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14 June 2006

Early Retirement and Company Characteristics

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Abstract

Early retirement decisions derived from a structural model with economic incentives and firm workforce changes, are estimated on Norwegian linked household and firm data. For households in which the wife is the first to become eligible for early retirement, the impact on early retirement of a reduction in the firm workforce is stronger relative to economic incentives than is the case for men, in particular in the private sector. Both for men and women, also an expansion of the firm workforce implies a higher retirement probability.The eligibility age in the early retirement programme has gradually been reduced from 66 in 1989 to 62 in 1998. We find that the economic incentives relative to the push factor have become more important, both for men and women, the lower the eligibility age is.

JEL: C35, J26

Keywords: Early retirement, demand side and supply side factors, microeconometric models, heterogeneity.

Introduction

The demographic transition and the continuing decline in labour force participation of older men in many industrialized countries have raised concern about the future financial situation of social security systems of the PAYGO type. Projections for Norway suggest that in the absence of major structural changes in the National Insurance System in Norway (NIS): "… expenditure on old age pension …is estimated to increase from 6 to about 15 percent of mainland Norway GDP …" from present to 2050 (Summary of Report No. 12 (2004-2005) to the Storting: Pension Reform - Safeguarding Our Pensions). These projections are driven both by demographics and by the maturing of the NIS, which was introduced in its present form in 1967. A continuation of the trend toward lower labour force participation, which we have seen for older males for many years, will exacerbate the financial difficulties.

The retirement age in the NIS is relatively high (67), but there is a generous access to disability benefit, which has played an important role in lowering labour force participation among older persons (Røed and Haugen, 2003). In addition, the introduction of an early retirement programme (AFP) in 1989 has contributed further to reduce labour force participation. At age 66 in 1997, about one fifth of the cohort was working and the rest equally divided between disability and all other states, among them early retirement (Statistics Norway, 1999). In principle, disability benefits are received on the basis of a medical assessment, whereas surveys indicate that AFP retirees are "healthy". In addition, there are strong economic incentives to stop working as AFP eligible. Policy changes to induce higher labour force participation, or at least to slow the decline, are therefore considered both with regard to early retirement and disability. In the paper we study the early retirement decision, since this appear to most readily influenced by policy measures. So far no substantial changes in the pension rules have been made, but reforms are being discussed. For the most recent proposal from the Government see Summary of Report No. 12 (2004-2005) to the Storting:

Pension Reform - Safeguarding Our Pensions. The website also contains previous reports, both in English and in Norwegian.

Previous studies (Hernæs *et al,* 2000, Hernæs and Strøm, 2000c and Bratberg *et al*, 2004) have shown that the take-up rate of AFP is strongly influenced by economic incentives, indicating that the replacement level might be an important tool for increasing labour force participation of older persons. This is well in line with results from other countries, see for instance Gruber and Wise (eds, 2004). Previous studies (Gustman and Steinmeier, 2000, Hernæs et al, 2001 and Jia, 2005) have also shown that the retirement decision of married persons is influenced by the labour market situation of the partner. In this paper, we extend this type of research along number of dimensions. Firstly, we split the sample into household in which the husband, respectively the wife is the leading spouse, that is the first spouse to become eligible for early retirement. This leads to the two major types of families considered in the paper: retiring older husband with younger working wife and retiring wife with already retired husband. We estimate the models for both groups.

Secondly, the introduction of the early retirement programme in the 1988-wage-negotiations as well as also the gradual decrease over the next 10 years in the eligibility age from 66 to 62, came as a surprise for all workers involved. Thus we can treat this programme almost as a experiment. The old age pension is not affected by any decision during the early retirement period, which in our sample ranges from 1 to 5 years. We do not think it is worthwhile to model the decisions during the early retirement period as a full stochastic dynamic programming problem, since the period is short and we believe that individuals are able to predict rather well what might happen to wage levels and work possibilities in the next 1-5 years. Therefore, in our modelling we have applied a forward-looking model in which we account for the fact that if an individual has not decided to retire early once he or she has become eligible to retire early, he or she has the option of doing so later, whereas we assume that there is no return from retirement. It should be emphasized that we estimate the early retiring probability of the leading spouse only the first 12 months after he or she has become eligible, but taking fully into account the consequences for later retirement options. The model allows for a transition also of the spouse of the leading person. In the analysis we apply the forward-looking model described below.

