ; t indicates the first year

5.2.2 Model B

In this model the individuals take into consideration the options available in period t+1 conditioned on the choice made in period t.

1) Given that the man has chosen i=1,2 the first year, the available options for the couple in the second year are

i=1,2,3
j=1,2,5

with the value realizations $\{V_{11}(t+1), V_{12}(t+1), ..., V_{35}(t+1)\}$

Let

$$Y^{1,2}(t+1) = \max\{V_{11}(t+1), V_{12}(t+1), ..., V_{35}(t+1)\}$$

Then, since V_{ij} are assumed to be extreme value distributed, we get

$$EY^{1,2}(t+1) = \ln[\sum_{k=1,2,3}\sum_{s=1,2,5} e^{v_{ks}(t+1)}] \equiv \psi^{1,2}(t+1) \text{ ; i=1,2 j=1,2,5}$$

We note that state no 4, delayed retirement, is not feasible for the man in period t+1.

We define a two-period indirect utility function $W_{ij}(t)$ which is the sum of the utility associated with period t and the discounted value of the expected value of the optimal choices made by the couple in period t+1.

$$W_{ij}(t) = V_{ij}(t) + g\, EY^{1,2}(t+1) = V_{ij}(t) + g\, \psi^{1,2}(t+1) \text{ ; i=1,2 j=1,2,5}$$

where $g = \frac{1}{1+r}$ and where r is the interest rate.

2) Given that the man has chosen state 3 or 4 the first year, the available options for the couple in the second year are i=3, j=1,2,5 with the value realizations $\{V_{31}(t+1), V_{32}(t+1), V_{35}(t+1)\}$

Let $Y^{3,4}(t+1) = \max\{V_{31}(t+1), V_{32}(t+1), V_{35}(t+1)\}$

and we get the result, analogously with case 1), that $W_{ij}(t) = V_{ij}(t) + g\,\psi^{3,4}(t+1)$ for i=3,4 j=1,2,5

$$\psi^{3,4}(t+1) = \ln[\sum_{s=1,2,5} e^{v_{3s}(t+1)}]$$

This means that for the choices in the first year, period t, we now have:

For i=1,2 and j=1,2,5

$$W_{it} = V_{ij}(t) + g\,\psi^{1,2}(t+1) = v_{ij}(t) + g\,\psi^{1,2}(t+1) + e_{ij}(t) \equiv w_{ij}(t) + e_{ij}(t)$$

For i=3,4 and j=1,2,5

$$W_{it} = V_{ij}(t) + g\,\psi^{3,4}(t+1) = v_{ij}(t) + g\,\psi^{3,4}(t+1) + e_{ij}(t) \equiv w_{ij}(t) + e_{ij}(t)$$

In the first year the couple chooses the states that maximise $W_{ij}(t)$, i.e.

$$\max[W_{11}(t),...,W_{31}(t),...,W_{45}(t)]$$

Again, with extreme value distributed stochastic parts of the utility function we get the following choice probabilities, denoted j_{ij}^{B}

$$j_{ij}^{B} = \frac{e^{w_{ij}(t)}}{\sum_{k=1,2,3,4}\sum_{s=1,2,5} e^{w_{ks}(t)}}\ ;\ \text{i=1,2,3,4 j=1,2,5}$$

where

$w_{ij}(t) = v_{ij}(t) + g\,\psi^{1,2}(t+1)$ for i=1,2 j=1,2,5

$w_{ij}(t) = v_{ij}(t) + g\,\psi^{3,4}(t+1)$ for i=3,4 j=1,2,5

$$\psi^{1,2}(t) = \ln[\sum_{k=1,2,3}\sum_{s=1,2,5} e^{v_{ks}(t+1)}]$$

$$\psi^{3,4}(t) = \ln[\sum_{s=1,2,5} e^{v_{3s}(t+1)}]$$

Since

$$\psi^{1,2}(t+1) = \ln[\sum_{k=1,2,3}\sum_{s=1,2,5} e^{v_{ks}(t+1)}]$$

and since we have $e^{w_{ij}}$ in all probabilities, then

$$e^{g\ln[\sum_{k=1,2,3}\sum_{s=1,2,5} e^{v_{ks}(t+1)}]} = [\sum_{k=1,2,3}\sum_{s=1,2,5} e^{v_{ks}(t+1)}]^g .$$

