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Early Retirement and Economic Incentives

By
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No 16	By Oddbjørn Raaum and Tom Erik Aabø: The effect of schooling on earnings: The role of family background studied by a large sample of Norwegian twins. 31 p.

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Early Retirement and Economic Incentives*

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Abstract

In Norway early retirement programs have gradually reduced the retirement age from 67 to 62 for a majority of the labor force. Based on micro data for 1990 and 1992, we estimate a competing risk models with three states: full retirement, partial retirement/part-time work, and full-time work, and we use the estimated model in simulations to study how financial incentives can be strengthened to extend working life. Both financial incentives, educational background and industry affiliation is found to influence retirement behavior. For low and middle incomes, the tax system shifts the incentives heavily towards retirement, in particular partial retirement combined with part-time work.

Key words: Early retirement, multinomial logit model, taxes

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1. Introduction

Demographic changes have raised, and will continue to raise quite drastically, the fraction of the population aged 65 and above in most OECD-countries. A good illustration of these demographic trends is given in NOU (1998). The burden of support on the working population is further increased by the strong decline in labor force participation of older persons, in particular older men. Gruber and Wise (1997) give an overview of the trends in 11 OECD countries during the last decades.

Up to 1989 the general retirement age in Norway was 67. In addition, special groups, for instance policemen, could retire at an earlier age, in some cases at the age of 60. In 1998 about one third of public employees and almost one tenth of private employees had a retirement age below 67 (NOU 1998: 19). In 1988, as a result of negotiations between trade unions and employers' organizations, an early retirement program was introduced. The argument in favor of cutting the retirement age, voiced by the parties that were involved in the negotiations, was to give the workers some other benefits than a rise in wages. Moreover, since the fall of 1986 the unemployment rate in Norway had been increasing and it was soon to reach an all time high post-war level.

Starting from January 1. 1989 the early retirement age was set to 66 and since then the retirement age in the early retirement program has gradually been reduced to reach 62 in 1998. This early retirement program now covers 43 per cent of all employees in the private sector and all employees in the public sector, a total of 60 % of the labor force. Given the demographic changes, which in Norway are quite similar to the OECD average, and given the early retirement programs, retirement may influence the financial stability of the economy and place an increasingly heavy burden on a shrinking fraction of working individuals.

Public policy questions related to retirement are discussed at some length in the recent OECD Employment Outlook, OECD (1998). A main conclusion in that OECD report is "…it appears likely that pension programs will be adjusted so that possibilities for early retirement are more limited or made relatively less attractive, and that workers will respond by seeking to delay retirement". The tone in the OECD report is quite optimistic in saying that the strengthening of financial incentives to extend working life, together with a large increase in the older population and improvements in their health, suggest that the supply of older workers will increase sharply in the coming decades.

Empirical estimates are needed for assessing policies to bring about the increases in labor force participation called for in the OECD report. On this background, the topics of this paper are to estimate a model of retirement behavior of individuals who became eligible to early retirement programs in the 1990s, and to use the estimated model in simulations to study how financial incentives can be used to extend working life.

The main conclusions are in the first place that a majority took the opportunity to retire partly or completely at the earliest possible date. Secondly, the probability of retirement varies considerably with education, gender, marital status and industry affiliation. Thirdly, economic incentives were found to influence early retirement, with a substantial effect of a bonus for delayed retirement. Of course, part of our result may be cohort-driven. As future older workers gradually become healthier, more may find it attractive to extend their working life beyond the current early retirement age. On the other hand, even for healthier older workers than the present ones, the economic benefits of an early withdrawal from the labor force relative to the benefits of extending working life will be of importance. It should also be emphasized that information about and eligibility to early retirement now has been spread to an increasingly larger fraction of the population. For psychological reasons one cannot ignore the possibility that an increasing number of persons will find it more socially acceptable and more attractive to retire early when early retirement is not restricted to a small and limited

group of manufacturing workers. Moreover, an increasing fraction of retired older people in the population may shift some of the political power towards the elderly and early retired, and this shift may be used to defend the rather generous early retirement programs. Although existing retirement programs can be moderated to some extent with respect to the financial incentives to retire early, the programs themselves, in particular the minimum retirement age may be difficult to roll back. On this background it may seem that the conclusion in the OECD report referred to above is unduly optimistic. Given this possibility of irreversibility of past decisions perhaps more awareness should be placed on early retirement as a mean to solve disputes in wage settlements.

Before we proceed with describing our own approach we will give a brief review of some recent and relevant literature. We will focus on contributions that allow for full retirement as well as partial retirement.

1.1. A Brief Review of Literature

Sueyoshi (1989) employ a competing risk model to estimate the influence of economic incentives on partial and full retirement. Three labor force states are accounted for in the analysis, full-time work, part-time work/part-time retirement, and out the labor force, which is assumed to be equivalent to full retirement. A proportional hazard rate model is estimated on ten-year biennial panel data covering the period 1969 to 1979 in the U.S. The data employed consists of a sample of 4016 men aged 58-63 in 1969. Simulation results indicate that the large increase in Social Security benefits in the early 1970s has had a moderate, but positive impact on the probability of full-retirement and a moderate, but negative, impact on partial retirement.

Blau (1994) estimates a discrete time hazard model of quarterly transition rates among three labor force states based on the same longitudinal data set as employed in Sueyoshi (1989). As in the former study three labor force states are considered: full-time work, part-time work/part-time retirement and out of the labor force. Transition probabilities are derived from an ordered probit model where the ordering follows from the specification of the three labor force states. By applying observations on a quarterly basis he alleviates the problem of missing transitions that may occur when annual or biannual data are used. Such missing transitions could introduce undercounting of some types of transitions. This will be important if it is possible to move from part-time jobs, or rather part-time retirement, to full-time work. The model he applies is a reduced form model with three types of variables; budget constraint variables, exogenous preference shifters and lagged endogenous variables. The latter variables are introduced to capture the effects of the past on current decisions. The budget constraint variables include wage rates at full-time and part-time work, pension and Social Security eligibility and benefits, and other sources of income. Because the income of the spouse may be considered to be an endogenous variable, it is not included. A person-specific random constant, assumed to remain unchanged over time, and a random term that varies across spells is integrated out of the likelihood. In contrast to Sueyoshi (1989) the main conclusions are that Social Security benefits matter and contribute to high exit rates from the labor force at the age of 65. Moreover, lagged endogenous variables are strongly associated with the transition probabilities.

Other studies that allow for partial retirement are Rust (1990) and Berkovec and Stern (1991). Both account for future consequences of current decisions and thus they apply a dynamic programming model in analyzing retirement behavior. Berkovec and Stern estimate both a static and a dynamic model and conclude that the dynamic model performs better.

Retirement is not an absorbing state since an individual who has retired has three options: remain retired, accept a full-time job or accept a part-time job. Utility in the different states is a linear function of income. Incomes in the different states are not observed and thus a reduced form is estimated. Because income is not observed one has to assume that out of the labor force is equivalent to retirement, which in fact it is not. Common observed characteristics across the states are education, race, age and health. It is assumed that the individuals have a perfect knowledge of their future health. Because the model is a reduced form model, it is not possible to use the estimated model to simulate the impact on retirement of changes in financial incentives. Key features of the model are the inclusion of unobservable individual and job-specific effects and the flexible correlation structure of unobserved variables.