Thirdly, we observe all who are eligible in the early retirement program and we also observe their wage income up to early retirement eligibility. Based on their earnings history, we impute their potential pension, both from the early retirement programme (AFP), and the additional pensions which some companies use to top up the AFP. Moreover we account for all details in taxation, which varies with wage and pension income, and we are thus able to construct potential household disposable income in all possible states. This means that we can estimate the impact of economic incentives to retire early. We assume that the households are maximising utility when they make their joint decision of retirement and work. As an outside observer we do not observe their preferences with certainty. We will therefore assume a random utility function, IID extreme value distributed across time periods, states and households. This leads to conditional logit choice probabilities. We have applied a structural model, with a specified and justifiable utility function and with budget constraints that covers all details, including tax as well as pension rules. The reason why is that "…knowledge of structural or causal parameters is essential for policy analysis", Cameron and Trivedi (2005).

Macro data indicate an inverse relationship between labour force participation of older persons and the rate of unemployment (Oshio and Yashiro, 1997). At the micro level, we hypothesise that changes in labour demand affect older persons via the company in which they work. If the number of employees are changing in private firms or in public sector offices, either because the unit is expanding or contracting, we expect that older persons will be encouraged to take out early retirement once the option becomes available. Because we have a panel, we are able to identify expanding and contracting working places, characterized by gross flows of workers. In the early retirement program that we are analysing, the cost for the employer if the employee retires early is less in the public than in the private sector. In the public sector the budget of the employing agency or office is not affected, since the pension is paid by the public sector pension programme. In the private sector the employer has to cover part of the pension costs. To check whether variation in incentives for employers to retain employees influence the retirement pattern, we weight the utility when retiring early, as measured by the deterministic part of the utility function, with a function of variables that indicates whether the work place of the agent is expanding, contracting, disappearing or remains unchanged. This weighting function can be considered as a probability density function related to stochastic opportunity sets, and reflects the frequency of push factors at the different working places. For more details about stochastic opportunity sets within random utility models we refer to Dagsvik and Strøm (2006).

We thus estimate the propensities to retire based on a random utility model with detailed data on economic incentives on the part of the individual, together with labour demand indicators. This provides a first look at "push factors" embedded in a structural microeconometric model of the retirement decision.

The estimates of the parameters of the deterministic part of the utility function compare well with estimates obtained on other datasets, see Dagsvik and Strøm (2006), and the model predicts rather well compared to observed values.

We find that both economic incentives and push factors matter for the decision to retire early. The strongest response to economic incentives is found in the case of leading (the first to become eligible for early retirement) husbands who work in the private sector. A striking result is that the push factors have the same sign whether the work place is expanding or contracting, but are strongest in contracting firms. For leading husbands the responses to push factors are strongest in the public sector and for leading wives in the private sector. The eligibility age in the early retirement programme has gradually been reduced from 66 in 1989 to 62 in 1998. We find that the economic incentives relative to the push factor have become more important, both for husbands and wives, the lower the eligibility age is.

The paper is organized as follows. The next section describes the institutional setting while Section 2 describes data. Section 3 presents the econometric model. The empirical specification of the model is given in Section 4. Estimates and policy simulations are given in Section 5 and 6, respectively. Section 7 concludes.

1. Institutional Setting

An early retirement programme (AFP) came into effect in Norway in 1989, as part of the national wage settlements of 1988. This programme allows retirement before age 67, when ordinary old age pension can be received. The AFP eligibility age was 66 from 1 January 1989, 65 from 1 January 1990, 64 from 1 October 1993, 63 from October 1 1997 and 62 from March 1 1998.

The AFP programme covers all government employees (of local and central government) and private sector employees of companies which have joined the programme. For private sector companies participation is voluntary, but will usually be a part of the agreement with the union. In 2001, about 60 per cent of the labour force is covered. In addition to working in a participating company or in the government sector, only those individuals are eligible for AFP who

had been employed in the company the last 3 years or had been employed in other companies also operating the AFP scheme the last 5 year,

had earnings at a level at least corresponding to the basic pension (G) when AFP is taken up, had earnings at least equal to the basic pension the year before,

had an average proportion between earnings and the basic pension of at least 1 in the 10 best years after the age of 50 and

had at least 10 years in which earnings were at least twice the basic pension.

Persons meeting these individual criteria, while working in companies covered by the programme, become eligible from the month after they turn the required age. With information on birth date, we are therefore able to identify exactly the date of eligibility.