Thus, let

$$y_{1,2} = [\sum_{k=1,2,3}\sum_{s=1,2,5} e^{v_{ks}(t+1)}].$$

Likewise $y_{3,4} = [\sum_{s=1,2,5} e^{v_{3s}(t+1)}]$

By dividing both numerator and denominator with $y_{1,2}^g$ we get

$$j_{ij}^{B} = \frac{e^{v_{ij}(t)}}{\sum_{k=1,2}\sum_{s=1,2,5} e^{v_{ks}(t)} + (\frac{y_{3,4}}{y_{1,2}})^g \sum_{k=3,4}\sum_{s=1,2,5} e^{v_{ks}(t)}} \text{ for i=1,2 and j=1,2,5}$$

$$j_{ij}^{B} = \frac{(\frac{y_{3,4}}{y_{1,2}})^g e^{v_{ij}(t)}}{\sum_{k=1,2}\sum_{s=1,2,5} e^{v_{ks}(t)} + (\frac{y_{3,4}}{y_{1,2}})^g \sum_{k=3,4}\sum_{s=1,2,5} e^{v_{ks}(t)}} \text{ for i=3,4 and j=1,2,5}$$

We can see from this that $j_{ij}^{A} = j_{ij}^{B}$ if $y_{3,4} = y_{1,2}$

By dividing the numerator and denominator of the j_{ij}^{B} expressions with $\sum_{k=1,2,3,4}\sum_{s=1,2,5} e^{v_{ks}(t)}$ we get that

$$j_{ij}^{B} = \frac{y_{1,2}^{g} j_{ij}^{A}}{y_{1,2}^{g}\sum_{k=1,2}\sum_{s=1,2,5} j_{ks}^{A} + y_{3,4}^{g}\sum_{k=3,4}\sum_{s=1,2,5} j_{ks}^{A}} \text{ for i=1,2 and j=1,2,5}$$

$$j_{ij}^{B} = \frac{y_{3,4}^{g} j_{ij}^{A}}{y_{1,2}^{g}\sum_{k=1,2}\sum_{s=1,2,5} j_{ks}^{A} + y_{3,4}^{g}\sum_{k=3,4}\sum_{s=1,2,5} j_{ks}^{A}} \text{ for i=3,4 and j=1,2,5}$$

Note that $\sum_{k=1,2}\sum_{s=1,2,5} j_{ks}^{A} + \sum_{k=3,4}\sum_{s=1,2,5} j_{ks}^{A} = 1$

$$j_{ij}^{B} = \frac{y_{1,2}^{g} j_{ij}^{A}}{y_{1,2}^{g}\sum_{k=1,2}\sum_{s=1,2,5} j_{ks}^{A} + y_{3,4}^{g}\sum_{k=3,4}\sum_{s=1,2,5} j_{ks}^{A}} \text{ for i=1,2 and j=1,2,5}$$

$$j_{ij}^{B} = \frac{y_{3,4}^{g} j_{ij}^{A}}{y_{1,2}^{g}\sum_{k=1,2}\sum_{s=1,2,5} j_{ks}^{A} + y_{3,4}^{g}\sum_{k=3,4}\sum_{s=1,2,5} j_{ks}^{A}} \text{ for i=3,4 and j=1,2,5}$$

Note that $\sum_{k=1,2}\sum_{s=1,2,5} j_{ks}^{A} + \sum_{k=3,4}\sum_{s=1,2,5} j_{ks}^{A} = 1$

The interpretation of these two expressions is that the numerators express the expected value of choosing the states i, j given that the i-choice has repercussions on the choice set in the next period.

Since we have assumed that the individuals know all the terms that are random to the analyst, the option terms are driven by deterministic comparisons between the outcomes of retirement and working one period.

5.3 Estimation of the models

Using the service sector dummy, the sample was split in two before estimation was run resulting in two sample groups characterised by:

1) Male in service sector
2) Male not in service sector

To estimate the model we had to specify the deterministic part of the utility function and to determine the values of alternative-specific covariates in states not occupied by the individuals.

5.3.1 Determining the covariates

The estimation of the different values of $C_{ij}(t)$, after-tax disposable income when the male is in state i and the female in state j, was described in chapter 3.2.5.