Blau (1997) estimates the impact of Social Security benefits on the labor force behavior of older married couples in the U.S. He distinguishes between a spouse benefit and a retired worker benefit. A spouse receives the larger of the two. If the spouse benefit is the largest, then this may create a work disincentive for the one who receives, typically the wife, as also found in earlier studies by McCarty (1990) and Vistnes (1994). However, Blau (1997) estimates a married couple model and is thus able to assess the impact on both spouses of the spouse benefit. A stochastic utility function, linear in wages and benefits, are employed and structural parameters are estimated on data covering transitions among a set of discrete labor force states. These states are classified according to whether one, both wife and husband, or none of the couples are working. The specified utility function permits that different sources of income may be evaluated differently by the couples. Income from private pensions is not included and the future consequences of current decisions are not accounted for. Data are the same as employed in Sueyoshi (1989) and Blau (1994) and are somewhat dated because the last year interview took place in 1979. His main findings are that the spouse benefit has a negative, but small, impact on the labor supply of the wives and a positive, but small, impact on the labor supply of the husbands. The latter effect is explained by Blau with a reference to the fact that in families that expect to receive a spouse benefit the return to the husbands payroll tax payments is higher than it would be in the absence of spouse benefits. The impact is small due to small spouse benefits. If this model had been estimated on more recent data say, for Norway the spouse benefit would have been of minor importance, or of no importance at all, simply because the retired worker benefits among most women by far would have exceeded the spouse benefits. The reason why is the strong increase in female labor force participation since the 1960s.

Krueger and Pischke (1992) estimate a reduced-form linear labor-supply equation with Social Security wealth and growth in this wealth as explanatory variables. They use cohort-data derived from the Current Population Survey in the U.S. covering males in the 1970s and 1980s. The study focuses on measuring the impact of a substantial and unanticipated reduction in Social Security wealth for individuals born after 1916. Their results indicate that the labor supply among the elderly continued to decline regardless of the decline in Social Security wealth.

A major weakness with the studies reported so far is that retirement is assumed to be equivalent with leaving the labor force. Pedersen and Smith (1996) do not assume this and allow for two different routes of out the labor force. One is out of the labor force without collecting pension benefits and the other is to be out of the labor force and at the same time collecting pension benefits. Thus, the individuals are allowed to move among three labor force states; labor force participation, out of the labor force and retirement. The latter state is assumed to be absorbing. A competing risk model with a specified proportional hazard rate is estimated on data for elderly people in Denmark, aged 52 or more in 1976 and covering the period 1976-1986. In Denmark an early retirement program was introduced in 1979 with the

purpose of reducing unemployment, that is to get younger people into employment. The eligible age group was 60 years and above. Within few years this early retirement program reduced the labor force by 100 000 people (more than one birth cohort) in the age group 60-66. A main conclusion in the study thus is that the estimates indicate that the opportunity to retire early and the pension benefits relative to the pay as employed have a significant impact on the propensity to exit to non-health related early retirement.

Another vein of research but related to the dynamic programming approach applied in Rust (1990) and in Berkovec and Stern (1991) is the option value approach of Stock and Wise (1990). The focus is on a pension plan in a large firm and the study is thus not directed to the effects of Social Security benefits on retirement, as in the cases referred to above. These firm pension plans typically offered the employees a bonus if they worked until a certain age. If they decided to retire earlier, the option of a later bonus was lost. Thus, continuing to work preserved the option of receiving a bonus if retiring later. The option value model may be considered as a simplified and myopic, sub-optimal, version of a dynamic programming model, but considerably less complex to estimate. The option value model is estimated on a sample of salesmen 50 years of age or older on January 1, 1980. A problem with this analysis is that one cannot ignore the possibility that workers who retire early from one firm may start to work for other firms and/or to become self-employed.

An important conclusion in Stock and Wise, *op.cit.* is that alternative pension plans, with respect to the early retirement age and benefits, have a strong impact on the decision to stay in the firm until some age and then to retire at some later age. Similar results are reported in Samwick (1998).

1.2 Our study

Like Stock and Wise (1990) we analyze the impact on retirement of firm-specific early retirement programs which in Norway were introduced in 1989 as a result of the wage negotiations between the unions and the employers' organization. Before 1989 the retirement age for those individuals we study here was 67. In 1989 the early retirement age was negotiated to become 65. This early retirement program was unanticipated by the employees and the outcome of the wage disputes in 1989 may be considered as an unanticipated change in the retirement laws. Moffit et al (1984) argue that unanticipated changes in retirement programs provide the best analytic basis for studying the impact of retirement rules on labor supply among the elderly. Others, who have used unanticipated changes in retirement rules in analyzing labor supply, are Pedersen and Smith (1996) and Krueger and Pischke (1992).

We follow Blau (1994) and others referred to above and allow for three labor force states: full retirement, partial retirement, and full-time work. Like Pedersen and Smith (1996) we will assume that full retirement is an absorbing state, which accords completely with observations. Moreover, we also assume that partial retirement is partially absorbing, in the sense that given that the individual is partly retired at time t-1, he or she is not allowed to transit to full-time work at time t. Again, this accords with observations. We observe the labor force states in 1990 and 1992 of all individuals who were aged 63-65 in 1990 and who were eligible under the early retirement program. Note that the Social Security age is 67 and when the individuals reach this age the early retirement benefits are replaced by the Social Security benefits. Based on the observations of the labor market transitions between 1990 and 1992 we estimate a three state, competing risk model. Like Blau (1994) our model is an ordered model where the individuals are assumed to move among states according to a utility maximizing behavior. We assume that the random utilities are extreme value distributed and obtain an ordered multi-nominal logit model. Unlike most others referred to above we observe all types

of pensions actually received: the benefits from the early retirement, Social Security benefits, private pensions and savings. Prior to retirement, we observe the major part of pension rights. Unlike in previous studies we are able to calculate taxes, which is considerably lower on low or middle incomes if the whole or part of the income is a pension. We also account for the reduction in retirement benefits in the part-time work/partial retirement case. Thus, our budget constraint variable is disposable income in the different states.

To estimate the model we need to assess the disposable income in all feasible states, and hence, we have to estimate the disposable income in the states not currently occupied by the individuals. Pension and wage equations are estimated as functions of observed characteristics (education, working experience, gender, years of age). In contrast to Blau (1997) income is assumed to be evaluated the same way regardless of the source of income. Spouse income is not included, since this might have introduced an endogeneity bias. We follow others referred to above and assume that the deterministic part of the utility function is a linear function of disposable income and leisure. In addition, observed socio-demographic characteristics like age, gender, education, marital status and industry affiliation are introduced in the utility function to capture effects on the retirement decisions – in excess of budget constraint variables - that others have argued are important, see Krueger and Pischke (1992) and Anderson (1998).

The estimated model is used to simulate the impact on early retirement of offering the individuals a bonus if they delay their retirement decision.

2. Institutional Setting

The backbone of the retirement system in Norway is a mandatory, defined benefit public pension system, covering all permanent residents, established in its current form in 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 two main components. One component is a minimum pension, paid to all persons who are permanently residing in the country. With less than 40 years of residence, the 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. The other main component is an earnings based pension.

A crucial parameter in the system, used for defining contributions as well as benefits, is the basic pension. The basic pension in 1991, which is the base year for calculating potential pension, was NOK 34 100 (around USD 4 500) in the period January – April and NOK 35 500 (USD 4 700) during May – December. The earnings based pension in the private sector 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. Earnings above 12 times the basic pension do not give points, and earnings between 6 and 12 times the basic pension (8 and 12 times before 1992) are reduced to one third before calculating points. The yearly points are then multiplied by 0.45 (points obtained after 1992 are multiplied by 0.42) and the average yearly points over the 20 best years are calculated. 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 we will only briefly recount here. Firstly, since we are still in the process of phasing in the public pension system, a special 'overcompensation' program is in operation for persons 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. 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 first two of these features have been taken into account when we calculated potential pension. We have not, however, identified married couples and have therefore not been able to take into account this reduction.