Although the AFP programme is a negotiated agreement, the benefits received are largely the same as in the ordinary public old age pension system (NIS), based on the actual earnings history and even with a projection of normal earnings from AFP take-up and up to age 67. Hence, there is no penalty on early retirement. At the end of the observation period (2001), the NIS pension for a single person varied between 91 000 NOK (1.8 times the basic amount, G, which was 50 603 NOK at the end of 2001) and 202 000 (4 times G). The exchange rate in June 2006 was around 7.8 NOK per Euro. Income above 12 G does not count towards the pension, and income between 6 and 12 G counts one third of income between 1 and 6 times G. For entitlements accrued before 1992, the split is at 6 G, rather than 8 G. The system is therefore strongly re-distributive. A detailed explanation of how the NIS pension is calculated is given by Hernæs and Strøm (2000b). An overview in English of the Norwegian Social Security System is given in The Norwegian Social Insurance Scheme (2005).

Private sector employees receive an AFP pension from take up to age 67 equal to the ordinary public old age pension. Public sector employees receive the same AFP pension as private sector employees up to age 65, when they receive the old age pension for public sector employees, which over the observation period was 2/3 of income up to 8 G and 2/9 of income between 8 G and 12 G. The details can be found in Hernæs and Strøm (2000b).

The AFP is generally strongly earnings tested. Up to 1 August 2000 earnings above 1 G implied 50 % reduction in the AFP pension. Before 1997, earnings from the private sector did not lead to a reduction in AFP for public sector retirees aged 65-67.

From 1 January 1997 part-time retirement was introduced. If the employer allowed it, an AFP eligible employee could take out pension one or two days a week, receiving 80 (60) per cent of the wage and 20 (40) per cent of the AFP pension.

There are also special tax rules, which apply to retirement benefits. Details are given in Haugen (2000). All details in the tax system are accounted for when estimating the model. In the early retirement programme an annual tax-free fixed amount is given to those who retired from a job in the private sector. In the government sector a higher, but taxed, amount is awarded.

Finally, some private companies top up the AFP pension. This is imputed as described in Section 4.

Pensions for private employees are financed partly by government and partly by employers. The government subsidy covers 40 per cent of pensions for retirees aged 64-67. The remaining 60 per cent, and the full pension for retirees aged 62-64, are covered by employers, via funds financed by pooled contributions from employers. In most industries the company of the incumbent contributes 10 per cent of the pension, whereas the rest is levied according to the wage sum of each company. In other industries the company of the incumbent pays the whole pension of their own retirees. Pensions for government employees are paid directly by the government.

2. 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. (Details about the data sources can be found in Hernæs and Strøm, 2000b.)

For the present study, we used register files covering the entire population and spanning the period 1992-2001. We extract detailed information on employment (including identification of the employer), earnings and benefits (including pension income) of various types, gender, birth date, marital status, educational attainment and place of residence. There is information about the month in which the retirement option becomes available and the month in which it is taken out.

Earnings history is available from 1967 in the form of on accrued rights in the public sector pension system, via year-by-year total pension-accruing income and pension points in the public pension system. This is the basis for predicting potential public pension. There is no identification of the income source in the earnings history files, so we do not know whether the income gives right to other pensions than the public. Hence, there is no direct information neither on accrued rights in employer-based pensions in the private sector or private pensions, nor on AFP eligibility. As described below, we use panel information on receipt of benefits among retirees and their former company, to identify companies which provide these benefits and impute the level of the potential pension for the individuals.

3. The Retirement Decision Model

Since ordinary old-age pension from age 67 is largely unaffected by any early retirement, we need only consider the economic attributes of alternative routes up to age 67 when modelling early retirement behaviour. Those persons who qualified at age 65 (before October 1, 1993) had two more years before qualifying for ordinary old-age pension at age 67, and this will be their planning horizon. Those qualifying at age 64 (from 1 October 1993) had a three years planning horizon, those qualifying at age 63 (from October 1, 1997) had four years planning horizon, and those qualifying at the age of 62 (from March 1, 1998) had five years planning horizon. Let period t be the 12 months period after the eligibility date and let t+1 and t+2, etc be the subsequent 12 months periods. As emphasized above, we estimate retirement probabilities only in period t=T1 (*i.e.* during the first 12 months after the agents become eligible), but we allow persons to take into account restrictions on the choice set and economic attributes following the choice in period t, over the remainder of the period until age 67. The reason is that we assume that if a person retires early in period t, then the only feasible state in later periods is retirement. If the person decides to work in period t, despite being eligible for retirement, then the options in period t+1 are work, retirement or out for the labour force. With 65 as the qualifying age, options both for period t+1 and t+2=T2 must be taken into account, and so on for lower eligibility ages.