$C_{ij} = r_i + r_j - T(r_i, r_j)$; r_k=gross income; k=i,j

Because of the income requirements imposed on the sample, as described in chapter 3.2.6, we will necessarily have that

$1000000 \geq r_i + r_j \geq 100000$

C_{ij} was calculated at t and t+1 for all i and j. Because of details in the taxation rules, the budget set is non-convex and its characteristics vary substantially across households.

The leisure terms were specified as follows:

$L_{sk} = 1 - \frac{h_{sk}}{8760}$; s=M, F k=i,j

h_{sk} =37,5*46 for k=1

h_{sk} =37,5*23 for k=2 and 3

h_{sk} =0 for k=4 and 5

5.3.2 Specifying the deterministic part of the utility function

Finally, the deterministic part of the utility function was specified as

$v_{ij}(t)= \alpha \ln C_{ij}(t)+\beta_1 \ln L_{Mi}(t)+\beta_2 \ln L_{Fj}(t)+\beta_3 \ln[(L_{Mi}(t)+L_{Fj}(t))/2]$

and we note that $e^{v_{ij}(t)} = v_{ij}(t)^*$, given below

$$v_{ij}(t)^* = (C_{ij}(t))^a [L_{Mi}(t)]^{b_1} [L_{Fj}(t)]^{b_2} [\frac{L_{Mi}(t) + L_{Fj}(t)}{2}]^{b_3}$$

The utility is therefore, as far as we can observe, a function of disposable income, individual leisure for the two spouses, and common leisure. Furthermore, the value of b_3 is allowed to depend on observed covariates. We have that

$$b_3 = b_3(t) = b_{30} + a_{31}[A_M(t) - A_F(t)] + a_{32}[A_M(t) - A_F(t)]^2$$

where A_s =age, gender s,

i.e.: The value of common leisure is allowed to vary with the age difference between the spouses.

a , a_{31}, a_{32}, b_1, b_2, and b_{30} are constants to be estimated.

5.3.2.1 A comment on the "common leisure" term

The expression $\frac{L_{Mi}(t)+L_{Fj}(t)}{2}$ is interpreted as "common leisure", but it should be noted that this interpretation is not straightforward.

Arithmetically, what we have expressed is average leisure in the couple, and there is no necessary connection between this and the amount of common leisure, understood as leisure-time the two spouses can spend together. Using rough values we have that

$L_{sk} \in \{0.8, 0.9, 1\}$; s=M, F k=i,j

and with our definition a couple where one spouse works full time and one is out of the labour force or retired, have as much common leisure as a couple where both spouses are working part time. This does not seem to be an intuitive way of looking at this, though, of course, it may turn out to be correct in individual cases, for instance if the wife works Mondays, Tuesdays and Wednesdays until lunch, while the husband works after lunch Wednesdays, Thursdays and Fridays.

Another problem with the measure is that if one spouse works less, then common leisure necessarily goes up, even if the remaining spouse still works full time. This complicates interpretation of the model, as will be seen below, since the individual leisure terms will be correlated with the common leisure term.

Although what we're really interested in, the intersection of two sets of "leisure time", would require a detailed time schedule for each of the spouses, a more intuitive way to measure common leisure might be

$$L_{Common} = \min\{L_{Mi}, L_{Fj}\}$$

Here the intuition is that the common leisure cannot be larger than the leisure of the spouse with the least leisure, i.e. that the intersection of two sets of "leisure time" cannot be larger than the smallest of the sets.

On the other hand, since the individual leisure terms can only attain three different values with equal spacing between the first and the second, and the second and the third, the common leisure term used in the model can only attain five values, and it is probable that these five values will indicate to some degree the amount of common leisure the couple can achieve. Furthermore, we're mainly interested in the labour supply of the males, and since many of the wives were out of the labour force to begin with, an increase in male leisure will in fact mean an increase in the common leisure whether one uses our expression or the L_{Common} expression.

5.3.3 Model A

The coefficients $a, b_1, b_2, b_{30}, a_{31}, a_{32}$ in the choice probabilities

$$j_{ij}^{A} = \frac{v_{ij}(t)^*}{\sum_{k=1,2,3,4}\sum_{s=1,2,5} v_{ks}(t)^*} \text{ ; i=1,2,3,4 j=1,2,5}$$

were estimated by log-likelihood.