Keeping 1992 regulations constant, the maximum future pension level will be 4.75 times the basic pension (G), NOK 168 625 (USD 22 500). This pension level will require 20 year with earnings of at least NOK 426 000 (USD 57 000) and another 20 years with earnings of at least NOK 35 500 (USD4 700). The relation between a constant 20 best year's earnings level (before and after tax) and the public pension is illustrated in Figure 2.1. Although there is a redistributive effect of the tax system also for pre-retirement earnings, this effect is much stronger after retirement. For pre-retirement earnings up to more than 100 000 NOK, after-tax pension is actually higher than after-tax earnings. Also, the after-tax public pension curve is fairly flat, implying a strong redistributive effect. The replacement level implied by the public pension curve falls from one at an income level of 2.344 G (below that level income does not influence the public pension). G is the basic pension. At earnings just giving the maximum pension, the replacement level in 1992 was 0.396. Later changes in the rules have reduced this replacement level to 0.328 and moved the curve downward accordingly.

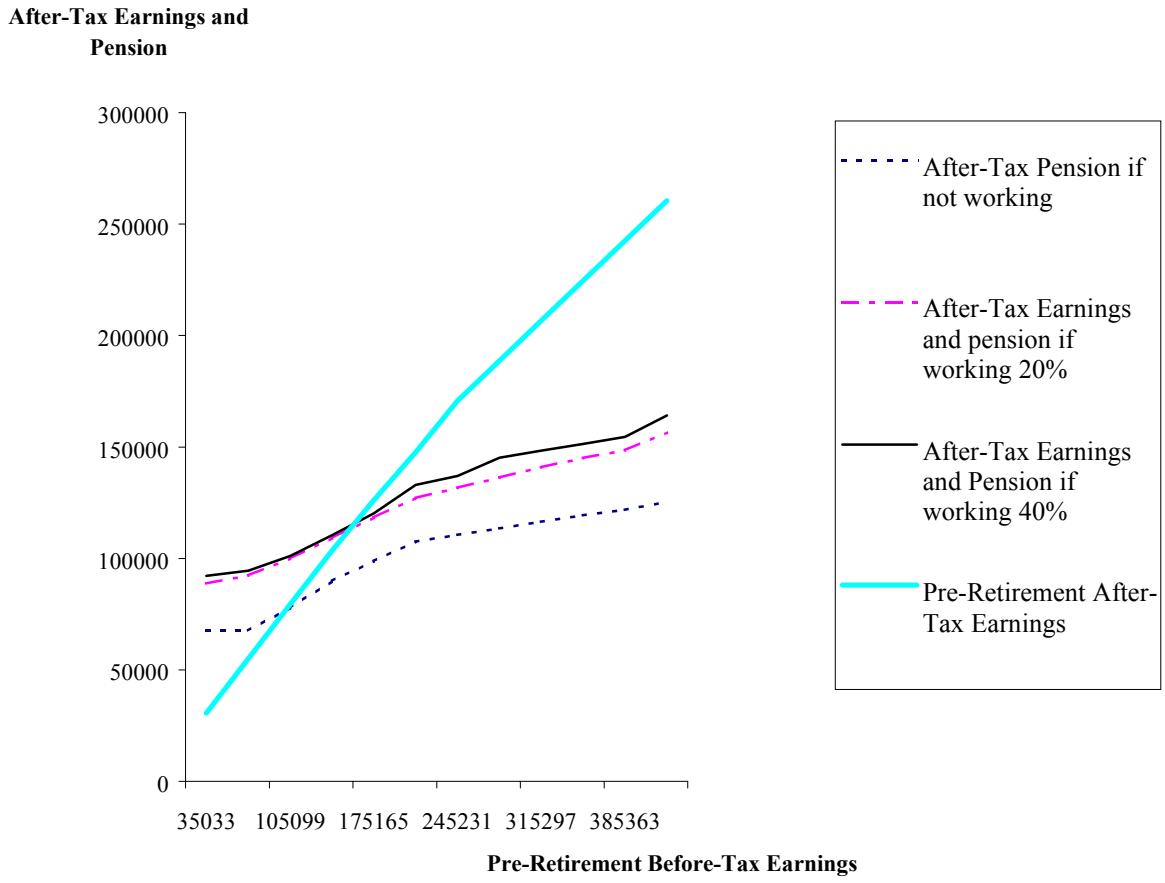
State and local government employees have alternative pensions, coordinated so that benefits will be the maximum of the public and the government pension. These are also shown on Figure 2.1. The government pension is calculated in much the same way as the public pension, but with some important distinctions. 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, giving a replacement ratio at that level of 0.51. In addition, there are employer based and private, additional pensions (tax deductible and widespread). The coverage is directly observed. An indication of their importance is given in chapter 5.3.

Finally, and central in our analysis, employers and unions in 1989 negotiated an early retirement scheme (AFP). Under this scheme, persons working for employers who are participating (today about 43 % of private employees and all employees of central and local government) and meeting individual requirement (see section 5.2) could retire at an earlier age than the ordinary 67. From January 1 1989, the AFP age was 66. It was lowered to 65 from January 1 1990, to 64 from October 1 1994, to 63 on from October 1 1997 and to 62 from March 1 1998. The pension level was 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.

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.

Finally, there are also special tax rules, which apply to retirement benefits. These are described in section 5.5, and illustrated by Figure 2.1. In the early retirement program a tax-free lump-sum amount was given those who retired from a job in the private sector. In the government sector a higher but taxed lump-sum amount was awarded. These lump-sum transfers were reduced if the retired pension worked 20 or 40 % of a full time job.

Figure 2.1 Earnings, Public Pension and Taxes 1992



3. Data Sources

The basis for the analysis is register files held by Statistics Norway. The files are all based on a personal identification number, which allows linking of files with different kind of information and covering different periods in time. For the present study, information covering the period 1990-92 has been extracted for the 30 % sample in the 1990 Population Census. The variables used in the model are defined in detail in chapter 5. The information contained in those register files, which are of interest here, are first the standard demographic variables:

- Gender, age, marital status, educational qualifications, place of residence, and also the local unemployment rate.

From the files of the labor market authorities, there is information on

- when people start register and when they stop registering as unemployed (with or without unemployment benefit), and
- when employers report start and stop of employment.

From the tax files, there is information on

- wage earnings,
- old age pensions with identification of early retirement benefits, and
- other social benefits.

Finally, the social security authorities files give information on

- Accumulated public pension rights

This gives individual histories covering employment, unemployment, disability and old age pension, with information on income in various states. The 1991 official data files contained a serious error in the pension information, so we had to use the 1990 and 1992 files to construct transitions.