Note that the start of period t, and hence of period t+1 and t+2, etc, may vary across households and thus, the periods do not follow the calendar year.

The decision model

Our starting point is the random utility framework (see McFadden, 1973 and Ben-Akiva, Lerman 1985). We assume that the utility of each alternative consists of two components – a deterministic part which depends on the characteristics of the alternative as well of the decision making household, and a stochastic part which randomly effects the choice. A common assumption in dynamic random utility settings is that the decision makers know the stochastic part of their utility only in the present time and rely in their judgements about the future on the expectation of random future utility. We add to this a discount factor γ to be able to compare the future and present utility. Denoting $U_{ij}(t)$ the random utility of household at time t when the leading spouse (who first qualifies) occupies state i and the second spouse occupies state j (household subscript is suppressed for simplicity) we have a dynamic random forward-looking recursive utility function of the form

$$U_{ij}(t) = u_{ij}(t) + \varepsilon_{ij}(t) + \gamma E\{ \max_{(x,y)\in S(i,j,t)} U_{xy}(t+1) \}, \tag{1}$$

where $u_{ij}(t)$ is the deterministic part of the utility and $\varepsilon_{ij}(t)$ is stochastic. We assume that $\varepsilon_{ij}(t)$ are independent and identically extreme value distributed (IDD) with location parameter η and scale parameter σ for all i, j and t. The last term in (1) represents the forward-looking nature of the utility. Choice set $S(i,j,t)$ faced by household in time period t+1 depends on the choice (i,j) made in period t according to the absorption assumption, and also the situation at their working place at time t.

The extreme value distribution has very convenient properties, which permit transformation from the recursive expression (1) to a simple multinomial logit model with some additional terms. We will do this separately for two models described below. The first one is a two period model and the second is a three period model. To extend it to more than three periods is straightforward.

Two period model

In the two periods setup the second period utility loses it's forward looking term and becomes just (T2 is period 2)

$$U_{rs}(T2) = u_{rs}(T2) + \varepsilon_{rs}(T2). \tag{2}$$

Since the random term is extreme value distributed the whole utility expression also follows this distribution but with the location parameter equal to $u_{rs}(T2)$. The expected maximum of the extreme value distributed utilities is equal to $\frac{1}{\sigma}\ln \sum_{(r,s)\in S(i,j,T1)} \exp[\sigma \cdot u_{rs}(T2)]$ with the common scale parameter σ (Ben-Akiva and Lerman (1985)). Thus

$$E\{ \max_{(r,s)\in S(i,j,T1)} U_{rs}(T2) \} = \frac{1}{\sigma}\ln \sum_{(r,s)\in S(i,j,T1)} \exp[\sigma \cdot u_{rs}(T2)] \ + \frac{\eta}{\sigma}, \tag{3}$$

where η is Euler constant (η ≈ 0.577). Utility function at T1 then becomes

$$U_{ij}(T1) = u_{ij}(T1) + \varepsilon_{ij}(T1) + \gamma \frac{1}{\sigma} \ln \sum_{(r,s)\in S(i,j,T1)} \exp[\sigma \cdot u_{rs}(T2)] + \gamma \frac{\eta}{\sigma}. \quad (4)$$

Denoting

$$v_{ij}(T1) = u_{ij}(T1) + \gamma \frac{1}{\sigma} \ln \sum_{(r,s)\in S(i,j,T1)} \exp[\sigma \cdot u_{rs}(T1+1)] + \gamma \frac{\eta}{\sigma}, \quad (5)$$

then

$$U_{ij}(T1) = v_{ij}(T1) + \varepsilon_{ij}(T1). \quad (6)$$

It is now clear that the one period forward-looking model allows for standard conditional logit interpretations. Indeed, the probability of choosing a particular state (*i,j*) by household *h* at T1 can be evaluated as follows (S_0 is the choice set faced by the household at T1, the household script is still suppressed).

$$Pr(i,j,h) = Pr\{U_{ij}(T1) = \max_{(x,y)\in S_0(i,j,T1)} U_{xy}(T1)\} = \frac{\exp(\sigma \cdot v_{ij}(T1))}{\sum_{(x,y)\in S_0(i,j,T1)} \exp(\sigma \cdot v_{xy}(T1))}, \quad (7)$$