5.3.4 Model B

The coefficients $a, b_1, b_2, b_{30}, a_{31}, a_{32}, g$ in the choice probabilities

$$j_{ij}^{B} = \frac{y_{1,2}^{g} v_{ij}(t)^*}{y_{1,2}^{g}\sum_{k=1,2}\sum_{s=1,2,5} v_{ks}(t)^* + y_{3,4}^{g}\sum_{k=3,4}\sum_{s=1,2,5} v_{ks}(t)^*} \text{ for i=1,2 and j=1,2,5}$$

and

$$j_{ij}^{B} = \frac{y_{34}^{g} v_{ij}(t)^*}{y_{1,2}^{g}\sum_{k=1,2}\sum_{s=1,2,5} v_{ks}(t)^* + y_{3,4}^{g}\sum_{k=3,4}\sum_{s=1,2,5} v_{ks}(t)^*} \text{ for i=3,4 and j=1,2,5}$$

where $y_{1,2} = \sum_{k=1,2,4}\sum_{s=1,2,5} v_{ks}(t+1)^*$

and

$$y_{3,4} = \sum_{s=1,2,5} v_{4s}(t+1)^*$$

were estimated by log-likelihood.

6 Estimation results

The utility function can be written

$$\ln v_{ij}(t) = a \ln C_{ij} + b_1 L_{Mi} + b_2 L_{Fi} + b_3(\ln(\frac{L_{Mi} + L_{Fi}}{2}))$$

which, since

$$b_3 = b_{30} + a_{31}(A_M - A_F) + a_{32}(A_M - A_F)^2$$

can be written

$$\ln v_{ij}(t) = a \ln C_{ij} + b_1 L_{Mi} + b_2 L_{Fi} + [b_{30} + a_{31}(A_M - A_F) + a_{32}(A_M - A_F)^2](\ln(L_{Mi} + L_{Fi}) - \ln 2)$$

As described in chapter 3 and chapter 6, we estimated the two models on two sets of data. One using observed and predicted income, one using only predicted.

6.1 Observed and/or predicted income

In the following I present the estimation results from all eight estimations (2x2x2, models, sectors, income estimations), but since one estimates a model with a purpose

in mind, one has to ask: Which of these models should be chosen (for instance for policy simulations).

In both cases income in the different states is estimated, the difference lies in how they are estimated. This was described in chapter 3.2.5.

Comparing the methods by use of the log-likelihood of the different estimations would be erroneous: Since the data used for estimation is different in the two cases, the two log-likelihood values are not connected in any obvious way. Besides, it is the difference in the data we are concerned with, and the fit of the model to these data is a secondary matter. We don't want "bad" data even if fitting a model should then turn out to be easier than is the case with "good" data.

Both ways of doing things have advantages and disadvantages. If we use observed income the data may be more influenced by measurement error and transitory fluctuations in income. If we use predicted earnings, we will only be able to capture the variation that is linked to the covariates we observe and use in the income regression. Unobserved covariates will mean that there is permanent variation we do not capture. Besides, when constructing a regressions model we have to specify how income varies with the observable covariates. Misspecification of the model may lead to biased results. On the other hand, even if we use observed income, we still have to use the income regression for the unobserved state.

My personal opinion is further influenced by two things:

The proportion of the variation in income that the income regression function is able to explain is quite low ($R^2 \approx 0{,}11$)
The workers in question will to a large extent have jobs covered by union wage settlements (since this is a characteristic of most of the jobs covered by the AFP scheme), and the amount of transitory fluctuations is likely to be quite low.

I would therefore think that more of the "true" variation in the estimates formed by the actual individuals would be lost by using only the predicted. I would think that the estimations using observed and predicted income would be the best.

Model A

The estimation results are presented in Tables 6-11 and 6-2.

All the estimates but two have t-values of more than two in absolute value. These two more uncertain estimates are uncertain in the sense that when each single variable is viewed as if it was "added last" to the model, the probability of finding results as strong as the presented results, had the real value of the coefficients been zero, is higher for these estimates than it is for the others. However, seen as a group these variables may turn out to be "significant" in this estimation as well. It is not statistically valid to use the t-values to judge the significance of several variables at a time.