4. The model

The three states specified in this model are full-time work, partial retirement and full retirement. Details about how these states are defined and observed are given in Section 5. State 1 is full retirement, state 2 is partial retirement and state 3 is full-time work. As mentioned above state 1, full-retirement, is assumed to be an absorbing state. Let U_k denote the utility derived from consumption and leisure when the individual is in state k. The individual is assumed to maximize utility and hence the individual prefer state j at time t, given that it occupied state i at time t-1, if the following holds:

$$[U_{j,t}|\text{state i at t-1 }]>[U_{k,t}\ |\text{state i at t-1}] \qquad (1)$$

Because state 1 is assumed to be an absorbing state, i=2,3. If i=2 at time t-1, then j and k are allowed to be {1,2}. This follows from the assumption that partial retirement is assumed to be

partial-absorbing, in that individuals are not allowed to exit from partial retirement to full time work. If i=3 at time t-1, then the persons are permitted to exit to all states, thus in this case j,k=1,2,3.

Preferences are assumed to vary across individuals with a deterministic part that captures the effects of consumption and leisure on individual welfare and with a stochastic taste shifter that accounts for the impact of unobserved variables. The deterministic part of the utility function is allowed to vary both with the exiting and destination state. Thus,

$$[U_k| \text{ state i at time t-1}]=v_{ik} + \varepsilon_{ik} \tag{2}$$

where v_{ik} is the deterministic part of the utility function and ε_{ik} is the stochastic part. The deterministic part v_{ik} is assumed to be a linear function of consumption, C_k, leisure L_k and socio-demographic variables (denoted Z_s) like gender, age, education, marital status and industry affiliation. Thus,

$$v_{ik}= \alpha_i C_k+\gamma_i L_k+\Sigma_s \beta_{iks} Z_s, \tag{3}$$

where the subscripts attached to the coefficients in front of the consumption and leisure variables indicate that we allow for different impacts on household welfare of consumption and leisure depending on the state previously occupied by the individual. If the empirical results imply that these coefficients vary across states, then this result might indicate state dependence in preferences. As alluded to above, and as suggested by Krueger and Pischke (1992), we assume that socio-demographic variables may have an impact on the movements of individuals among the labor market states, in excess of their effects on labor income and pensions. We assume that the stochastic variables ε_{ik} are i.i.d across states and individuals with the following probability distribution function:

$$P(\varepsilon_{ik}\leq y)=\exp(-e^{-y}) \tag{4}$$

Thus the stochastic term is extreme-value distributed of type I. This assumption, together with the utility maximizing behavior governing the movements of individuals among states, (1), and the specification of the utility function, (2), yield a multi-nominal logit model for the transition probabilities. These probabilities are shown below.

4.1 Transition probabilities given that state 2, partial retirement, is the initial state

Given that the individual is in state 2 at time t. the only feasible destination states are state 1 (full retirement) and state 2 (partial retirement). Let Q_{2k} denote the probability that state k=1,2 is chosen, given that state 2 was the initial state. After normalization we get,

$$Q_{22} = \exp(v_{22}-v_{21})/[1+\exp(v_{22}-v_{21})] \tag{5}$$

$$Q_{21} = 1-Q_{22}. \tag{6}$$

From the specification in (3) it follows that

$$v_{22}-v_{21}=\alpha_2(C_2-C_1)+\gamma_2(L_2-L_1)+\Sigma_{s=0}(\beta_{22,s}-\beta_{21,s})Z_s$$

and by noting that partial retirement is associated with an individual working a fixed number of hours a year say, M, with that many hours less leisure, we further get

$$v_{22}-v_{21} = \alpha_2(C_2-C_1)+(\beta_{22,0} -\beta_{21,0}-\gamma_2 M)+\Sigma_{s=1}(\beta_{22,s} -\beta_{21,s})Z_s \quad (7)$$

With no measured variation in hours worked in partial retirement, the leisure term is absorbed in the constant for each state, and can not be identified.

4.2 Transition probabilities given that state 3, full-time work, is the initial state

As for transitions from partial retirement, we obtain for the transitions to full-time work after normalization:

$$Q_{33} = \exp(v_{33}-v_{31})/[1+\exp(v_{32}-v_{31})+\exp(v_{33}-v_{31}] \quad (8)$$

$$Q_{32} = \exp(v_{32}-v_{31})/[1+\exp(v_{32}-v_{31})+\exp(v_{33}-v_{31}] \quad (9)$$

$$Q_{31} = 1-Q_{32} – Q_{33} \quad (10)$$

Rewriting while assuming M hours of work in partial retirement, we obtain for the choice between full and partial retirement:

$$v_{32}-v_{31} = \alpha_3(C_2-C_1)+[\beta_{32,0} -\beta_{31,0} -\gamma_3M]+\Sigma_{s=1} (\beta_{32,s}-\beta_{31,s}) Z_s] \quad (11)$$

and for the choice between continued full-time work and full retirement, assuming N hours of work in full-time work:

$$v_{33}-v_{31} = \alpha_3(C_3-C_1)+[\beta_{33,0} -\beta_{31,0}- \gamma_3N]+\Sigma_{s=1} (\beta_{33,s}-\beta_{31,s})Z_s] \quad (12)$$

Although we allow the impact of consumption on transition probabilities to vary across initial states we would not expect α_3 and α_2 to be very different. Both coefficients are the marginal utilities of consumption, which are positive according to economic theory. Positive α_3 and α_2 mean that an increase in consumption as part-time worker or full-time worker relative to the consumption as full retired will reduce the transitions to full retirement. Stock and Wise (1990) allow, and also estimate, different effects of consumption in work and in retirement. An important component of this difference is probably caused by leisure, of which neither Stock and Wise nor we have any direct observations. In our approach the leisure term is absorbed in the intercept terms. From (7), (11) and (12) we observe that individuals are assumed to choose among states according to the level of consumption only in year t. In this year the persons included in our sample are aged 65-67. Since the pension level from age 67 is largely unaffected by early retirement, future income streams cancel out at the individual level and our estimates are based on individual variation in income in year t only. Hence, we do not need to predict and discount future income streams, and do not need to model a sequence of decisions. On the other hand, simulations of effects of changes in pension levels based on our estimates may be considered ‘out of sample’. Our estimates will be relevant also for such predictions, given the following assumptions:

- consumption is proportionate to wealth, and hence differences in consumption is proportionate to wealth differences,
- wealth is equal to the discounted value of future disposable incomes,
- the planning period is equal to the expected remaining life time,
- real incomes are constant,
- the real rate of interest is constant over time.

Although these assumptions are in line with what many others have applied, explicitly or implicitly, in similar empirical works before, it would of course have been better to derive the movements among labor force states from a stochastic, dynamic programming model like in Rust (1990). See also Stern (1997) for an assessment of static versus dynamic models. To do so and to gain more insight than based on our approach, one needs data on the probabilities of surviving from one year to another, future interest rates, initial wealth, future personal saving and bequest, future taxes, etc. Because such data is not available, we have adopted a more pragmatic and myopic approach to analyze the movements among labor force states for persons who became eligible for early retirement in 1992.

5. Empirical Specification of the Model

5.1. Definition of the States

The principles for classification of persons into states are set out in Table 5.1. To give an overview of the labor market attachment and retirement behavior of older persons, we classify the whole age group 60-70 (in the 30 % population sample in the 1990 census), using the two step classification in Table 5.1. The first step is classification into the 8 states shown in Italics, and the second step is the classification into the 3 states shown in bold. Not all dating within the year in the registers is reliable, and we are not able to put all events within the year into a chronological sequence. Hence, we have pooled all information relating to the same year, and classified according to the principles, which can be read from Table 5.1.