Now define

$$Y(i,j,h) = \begin{cases} 1 \text{ if household } h \text{ is observed in state } (i,j) \text{ after } T1, \\ 0 \text{ otherwise.} \end{cases} \quad (8)$$

The likelihood function can then be directly written as

$$LF = \prod_{h=1}^{H} \prod_{(i,j)\in S_0(i,j,T1,h)} Pr(i,j,h)^{Y(i,j,h)}, \quad (9)$$

where H is the total number of households. The log-likelihood function is

$$logLF = \sum_{h=1}^{H} \sum_{(i,j)\in S_0(i,j,T1;h)} Y(i,j,h) \cdot \ln Pr(i,j,h). \quad (10)$$

The parameters of the model can be estimated through a maximum likelihood procedure.

Three period model

In the three period model it is reasonable to trace the evolution of the utility function from the recursive form in all periods starting from the third one. At the last period the forward looking component is missing as in the previous setup.

$$U_{kl}(T3) = u_{kl}(T3) + \varepsilon_{kl}(T3). \tag{11}$$

The same logic as above helps to express the second period expectation of the third period best choice as

$$E\{\max_{(k,l)\in S(r,s,T2)} U_{kl}(T3)\} = \frac{1}{\sigma}\ln \sum_{(k,l)\in S(r,s,T2)} \exp[\sigma \cdot u_{kl}(T3)] + \frac{\eta}{\sigma}. \tag{12}$$

At T2 these two variables take form

$$U_{rs}(T2) = u_{rs}(T2) + \varepsilon_{rs}(T2) + \gamma E\{\max_{(k,l)\in S(r,s,T2)} U_{kl}(T3)\} =$$

$$= u_{rs}(T2) + \varepsilon_{rs}(T2) + \gamma\frac{1}{\sigma}\ln \sum_{(k,l)\in S(r,s,T2)} \exp[\sigma \cdot u_{kl}(T3)] + \gamma\frac{\eta}{\sigma}. \tag{13}$$

$$E\{\max_{(r,s)\in S(i,j,T1)} U_{rs}(T2)\} =$$

$$= \frac{1}{\sigma}\ln \sum_{(r,s)\in S(i,j,T1)} \exp\left(\sigma \cdot u_{rs}(T2) + \gamma \ln \sum_{(k,l)\in S(r,s,T2)} \exp[\sigma \cdot u_{kl}(T3)] + \gamma\eta\right) + \frac{\eta}{\sigma} \tag{14}$$

And finally at T1 we have

$$U_{ij}(T1) = u_{ij}(T1) + \varepsilon_{ij}(T1) + \gamma E\{\max_{(r,s)\in S(i,j,T1)} U_{rs}(T2)\} =$$

$$= u_{ij}(T1) + \varepsilon_{ij}(T1) +$$

$$\gamma\frac{1}{\sigma}\ln \sum_{(r,s)\in S(i,j,T1)} \exp\left(\sigma \cdot u_{rs}(T2) + \gamma \ln \sum_{(k,l)\in S(r,s,T2)} \exp[\sigma \cdot u_{kl}(T3)] + \gamma\eta\right) + \gamma\frac{\eta}{\sigma}. \tag{15}$$

Letting

$$w_{ij}(T) = u_{ij}(T1) + \gamma +$$

$$\frac{1}{\sigma}\ln \sum_{(r,s)\in S(i,j,T1)} \exp\left(\sigma \cdot u_{rs}(T2) + \gamma \ln \sum_{(k,l)\in S(r,s,T2)} \exp[\sigma \cdot u_{kl}(T3)] + \gamma\eta\right) + \gamma\frac{\eta}{\sigma}, \tag{16}$$

we again get a simple expression

$U_{ij}(T1) = w_{ij}(T) + \varepsilon_{ij}(T1).$

Here T is the vector {T1,T2,T3}. (17)

Once again it is clear that the model allows for a simple multinomial logit interpretation with the choice probabilities

$$Pr(i,j,h) = \frac{exp(\sigma \cdot w_{ij}(T))}{\sum_{(x,y)\in S_0(i,j,T;h)} exp(\sigma \cdot w_{xy}(T))}, \quad (18)$$

and as before the log-likelihood function is

$$logLF = \sum_{h=1}^{H} \sum_{(i,j)\in S_0(i,j,T;h)} Y(i,j,h) \cdot \ln Pr(i,j,h). \quad (19)$$

Thus, both models are simple modifications of the standard multinomial logit model. This is due to the special approach to dynamic modelling. Future choices are represented by terms describing the expected best option, which will be chosen from the available set in the next periods. The only difficulty left to the estimation stage is the relationship between the choices being made and the choice sets available in the following periods. In calculating the values for $v_{ij}(T1)$ and $w_{ij}(T)$ all the branches of the corresponding decision tree must be carefully followed. Otherwise, the models are estimated with standard maximum likelihood procedure.