These two estimates occur in estimations A-1 and A-2, and are both connected to female individual leisure. The fact that they're both connected with leisure terms may be important, since we are trying to determine five coefficients for various leisure terms (out of a total of six coefficients). Since individual leisure, ceteris paribus, cannot change without common leisure changing, these terms should probably be viewed together and interpreted carefully. That some of them seem to be less "significant" than other coefficients may not be important if the overall picture of the effects of changing leisure is clear.

The utility of common leisure is positive, but decreases with the age difference. Because of the quadratic term in the b_3 expression the sign of the first derivative changes (from negative to positive) when the age difference becomes larger than, roughly, fifteen years. However, since the functional form of this relationship is rather uncertain and since we have a limited number of observations with age differences of this size, we should not attach too much weight to this. Also, again, interpretation of the leisure terms must be done carefully since they are somewhat interconnected.

The coefficients for consumption have the expected sign for all the estimations, while several of the leisure terms (except the two "more uncertain" estimates, female leisure in A-1 and A-2) are negative. Though this initially seems strange, there are various explanations possible.

For one thing, it could be a result of the rationing in the labour market, where one only has three choices available: Full Time, Part Time, or No Work. In such a situation, the marginal utilities of the different goods no longer have the same importance in the choice problem. As an example, consider a good X that it is vitally important to have at least some of, but where too much of it is just a nuisance. For instance, this could be the way a misogynist might think of female company or, for that matter, the way some women might think of men. However, there are only two choices available to the individual: None of the good, or too much of it (chastity or marriage). It may well be that the "too much" option is the best of these; to miss the good completely may be far worse than having to suffer an excess of it, yet this may mean that the last units of the good are a burden (i.e. negative marginal utility).

Besides, individual leisure also goes into the joint leisure term, which means that looking at individual leisure term by itself is problematic. Differentiating finds that

$$\frac{\partial v_{ij}}{\partial L_{Mi}} = \left(\frac{b_1}{L_{Mi}} + \frac{b_3}{L_{Mi} + L_{Fj}} \right) v_{ij}$$

Let $E_M = \left(\frac{\partial v_{ij}}{\partial L_{Mi}} \right) \frac{L_{Mi}}{v_{ij}}$ denote the elasticity of utility with regards to the male's leisure, and E_F analogously the elasticity of utility with regards to the female's leisure.

Furthermore, define $l_M = L_M/(L_M+L_F)$, i.e. the male's share of the leisure.

Then $l_F = 1-l_M$ is the female's share

This gives us $E_M = \beta_1 + \beta_3 l_M$ and $E_F = \beta_2 + \beta_3(1-l_M)$

Letting $a=A_M-A_F$ denote the age difference, and disregarding the small a^2 term, we then define a* as an age-difference such that when a>a*, the marginal utility of leisure becomes negative; a*(M) for males and a*(F) for females. This can be calculated for the possible values of l_M =[0.44, 0.47,0.5, 0.53,0.55], and the results differ depending on which model (A or B) we use, whether or not the husband works in the service sector, and how the income is predicted.

The values for a*(F) are without exception very large, larger than 10 (the mean value of a in the sample is 4,7, the standard deviation 0,06), the values for a*(M) are more mixed. In A1, A3 and B3 (note: all these are estimations where husband is in service sector) they're negative for all values of l_M , which means the elasticity will be negative for most of the observed couples. In A4, B1 and B4 the values for a*(M) are negative or positive depending on l_M , but in all cases a*(M) is lower than the observed mean in the sample. Finally, in A2 and B2 a*(M) is positive for all values of l_M , though in A2 these values lie below the mean of a and in B2 they all lie well above the mean of a.

Thus, a closer examination of the results show us the importance of interpreting the leisure terms carefully, as the sign on the marginal effect on utility of changing an individual's leisure depends on more than the "individual leisure" term. In several cases the sign changes for most of the observed couples when the elasticity is evaluated instead of the individual term.