Table 5.1. Classification Principles for Labor Market Attachment each Year. All amounts in NOK 1000 NOK (USD130)

States	*Earnings*	*Registered as unemployed*	*Pension recipient*	*Other benefit recipient*	*Total earnings, sick payment and benefits received*
Retired					
Out of the labor force	-	No	No	No	<10
Retired	<10	No	Yes	-	-
Disabled	<10	No	No	Yes	-
Partly Retired					
Employed/retired	>10	No	Yes	-	-
Employed/disabled	>10	No	No	Yes	-
Full-time Work					
Employed	>10	No	No	No	-
	-	No	No	No	>10
Unemployed	<10	Yes	-	-	-
Employed/unemployed	>10	Yes	-	-	-

Table 5. 2. Labor market attachment for the population aged 60-70 in 1990 based on activities during 1990

Age	*Employed*	*Un-employed*	*Employed/ Un-employed*	*Out of the labor force*	*Retired*	*Disabled*	*Employed/retired*	*Employed/disabled*	*Total*
60	50.2	0.9	5.3	8.2	6.8	16.5	5.9	6.2	15265
61	46.3	0.9	5.1	9.1	8.5	17.7	6.3	6.1	14681
62	40.7	0.8	4.6	10.3	10.2	19.2	8.5	5.6	14952
63	36.4	0.8	4.5	10.7	12.1	20.7	8.6	6.1	14535
64	32.5	1.4	3.8	10.7	14.5	22.2	8.8	6.1	15107
65	25.6	1.4	3.2	11.5	15.9	24.0	12.3	6.1	14981
66	21.1	1.7	2.5	12.6	19.4	25.6	11.4	5.8	15150
67	4.3	1.9	1.6	0.2	64.6	0.0	27.3	0.1	15420
68	2.2	0.0	0.1	0.1	77.8	0.0	19.8	0.0	14998
69	1.8	0.0	0.0	0.1	82.6	0.0	15.4	0.0	14949
70	0.1	0.0	0.0	0.1	85.6	0.0	14.2	0.0	15599
Total	23.6	0.9	2.8	6.7	36.5	13.2	12.6	3.8	165637

From table 5.2 we note the gradual transition from work with rising age. At age 60 half the population are classified as being employed without any spells of unemployment, disability or other inactivity during the year (1990). 17.4 % are registered with employment in combination with unemployment, disability or retirement, either because they are in a transitional stage or because they combine activities during a period. In particular, a substantial proportion retire partly and combine employment and retirement, which can be seen (below) from the fact they are in this state both in 1990 and in 1992. This level of employment at age 60 places Norway in the middle of the OECD countries (Gruber and Wise, 1997). We further note that a rising proportion are disabled as the retirement age approaches, indicating that this might be an alternative way out of employment and perhaps serve as a form of early retirement. However, this is not the case in the group we have analyzed, which comprise people who are eligible for the new early retirement scheme. In our sample there is little transition to being disabled, see the next section and Hernæs *et al.* (1997) for further details. Eligibility for the early retirement scheme analyzed here requires a fairly high level of employment, and the negligible size of the transition to disability is compatible with the interpretation that disability comes after prolonged sick leave, and is not in fact an early retirement scheme. Thøgersen et al. (1998) point out that those who take out disability are different in important respects from those taking early retirement, which supports our interpretation. For our analysis, it suffices to note that transition to disability is unimportant.

Finally, it is noteworthy that many seem to choose a gradual transition from work to retirement. At age 70, one out of seven combines work and retirement.

5.2 The Early Retirement Sample

Although early retirement (AFP) is important, it is not universal, and for the analysis we need to identify those who are eligible. We do this in two steps. First, we identify the firms where some of the employees took out AFP in 1992 and all employees in these firms in 1990. The coverage is by firm, and all employees in these firms will have the option of AFP, provided they meet certain requirement at the individual level. The second step is therefore to identify all employees who meet the individual requirements. In addition to being aged 65 (or more) in 1992, the requirements we are able to implement are:

- 10 years with earnings at least equal to the basic pension since the age of 50;
- 10 years with twice that earnings level since 1967; and,
- labor income level at least corresponding to the basic pension both in the calendar year when AFP is taken out and in the calendar year before.

We have not been able to implement the requirement that eligibility requires not receiving pension beforehand and having been employed by the company the last three years. The sample consists of 1575 persons. Given the eligibility requirements practically none in the sample are unemployed, retired or disabled. Hence, aggregation into the three states used in the analysis is trivial except for the partly retired group. Here, we include both those who go from work to retirement during 1992 and those who combine work and retirement, without being able to distinguish the two groups. Among persons partly retired in 1990, we probably also include persons in occupations with lower retirement age. Focussing on the transition from work to retirement reduces the latter problem, whereas focussing on the transition from full time work to full retirement reduces also the latter problem.

Table 5. 3. Transition 1990 – 1992 for Persons Eligible for Early Retirement (AFP)

State in 1990	*State in 1992*			
	Retired	*Partly Retired*	*Full Time Work*	*Total*
Retired	14	0	0	14
Partly Retired	272	153	11	436
Full Time Work	285	408	432	1125
Total	571	561	443	1575

The gradual transition from work to retirement shows clearly, with slightly more than 1/3 of the full time worker in 1990 being partly retired in 1992, and slightly above 1/3 of the partly retired in 1990 being partly retired also in 1992.

5.3 Individual Specific Variables

The reference group for age is 63 years of age in 1990, with two dummy variables for having reached 64 or 65, respectively. There are similarly dummy variables for female, for being married, for having completed at least 12 years of education and for working in the service sector.

5.4 Potential Pre-tax Income

Full-time work in 1992 is an alternative only for those working full-time also in 1990. We observe the 1990 earnings and assume potential earnings in full-time work in 1992 to be the same as in 1990. Potential income as partly retired in 1992 as well as potential pension in full-time retirement, for persons working full-time in 1990, is predicted as described below. For persons partly retired in 1998, potential income in that state in 1992 is assumed to be the same, whereas potential pension is predicted as described below. In section 5.5, tax rules are applied to obtain disposable income. These two steps are carried out for each individual.

Potential Public Pension

For all persons in the sample, we know the sequence of public pension points since the start of the present system in 1967. The current pension depends on this sequence via the formulae below. The main structure is discussed in chapter 2 above.

$$F = G \bullet T\left(\frac{\min(4, P)}{YO} + \frac{\max(0, P-4)}{40}\right) * 0.45$$

where

G = Basic public pension
F = Earnings based public pension
T = Number of years with earnings above the basic pension, $0 \leq T \leq 40$
P = Average points over the 20 best (non-zero) years
YO = Overcompensation factor: YO =(Birthyear – 1897) and $20 \leq YO \leq 40$

A special supplementary pension is

$S = G*0.605$

giving total predicted public pension (basic and earnings based):

$B = G + max\ (F, S)$

In addition, persons retiring under the AFP-scheme receive a tax-free income, which in 1992 was NOK 11400. The gross pension is taxed according to special rules, see section 5.5.

Full Potential Pension

In addition to the public pension, people in the sample may be entitled to employer-based pensions and they may have private pensions. Information on pension rights like what we utilized in the previous section for the public pension is not available for these other pensions. However, we do know the full pension for those who have retired. In order to avoid selection bias, we estimated the relationship between predicted public pension and full pension in the 30 % census sample of 66010 retired persons aged 68 or more in 1992. We obtained the following regression, which have been used to predict the full pension, Y_1, for persons in our sample,

$$Y_1 = -31030 + 1.6135 \bullet B + 24268 \bullet Educ12 - 280 \bullet Female,$$

where *Educ12* is dummy variable for at least 12 years of education and *Female* is a dummy variable for females. In the estimated equation, $R^2=0.62$

This procedure preserves the individual variation in the predicted public pension, but does not add any other variation. The main effect will therefore be to scale the coefficient estimates.