To account for the push factors we let $g(z_r)$ denote the demand side density where z_r is a vector of work place characteristics associated with the state of retirement for the leading spouse. In the state of working for the leading spouse, g(.)=1. The probability in (18) then takes the form:

$$\Pr(i,j,h) = \frac{\exp(\sigma w_{ij}(T)) g(z_i))}{\sum_{x,y\in S_0(i,j,T;h)} \exp(\sigma w_{xy}(T)) g(z_x)} \quad (20)$$

We note that σ is absorbed in the scaling of the utility functions and hence it is not identified. The probability in (20) allows for distinguishing between the economic incentives in the retirement decisions, variables in the w(.) functions, and demands side factors related to the work-place captured by the g(.) functions.

4. Empirical Specification

Sample

The observation window given by our data allows for observation of the labour market situation before and after eligibility for AFP for persons who became eligible during the period 1 January 1993 – 31 December 2001. Since the eligibility age for AFP was lowered from 64 to 63 from 1 October 1993 and to 62 from 1 March 1998, the population whose behaviour can be studied is restricted to persons born between 1 January 1928 and 31 December 1937. In the cohorts we are looking at, the majority of the population is married. 76 per cent of males and 66 per cent females aged 64 were married 1 January 1999 (Statistics Norway; http://www.ssb.no/emner/02/01/10/folkemengde/arkiv/1999/t-4n.html).

Since the AFP programme is employer-based, we identify employers where some of the employees took out early retirement and identify all other employees in those companies. With this procedure, we may miss some companies, but are certain that those companies that are identified are participating. Employees of companies not covered, typically small companies in the private sector, persons with short labour market careers and self-employed are excluded. From a modelling point of view, this is a reasonable limitation, since the incentives will be different for employees in very small companies and for self-employed, requiring a different modelling approach. Even with this limitation, the AFP companies cover employees of more than half the labour force. A substantial proportion is still in the labour force at age 64, in 1997 40 per cent of males and 29 per cent of wives (Statistics Norway, 1999). The analysis therefore covers an important phase in the transition from work to retirement, although not all these employees qualify for AFP. In addition to being employed by companies that are covered, there are individual requirements on working hours and work experience as described in Section 2.

The unit of our analysis is a household with at least one family member becoming AFP eligible. We allow for different behaviour depending on whether the husband or the wife first becomes eligible, also taking into account choice opportunities of the second spouse (particularly, whether she or he later becomes eligible for AFP). Tables 1 and 2 show the populations studied.

Table 1 Total and target population born 1928-37, resident 1992 -1997

Category	Number of persons or couples
Individuals born 1928-37, resident 1993-2001	622 467
Of these:	
Single males (including widowers and divorcees)	176 680
Single females (including widows and divorcees)	195 329
Couples married throughout period 1993-2001	170 731
- with one person eligible for AFP	57314

Table 2 Labour states of the target population before AFP eligibility

Spouse	Labour situation	Qualifying spouse in a household		Total
		Husband	Wife	
Husband	Work	43 130	5 038	48 168
	Pension	-	7 368	7 368
	Disability benefits	-	943	943
	Unemployment	-	114	114
	Other	-	721	721
Wife	Work	28 682	14 184	42 866
	Pension	1 263	-	1 263
	Disability benefits	6 746	-	6 746
	Unemployment	582	-	582
	Other	5 857	-	5 857
Total number of households		43 130	14 184	57 314

The states

Feasible states for each of the spouses are given in the Table 3. The household thus occupies one of nine states which are combinations of states held by wife and husband.

Table 3 Feasible states

States	Qualifying spouse	Other spouse
1	Work	Work
2	Retirement	Retirement
3	Out of labour force (OLF)	Out of labour force (OLF)

Each person is classified as initially (with priority to the first state found):

working if earnings as employee in year T-1, *i.e.* the year before AFP eligibility of leading spouse

retired if receiving AFP or age 67 (receiving old-age pension)

OLF otherwise

The destination states are similarly defined

working if earnings as employee in year T1 and T2, or earnings as employee in one of those years and not found in any other registers.

retired if receiving AFP or age 67 within 12 months after AFP eligibility of leading spouse

OLF otherwise

We assume absorption for both retirement and OLF states. Thus, once retired or moved out of labour force, a person has no option to go back to work. Even though this seems a rather simplifying assumption, it is supported by the data. Tables A.1 and A.2 in the Appendix present the transfer matrices for the households under consideration.