Table 6-1 Estimation results for Model A using observed and predicted income

		A-1: Husband in service sector		A-2: Husband not in service sector	
Term	Coefficient	Estimate	t-value	Estimate	t-value
b_{30}	Common leisure: constant	26.97	2.16	26.20	2.67
a_{31}	Common leisure: linear	-2.26	-15.22	-1.66	-9.83
a_{32}	Common leisure: quadratic	.07	9.74	.06	5.21

a	Consumption	4.29	28.45	5.77	37.34
b_1	Male leisure	-16.23	-2.64	-10.37	-2.14
b_2	Female leisure	2.22	.340	7.45	1.46
	log-likelihood	-5212.43		-5867.33	

Table 6-2 Estimation results for model A using predicted income only

		A-3: Husband in service sector		A-4: Husband not in service sector	
Term	Coefficient	Estimate	t-value	Estimate	t-value
b_{30}	Common leisure: constant	43.66	3.73	67.94	7.42
a_{31}	Common leisure: linear	-2.09	-14.94	-1.79	-11.64
a_{32}	Common leisure: quadratic	.07	9.02	.06	5.76
a	Consumption	1.29	9.95	2.54	19.90
b_1	Male leisure	-28.82	-5.00	-35.40	-7.87
b_2	Female leisure	-14.41	-2.35	-21.98	-4.66
	log-likelihood	-6043.38		-7109.59	

6.2 Model B

This time we find seven estimates with a t-value of less than two. Again it's the leisure terms, this time the constant in the b_3 expression (in B-1, B-2 and B-3), the coefficient of male leisure (in B-1, B-2 and B-3) and the coefficient of female leisure (in B-3).

Again we find that the coefficient of consumption is positive in all of the estimations.

As for the individual leisure terms, the coefficient estimates now present a more mixed picture, but as the discussion above made clear, these results do not have a straightforward interpretation. The sign on the elasticities of utility with regards to male and female leisure was commented above for both models.

When estimating Model B, the option weight term was also estimated. When interpreting this it helps to note that $g = \frac{1}{1+r}$ so that $r = \frac{1}{g} - 1$. In other word, this is an estimate of the interest rate the individual calculates with when considering future income.

As shown in table 6-3 the estimates of r are consistently higher for those not in the service sector. This may be open for several interpretations. If education is a long term investment in human capital and education tends to be necessary to a job in the service sector, a higher r used in calculations may be part of the reason why these individuals came into the non-service sector in the first place. If the health prospects and life-expectancy of a worker in the non-service sector tends to be lower than for one in the service sector, this may be another reason for this effect (i.e. if you're going to become ill or die in the future, the prospect of future money seems less alluring). Or it may be that work in the non-service sector tends to be more physically demanding and exhausting, and that, as these individuals grow older they are "tired" of working and let the temporally distant factors count less in their decisions.

Table 6-3 Implicit estimates of r

	B-1	*B-2*	*B-3*	*B-4*
r	0,49	1,38	0,54	1,70

Table 6-4 Estimation results for model B using observed and predicted income

		B-1: Husband in service sector		B-2: Husband not in service sector	
Term	Coefficient	Estimate	t-value	Estimate	t-value
b_{30}	Common leisure: constant	-15.95	-1.32	-4.44	-.46
a_{31}	Common leisure: linear	-1.51	-12.01	-1.16	-8.05
a_{32}	Common leisure: quadratic	.05	8.38	.04	4.21
a	Consumption	4.54	31.79	5.57	38.59

b_1	Male leisure	8.09	1.36	6.31	1.34
b_2	Female leisure	23.84	3.78	21.86	4.42
g	Option weight	.67	10.58	.65	9.67
	log-likelihood	-5083.67		-5771.61	

Table 6-5 Estimation results for model B using predicted income

		B-3: Husband in service sector		B-4: Husband not in service sector	
Term	Coefficient	Estimate	t-value	Estimate	t-value
b_{30}	Common leisure: constant	11.74	1.01	45.43	4.96
a_{31}	Common leisure: linear	-1.62	-12.86	-1.40	-9.97
a_{32}	Common leisure: quadratic	.050	7.88	.042	4.76
a	Consumption	2.07	15.39	2.86	23.21
b_1	Male leisure	-9.46	-1.65	-22.66	-5.03
b_2	Female leisure	3.55	.59	-10.13	-2.15
g	Option weight	.42	9.47	.37	7.65
	log-likelihood	-5938.37		-7048.80	

6.3 Comparing the models

There is no need to choose model A or B exclusively. When performing policy simulations, for instance, there is nothing wrong with stating what the results would be with different assumptions made about the way the individuals choose. In Model A we assume that they only look at the first-year consequences of the choice they make, in Model B we assume that they also take into consideration the fact that retiring in the first year means that it becomes hard (in the model: impossible) to work the next year.