Potential Income as Partly Retired

For those who were partly retired in 1990, we have assumed that the potential income as partly retired in 1992 was the same as in 1990. For those who were working full-time in 1990, we predicted potential earnings and pension in 1992 (the two income components as partly retired) based on two regressions run for those who actually went from full time work to partly retirement. For those who did not choose to become partly retired, this regression may of course overestimate potential earnings and introduce a bias. However, we have used a number of variables to control for heterogeneity, as shown below. The estimated regression for income as partly retired, Y_2 is:

$$Y_2 = (Potential\ earnings) + (Potential\ pension)$$
$$=(36555 + 0.3338 \bullet Earnings1990 + 0.2559 \bullet Y_1 - 7941.6 \bullet Educ12 - 46295 \bullet Age64 - 24423 \bullet Age65 + 7632.4 \bullet Female - 12878 \bullet Married)$$
$$(-33372 + 0.2876 \bullet Earnings1990 + 0.2889 \bullet Y_1 + 922.9 \bullet Educ12 + 29071 \bullet Age64 + 14887 \bullet Age65 - 797.6 \bullet Female + 8493.1 \bullet Married),$$

where

Married is a dummy for being married
Age64 and *Age65* are dummies for those two ages
Earnings1990 is just that, *i.e.* not pension,

By collecting terms, we get,

$$Y_2 = 3183 + 0.6214 \bullet Earnings1990 + 0.5448 \bullet Y_1 - 7018{,}7 \bullet Educ12 - 17224 \bullet Age64 - 9536 \bullet Age65 + 6834.8 \bullet Female - 4384.9 \bullet Married,$$

5.5 Potential Disposable Income

In order to obtain disposable income in the potential states in 1992, we have applied detailed tax rules. These are too complicated to be explained in detail here, but we will point out the most important features and how the rules operate; for further details about the tax rules and pensions see Hernæs, Sollie and Strøm (1998). Table 5.4 shows average potential income, before and after tax. Note that the average income after tax is not the disposable income that follows from applying the tax rules on the average income before tax. The average income after tax is the sample average of the disposable income after applying tax rules on the individual level. As shown in the top panel of the table, average potential pre-tax income is higher as partly retired than as retired. As expected, the potential income is highest for those working full time. Although the 1992 income varies somewhat with the state in 1990, this variation is small compared to the variation across the potential states in 1992.

Taxes change the relative incomes across states and increase dramatically the incentive to retire. For those who were partly retired in 1990 the decline in average potential pre-tax income if retiring in 1992 is NOK 54 324 (USD 7 423). The drop in disposable income is only NOK 16 110 NOK (USD 2 148). For a person working full time in 1990 the reduction in pre-tax income from retiring in 1992 is NOK 62 257 (USD 8 301). However, the drop in disposable income of transiting from working full time in 1990 to full retirement in 1992, is only NOK 17 340 (USD2 312 USD). Even more striking, the average disposable income is higher when transiting from full time work to partial retirement than to continue in full-time work. As alluded to above these averages are sample averages of two income variables. At the individual level differences in potential income between alternatives sufficiently often go in the 'right' direction.

The source of the work disincentive of the tax rules can easily be tracked down to the special tax rules for retirees. For people who receive public or AFP pension, even in combination with other income, income below a stipulated minimum pension (60.5 % above the basic public pension) is not taxed, and tax on income exceeding this minimum pension is capped at 55 %. These rules mean that the tax for full or part-time retirees is zero on an income up to NOK 73 750 (around USD 9 800), whereas the tax on the same level of earnings is 27 %. In addition as mentioned above, there is an additional pension of 11400 NOK exempt from tax for those taking out AFP, and if this is taken into account the income tax is negative on pensions up to about ¾ of the average AFP pension.

Summing up, the tax rules favor retirement, and the application of the special tax rules also to a combination of pension and earnings particularly favors partly retirement. This structure illustrates the need to account for the actual tax rules as well as individual heterogeneity when analyzing retirement behavior.

Table 5.4 Average potential state-specific income, before and after tax

	State in 1992		
State in 1990	*Retired*	*Partly retired*	*Full time work*
		Pre-tax income, NOK	
Retired	100 281	---	---
Partly retired	114 158	168 482	---
Full-time work	118 532	165 906	180 789
		Disposable income, NOK	
Retired	99 452	---	---
Partly retired	107 691	123 801	---
Full-time work	110 383	132 053	127 723
		Average tax as a percentage of income	
Retired	0.8	---	---
Partly retired	5.7	26.5	---
Full-time work	6.9	20.4	29.4

6. Results

As outlined in Section 4 the model consists of two separate blocks depending on the initial state in 1990. These two blocks are estimated separately. Thus when the initial state is partial retirement, the likelihood equals the product-sum of the probabilities Q_{22} and Q_{21}. It should be remembered that we have assumed that the partial retirement is partially absorbing, in the sense that persons are not permitted to exit to full-time work. When the initial state is full-time work, all three states are permitted as destination states. In this case the likelihood equals the product-sum of Q_{33}, Q_{32} and Q_{31}.

When reading the results below one should keep in mind that we have normalized all probabilities with the utility-values related to full retirement.

6.1 Estimation results when partial retirement is the initial state

Table 6.1 Transition probabilities from State 2, Partial retirement into State 1, Full retirement and State 2 Partial retirement

	Destination state 1, Full retirement		
Variables	**Coefficients from (7)**	**Estimates**	**t-values**
Consumption, C_2-C_1	α_2	$0.159\ 10^{-4}$	4.1
Intercept	$\beta_{22,0}$-$\beta_{21,0}$-γM	-0.598	-1.6
Age 64 in 1990	$\beta_{22,1}$-$\beta_{21,1}$	-0.236	-0.7
Age 65 in 1990	$\beta_{22,2}$-$\beta_{21,2}$	-0.810	-2.9
Education at least 12 years	$\beta_{22,3}$-$\beta_{21,3}$	0.281	1.1
Female	$\beta_{22,4}$-$\beta_{21,4}$	0.157	0.5
Married	$\beta_{22,5}$-$\beta_{21,5}$	0.085	0.3
Service industry affiliation	$\beta_{22,6}$-$\beta_{21,6}$	0.371	1.6

No of observations: 425, Log-likelihood: -256, Means Q_{21}=0.64, Q_{22}=0.36.

From Table 6.1 we observe that only state specific consumption and years of age 65 in 1990 have a significant impact on the transitions from state 2, partial retirement.

From the estimates given in Table 6.1, we can calculate the impact of the transition probabilities of an increase in state specific consumption. Thus, if (C_2-C_1) is increased by NOK 10 000 in 1992[1], the mean probability of exiting to full retirement is reduced by 3.7 percentage points, from 0.640 to 0.603. Thus, if a person with mean characteristics is partially retired in 1990, the chances that he or she will extend his or her partial retirement throughout 1992 is increased by 3.7 percentage points.

The estimate of the age coefficient implies that the probability that a person aged 65 in 1990 should exit to full retirement is higher than that a person aged 63 should do so. The difference in exit probabilities is rather large. If a 63 years old person is predicted to have a fifty-fifty chance of exiting from partial to full retirement, then a 65 years old, with the same personal characteristics other than age, is predicted to have a 69 percent chance of exiting to full retirement.