From Tables A.1 and A.2 we note that among households in which the husband first qualifies, 30 per cent of the wives are out of the labour force, mostly being unemployed.

When the wife qualifies first, most of the husbands already receive pension. This reflects the typical age pattern in marriages.

Of the qualifying spouses about one quarter retires during the first 12 months after being eligible to retire early, and most of the rest continue working. A small percentage leaves their job without early retirement. Some start receiving disability benefit, some become unemployed and some may be misclassified. Among the spouses who do not qualify 95 per cent continue to work. Among those who change their state, some start receiving a pension, and a certain percentage, particularly among women, leave their job, mostly becoming unemployed.

The labour affiliation of the non-qualifying spouse (as well as his or her age) is not restricted which requires taking into account possible limitations on her choice sets. Typical cases would be a household with husband qualifying and his younger wife not, or on the other hand wife qualifying with her older husband already retired. Such limitations are fully embedded into the estimation procedure in the form of decision tree cropping for corresponding observations.

Functional form of the utility

The deterministic utility function u_{ij} is specified as a Box-Cox transformation of disposable household income and linear in leisure of the two spouses.

$$u_{ij}(t) = \alpha(\frac{C_{ij}^{\lambda} - 1}{\lambda}) + a(X_L)LL + b(X_s)LS + f(X_F)LF \tag{21}$$

Here C_{ij} stands for household disposable income in 1000 NOK. If the shape parameter λ is equal to 1, the deterministic part of the utility function is linear in income. If the shape parameter goes towards zero, the function becomes a log-linear function of income. A justification for a utility function that is a Box-Cox transformation of disposable income is given in Dagsvik and Strøm (2006).

Moreover, leisure is denoted as follows:

LL=leisure of leading spouse

LS= leisure of the second spouse

LF= min(LL, LS)=common leisure.

The scale parameters of the functions are α, $a(X_L)$, $b(X_S)$ and $f(X_F)$. The scale parameters for leisure are assumed to depend on observed covariates. This reflects a hypothesis that many of the non-pecuniary effects on the retirement decision operate through evaluation of leisure compared to income. The leisure parameters are assumed to be

$a(X_L)=a_1+a_2X_L$, where X_L= education in years of leading spouse

$b(X)=b_1+b_2X_S$, where X_S= education in years of the other spouse

$f(X_F)=f_1+f_2X_{F1}+f_3X_{F3}$, where X_{F1}= absolute age difference in years between spouses, and $X_{F3}=X_{F1}^2$

Disposable income

$$C_{ij}=r_{Mi}+r_{Fj}-T(r_{Mi},r_{Fj}) \qquad (22)$$

r_{Mi} is pre-tax income of the husband if he is in state i, and r_{Fj} is pre-tax income of the wife is she is in state j. $T(r_{Mi},r_{Fj})$ is the tax paid by the couple.

For both spouses, pre-tax income in the working-state is assumed to equal earnings in the calendar year prior to the eligibility year. Since there is no transition back to work among non-working spouses, we do not need potential work income for those.

Potential pre-tax retirement income (pension) is predicted from the earnings history. The NIS pension follows from the earnings history, which is available from 1967. The NIS pension treat all "pension accruing earnings" the same way, regardless of the source or type of employer. As for the AFP pension from age 65 of former government employes, we know the identity of the employer only from 1992, so we assume that persons who were government employees in the calendar year before eligibility were also government employees throughout the recorded earnings history. This forms the basis for predicting government pension. The unobserved private sector top-up of the AFP pension is predicted with a methodology similar to that used to identify AFP eligibility. The panel data give the amount of occupational pension received by retirees, and identifies their former company. Current employees of these companies are then assumed to have their potential AFP topped up by the company. The level is predicted with a regression on last wage, industry and gender. More details can be found in Iskhakov and Kalvarskaia (2003)

The fixed AFP-amount does not vary and is not explicitly included. It will be absorbed in the constant term.