As for the estimation results, the log-likelihood is larger for Model B with all versions of the data set. However, since Model B has one variable more with which to fit itself

to the data, this is hardly surprising. The t-value of the option term is significant in all cases, indicating that, if the variable was zero, the improvement in fit that it causes in our case would be statistically unlikely. It might therefore seem that this model would be best, if one were forced to choose only one. However, I am quite aware of my shortcomings when it comes to judging econometric results of this nature. Misspecification of the model, omitted variables and the fact that we're dealing with an estimated utility function assumed to be common across the households might all be phenomena causing my comments to be misguided or just plain wrong.

References

Baker, Michael (1999): "The Retirement Behavior of Married Couples: Evidence from the Spouse's Allowance", *NBER Working paper #7138*

Blau, David M. (1998): "Labour Force Dynamics of Older Married Couples", *Journal of Labour Economics, 1998, vol. 16, no. 3: 595-629*

Felleskontoret for LO/NHO ordningene (1992): Årsmelding 1992 for ordningen med avtalefestet pensjon (AFP)

Felleskontoret for LO/NHO ordningene (1993): Årsrapport 1993 for ordningen med avtalefestet pensjon (AFP)

Felleskontoret for LO/NHO ordningene (1994): Årsrapport 1994 for ordningen med avtalefestet pensjon (AFP)

Felleskontoret for LO/NHO ordningene (1995): Årsrapport 1995 for ordningen med avtalefestet pensjon (AFP)

Felleskontoret for LO/NHO ordningene (1996): Årsrapport 1996 for ordningen med avtalefestet pensjon (AFP)

Felleskontoret for LO/NHO ordningene (1997): Årsrapport 1997 - Ordningen med avtalefestet pensjon

Felleskontoret for LO/NHO ordningene (1998): Fellesordningen for avtalefestet pensjon - Årsrapport 1998

Haugen, F. (1999): "Skatter og pensjoner 1990/1997", *Unpublished draft.*

Haugen, F., Hernæs, E., Røgeberg, O., and Strøm, Steinar (1999): "Early Retirement and Economic Incentives Among Married Men" *Forthcoming as a Memorandum from the Department of Economics, University of Oslo*

Hernæs, E, Sollie, M. and Strøm, S. (1999): "Early Retirement and Economic Incentives", *Under revision for publication in Scandinavian Journal of Economics*

Hurd, M. D. (1997??): "The Joint Retirement Decisions of Husbands and Wives", *In "Issues in the Economics of Aging", edited by David A. Wise, pp. 231-254. Chicago: University of Chicago Press*

Hurd, Michael D. (1990): "Research on the Elderly: Economic Status, Retirement, and Consumption and Saving", *Journal of Economic Literature, Vol. XXVIII (June 1990), pp. 565-637*

O'Donoghue, Ted and Rabin, Matthew (1998): "Procrastination in Preparing for Retirement" *In Henry Aaron, editor, "Behavioral Dimensions of Retirement Economics", Brookings Institution Press & Russell Sage Foundation, 1999, pp. 125-156*

Pozzebon, S and Mitchell O.S. (1989): "Married Women's Retirement Behavior" *Journal of Population Economics 2: 39-53*

Raknerud, Arvid (1999): "What Causes a Firm to Exit?" *Unpublished article, appears as chapter 3 ("A rational expectations model of firm exit") of "Dynamic models for panel data – Methods and applications", Doctoral dissertation, University of Oslo*

Samwick, A. A., and Skinner, J. (1998): "How will Defined Contribution Pension Plans Affect Retirement Income?", *NBER Working Paper #6645*

Samwick, Andrew A. (1998): "New Evidence on Pensions, Social Security and the Timing of Retirement", *NBER Working paper #6534*

Stock, James H. and Wise, David A. (1988): "Pensions, the Option Value of Work, and Retirement" , *NBER Working Paper #2686*

Vistnes, J. P. (1994): “An empirical analysis of married women’s retirement decision” *National Tax Journal, Vol. 47, Nr.1, 135-155*

Zweimüller, Josef, Winter-Ebmer, Rudolf and Falkinger, Josef (1996): “Retirement of Spouses and Social Security Reform”, *European Economic Review 40 (1996) 449-472*