It should be noted that although we follow all persons over a three-year period, they reach the age of eligibility at different times in this period. Hence, they have been followed for different periods after having become eligible. If we assume that nobody will take out pension, for example private pension, before AFP-eligibility, then the age effect can be interpreted as reflecting the gradual retirement after the date of eligibility. As emphasized by Blau (1994) this indicates that it would give more insights into the retirement process if we studied changes over a shorter time period than whole years. Furthermore, 65 year olds became eligible even during 1990, and those who were then working full time may of course be a select group.

[1] This is around 15 percent of the average disposable pension per person in the population of all retired persons in Norway in 1992.

6.2 Estimation results when full-time work is the initial state

Table 6.2 Transition probabilities from State 3, Full-time work into State 1, Full retirement, State 2, Partial retirement and State 3, Full-time work

Variables	Destination states (j)					
	State 2, Partial retirement			State 3, Full-time work		
	Coeffi-cients from (11)	Esti-mate	t-value	Coeffi-cient from (12)	Estimate	t-value
Consumption: C_j-C_1	α_3	0.208 10^{-4}	4.8	α_3	0.208 10^{-4}	4.8
Intercept. -	$\beta_{32,2}$-$\beta_{31,2}$	-0.270	-0.1	$\beta_{33,2}$-$\beta_{31,2}$	0.382	1.4
Age 64	$\beta_{32,1}$-$\beta_{31,1}$	-0.758	-3.6	$\beta_{33,1}$-$\beta_{31,1}$	-1.281	-6.4
Age 65	$\beta_{32,2}$-$\beta_{31,2}$	-0.636	-3.0	$\beta_{33,2}$-$\beta_{31,2}$	-2.638	-10.6
Education at least 12 years	$\beta_{32,3}$-$\beta_{31,3}$	0.683	3.2	$\beta_{33,3}$-$\beta_{31,3}$	0.903	4.0
Female	$\beta_{32,4}$-$\beta_{31,4}$	-0.134	-0.6	$\beta_{33,4}$-$\beta_{31,4}$	0.611	2.7
Married	$\beta_{32,5}$-$\beta_{31,5}$	0.290	1.3	$\beta_{33,5}$-$\beta_{31,5}$	0.535	2.1
Service Industry affiliation	$\beta_{32,6}$-$\beta_{31,6}$	0.710	3.5	$\beta_{33,6}$-$\beta_{31,6}$	0.357	1.6

No of observations: 1125, Log-likelihood: -1098, Means: Q_{33}=0.384, Q_{32}=0.362, Q_{31}=0.253

From Tables 6.1 and 6.2 we see that the estimates of α_2 and α_3 differ. By testing the hypothesis that they are equal against the hypothesis that they are different, we cannot reject the hypothesis that they are equal. Thus, we cannot reject the hypothesis that the marginal utility of consumption is the same across initial states.

For a person initially working full time and with average characteristics, an increase in consumption of NOK 10 000 as a full-time employee will reduce the probability of exiting to full retirement by 2 percentage points. Moreover, it will also reduce the probability of exiting to partial retirement by nearly 3 percentage points. Consequently, it will increase the probability of staying in the state of full-time work by nearly 5 percentage points. A similar increase in consumption as part-time retired will have similar impacts on the transition rates, but with an increase in the transition rates of partial retirement and a reduction in the probability of remaining full-time worker.

To illustrate the partial impact of the individual characteristics on the transition probabilities we first set all dummy variables equal to zero and then include them one at the time. The disposable income in full-time work and partial retirement are set to the same value, close to sample averages in these two states for those who initially occupied the state of full-time work. The intercepts are set equal to zero. (As seen from Table 6.2 they are not significantly different from zero.) Consequently, the probability of staying in the state of full-time work and the probability of moving to partial retirement are the same, and equal to 0.40. Hence the probability of exiting to full retirement is equal to 0.2. The results are given in

Table 6.3. It should be noted that the reported effects are partial effects. Some of the individual characteristics, like education, also have a strong impact on income and pensions, and hence on disposable income. Keeping the disposable income constant we only assess the partial impact of individual characteristics on the transition probabilities.

Table 6.3. The impacts on transition probabilities from full-time work of partial variation in individual characteristics

Variables	Staying in full time work, Q_{33}	Exiting to partial retirement, Q_{32}	Exiting to full retirement, Q_{31}
Reference: All dummies are zero	0.40	0.40	0.20
Age 64 in 1990	0.23	0.37	0.40
Age 65 in 1990	0.07	0.48	0.45
Education at least 12 years	0.50	0.40	0.10
Female	0.57	0.27	0.16
Married	0.48	0.38	0.14
Service industry affiliation	0.36	0.51	0.13

From Table 6.3 we observe that age has a strong impact on the transition structure. The probability of exiting to full retirement increases from 20 per cent in the reference age group, 63 years in 1990, to 40 per cent among 64 year olds in 1990 and 45 per cent among 65 year olds. The probability of exiting to partial retirement is reduced to a much smaller extent, and most of increase in retirement is accounted for by a decreased probability of staying on in full-time work.

The education variable indicates that the higher the education is, the longer is full-time work extended. Women are predicted to extend their full-time work longer than men do, while the opposite is indicated with respect to part-time work. The net result with respect to the probability to retire fully is that women are predicted to have lower probabilities than men do. The number of females eligible for AFP is less than one fifth of the whole group, due of course to the historically low female labor force participation in this age group. This may imply that the females in our sample are a select group and may explain why they tend to extend their full-time work longer than males. Married persons also extend their full-time work more than their unmarried counterparts. Finally, to be employed in the service industry seems to favor transitions to partial retirement to an extent that the propensity to retire fully is drastically reduced. Again, it should be emphasized that the effects reported here are partial effects. For instance, women are likely to be over-represented in the service industries, which we have controlled for and which gives high transition to partial retirement. The combined effect of gender and industry affiliation may give the females a higher transition to partial retirement than males. Moreover, incomes and pensions are kept constant. To assess the total impact on the transition structure of variations in individual characteristics one has to account for the effects of these variations on incomes and pensions.

7. The simulated effects on the transition probabilities of offering a bonus if retirement is postponed

The estimated model has been used to simulate the effects on the transition probabilities of strengthening the financial incentives to extend the working life among those who are eligible to retire early and who work full time in 1990. Each individual who says yes to work full-time throughout 1992 is offered a bonus. The youngest one will then be 65 and the oldest one 67 years of age. The bonus chosen implies that the annual pension from 1993 and onwards are increased by 7.2 percent. This increase in the annual pension is equivalent to a wealth-increase that amounts to 72.34 percent of the annual disposable pension, when pensions are evaluated at sample means. Wealth is defined as the discounted value of future annual disposable pensions. Expected remaining lifetime is then set to 18 years, which is close to the actual mean for people in the relevant age groups in 1992, and the real interest rate is assumed to be equal to 7 percent. We assume that the real incomes are constant over time. It should be noted that our estimates are based on variation in pension and earnings in the near future. For each individual income streams beyond 1992 are unaffected by the state chosen in that year. Variation in the total future income stream is outside the observation set, and the validity of our approach depends on the assumptions set out in Section 4.

The chosen bonus accords with a bonus suggested by a government committee, NOU (1980). To check the responses we have also simulated the impact on the transition probabilities of giving the retired persons a smaller bonus, that is 1/10 of the bonus described above.

We have restricted the bonuses to those who worked full time in 1990. For each individual we have used the estimated model – also the pensions and income functions - to predict the choice probabilities. The aggregate transition probabilities shown below are the average of the predicted individual probabilities.

Table 7.1 Effects on transition probabilities from full-time work of offering a bonus if working life is extended

	Transition probabilities		
Alternatives	Staying in full time work, Q_{33}	Exiting to partial retirement, Q_{32}	Exiting to full retirement, Q_{31}
Reference case	0.384	0.362	0.253
Annual pensions increased by 7.2% after 1992 if working full time in 1992	0.706	0.164	0.130
Annual pensions increased by 0.72% after 1992 if working full time in 1992	0.418	0.341	0.241

A bonus that raises the annual pension by 7.2 percent from 1993 and onwards, that is throughout the remaining expected lifetime, will nearly double the probability of staying in a full-time job throughout 1992. This bonus reduces the probability of partial retirement relatively more than the probability of full retirement. It should be remembered that we have assumed that all other real incomes are constant over time. Thus, an increase of 7.2 percent in the annual pension is a rather generous bonus. From Table 7.1 we observe, however, that a tenth of this increase has a rather modest influence on the transition probabilities.

Given the way we have specified the budget constraint, the bonus is defined in terms of disposable income, and it is not readily interpreted in a policy context. A more realistic policy experiment would be to increase the pre-tax income and to adjust the taxation of retirement benefits to reach the desired income distribution. Finally, we have predicted the effects of an increase in total pensions, including employer-based and private pensions, which are endogenous. Taken together, policy experiments need more elaborate modeling than we have made here, or for that matter, than we have seen anywhere to date.

8. Conclusion

In this paper we have identified a group of 63-65 year olds who were qualified for a new early retirement scheme (AFP), and we have analyzed their retirement behavior during the period (1990-92) in which they became eligible. About one third went to each of the three destination states: continued full-time work, partial retirement and full retirement. The retirement behavior differed widely with personal characteristics and incentives.

Among those who worked full time in 1990, the proportion that went to full retirement in 1992 was 20 percentage points higher among 64 year olds than among 63 year olds. Because of the observation method, this reflects that retirement is drawn out in time, which can be caused both by the fact that the AFP-scheme was fairly new, and by a prolonged decision making process by the potential retirees. Hence, the take-up rate may increase over time, which indeed seems to have happened (Thøgersen *et al.*, 1998). Furthermore, since there has been a gradual reduction in the age of eligibility, with the latest reduction to 62 years effective from March 1 1998, retirement may be set to increase for many years, even in the absence of further changes. This may be part of the background for the work of a recent government committee on early retirement.

Early retirement tends to be low among females, among those with more education and among those working in the service sector. The proportion of the work force with these characteristics is likely to increase in the future, and this may slow down the increase in early retirement.

The economic incentives appear to influence retirement behavior, and the tax system reduces dramatically the economic incentives for full-time work. Earnings up to about ¾ of the average pension are taxed by 27 %, whereas pension or even a combination of pension and earnings up to that level are not taxed at all. This may be part of the explanation for the high transition to partial retirement.

Illustrating the response to economic incentives with a bonus increase in the yearly disposable pension, given for one more year of work (the size corresponds to a proposal a few years back by a government committee), the percentage working full-time an extra year increased by about 30 percentage points. We have not investigated the macroeconomic consequences of such a bonus.

Taking these effects into account and looking ahead, it appears that there are conflicting trends. Take-up rates may increase 'on their own', particularly in the light of the increases in early retirement coverage; while the changing work force composition towards more people working in the service industries and a higher educational level may tend to decrease take-up rates. Turning to the OECD report, OECD (1998) and the call for policy measures, we have found responsiveness to economic incentives, and we have also found strong work disincentives in the tax system. This might point to the tax system as a candidate for reducing early retirement. Regarding the pension system, we will point out that a substantial part is private and employer-based, and that one should take responses on the part of the employers and employees into account before embarking on reforms of public pensions.

References

Anderson, P. Gustman, A. and Steinmeier, T.: Trends in Male Labor Force Participation and Retirement: Some Evidence on the Role of Pensions and Social Security in the 1970s and the 1980s. National Bureau of Economic Research, Working Paper No. 6208, October 1997.

Berkovec, J. and Stern, S. Job Exit Behavior of Older Men. *Econometrica* 59, 1: 189-210, 1991

Blau, D. M.: Labor Force Dynamics of Older Men. *Econometrica* 62, 1: 117-156, 1994.

Blau, D. M. Social Security and the Labor Supply of Older Married Couples, *Labour Economics 4*, December 1997:373-418, 1997.

Gruber, J. and Wise, D.: Social Security Programs and Retirement Around the World. National Bureau of Economic Research, Working Paper, No. 6134, 1997.

Hernæs, E., Sollie, M. and Strøm, S.: Økonomiske betingelser og pensjonsbeslutning. *SNF-rapport 37,* 1997.

Hernæs, E., Sollie, M. and Strøm, S.: Virkninger på arbeidstilbud i yrkesaktive år av alternative pensjonsopplegg. In "*Fondering av Folketrygden",* NOU 1998:10.

Krueger, A.B. and Pischke, J-S.: The Effect of Social Security on Labor Supply: A Cohort Analysis of the Notch Generation. *Journal of Labor Economics* 10, 4: 412-437, 1992.

McCarty, T.A.: The Effect of Social Security on Married Women's Labor Force Participation. *National Tax Journal* 43, 95-110, 1990.

Moffitt, Robert, A.: Trends in Social Security Wealth by Cohort. In Moon, M. (ed): *Economic Transfers in the United States*, Studies in Income and Wealth, Vol 49, Chicago and London, University of Chicago Press, 1984

NOU 1980: Deltidspensjon og førtidspensjon fra folketrygden. *NOU 1980: 54*.

NOU 1998: Fleksibel pensjonering. *NOU 1998: 19*

OECD: Work-Force Aging: Consequences and Policy Responses. Chapter 4 in *Employment Outlook,* June 1998.

Pedersen, P. J. and Smith, N.: Duration Analysis of the Decision to Retire Early. In Wadensjø, Eskil (ed.) "*Leaving the Labour Market Early in the Welfare State"* North-Holland Elsevier, 1996.

Rust, J.: Behavior of Male Workers at the End of the Life-Cycle: An Empirical Analysis of States and Control. In *Issues in the Economics of Aging*, ed D. Wise. Chicago, University of Chigaco Press, 1990.

Samwick, A.A.: New Evidence on Pensions, Social Security, and the Timing of Retirement. *National Bureau of Economic Research*, *Working Paper* No. 6534, 1998.

Stern, S.: Approximate Solutions th Stochastic Dynamic Progams. *Econometric Theory* 13, 392-451, 1997.

Stock, J. and Wise, D. E.: Pensions, the Option Value of Work, and Retirement. *Econometrica* 58, 5: 1151-1180, 1990.

Stern, S.: Approximate Solutions to Stochastic Dynamic Programs. *Econometric Theory,* 13: 392-405, 1990.

Sueyoshi, G. T.: Social Security and the Determinants of Full and Partial Retirement: A Competing Risk Analysis. *National Bureau of Economic Research Working Paper* No. 3113, 1989.

Thøgersen, Ø., Bratberg, E. and Holmås, T. H.: Normer, incentiver og tidligpensjonering. *SNF-rapport* 33, 1998.

Vistnes, J. P.: An Empirical Analysis of Married Women's Retirement Decision. *National Tax Journal,* 48: 135-155, 1994.