For married couples, the option for the non-qualifying spouse of leaving the labour force before retirement, for instance at the same time as the (qualifying) spouse, incur the loss of any AFP pension before age 67, since one of the requirements for AFP is to be working. Therefore, we identify all who are working in AFP companies, including persons who qualify after their spouse, and calculate the loss of AFP following the OLF option.

Leisure

We distinguish between two fixed levels of leisure corresponding to the working state and the two non-working states. The leisure values are equal to the fractions of time available for leisure per week after deducting 8 hours per day, *i.e.* 37.5 divided by 7 times 16 if working, and 1 if not working.

Company characteristics and the evaluation of leisure

Both in contracting and in expanding firms in the private sector and public offices, there may be a pressure on older persons to take early retirement if that is an option. Expanding firms may want to renew their competence, and contracting firms may find it easier to encourage early retirement than to fire people. We thus assume that high turnover may indicate that the company wants to reduce the number of older workers. To avoid endogeneity problems we use flows of persons in the years preceding AFP eligibility. We measure the relative flows as proportions of the number of employees in the annual employer registers.

To avoid short-term hires, we include entrants over the year who are still in the company next 1. February and exits who were in the company the previous 1. February. The pressure effect is assumed to influence the evaluation of the time worked, and thereby also the evaluation of leisure. For persons becoming eligible in each calendar year, we use the flows measured between 1. February of that year, and 1. February of next year.

The g-density function is specified as:

$$g(Z_r)=\exp(g_1 Z_{1r}+g_2 Z_{2r}+g_3 Z_{3r}) \qquad (23)$$

where r indexes the spouse who is eligible to retire early, and

Z_{1r}= 1 if the relative change in the number of employees in the previous year is less than -95% (disappearing work place) and 0 otherwise,

Z_{2r}= 1 if the relative change in the number of employees in the previous year is between 95% and -5 % (contracting work place) and 0 otherwise,

Z_{3r}= 1 if the relative increase in the number of employees in the previous year is more than 5% (expanding work place) and 0 otherwise.

Thus the reference case is a work place where change in the number of employees was between -5% and + 5% (stable work place).

5. Estimation results

All models are estimated separately according to whether husband or wife first qualifies for AFP ("leads"), and whether he or she works in the public or private sector. Thus, we have four cases for each model. In all cases the discount factor γ was set equal to 0.95. As described above, we estimate solely the probability of retirement during the first 12 months after eligibility, but with the agents taking into account consequences for later retirement options.

We have estimated models with one, two or three periods, and found that the log-likelihood increased substantially from one to two periods, but not much from two to three periods. We decided not to go beyond a window of three periods, and we have not reported results from the one period model.

Most of the parameters are sharply estimated and the estimates are almost the same across the length of the early retirement period prior to the NIS age of retirement at 67 (two and three periods). We have also estimated the models on a reduced sample, which includes only those who became eligible at the age of 62-64 (in the full dataset also those eligible to retire at the age of 65 were included). In the appendix we have given the full results of estimations of the two and three period models with the full and the reduced samples. From Tables A3- A.6 we observe that the coefficients are estimated to be very similar in the full and in the reduced sample. In the following, we focus on the three period model and give the most important estimates from the full samples in Table 4.

(Table 4 about here)

With one exception the estimates of the shape coefficient λ ranges from 0.40 to 0.72, which are the same magnitude as estimates obtained on quite different labour supply data, see Dagsvik and Strøm (2006). The exception is the case where the husband is leading and works in the private sector. Here the shape coefficient is not significantly different from 0, which means that the deterministic part of the utility function is log-linear in consumption.

When the wife is leading and works in the private sector, her marginal utility of leisure is estimated to increase with her educational level, while the opposite is the case if she works in the public sector. The reason for the difference may be that in the public sector, more educated women are more likely to work in interesting jobs in e.g. schools, colleges, universities and hospitals. If jobs in the public sector for more educated women are more challenging and varied than in the private sector, the marginal utility of leisure may decline with education levels, and thus give educated women an incentive to postpone retirement. In the private sector the more educated women may have more stressful jobs, with less chance of reaching high-ranking positions, at least in the cohorts considered here.

When the husband is leading, his marginal utility of leisure is increasing with the education level, irrespective of sector affiliation. If the husband works in the private sector the marginal utility of his wife's leisure also increases with her education level, while the education level has no impact on her marginal utility of leisure if the husband works in the public sector (see appendix).

The marginal utility of joint leisure is a u-shaped function of the age difference between the spouses, but for the relevant age differences the marginal utility of joint leisure is lower the larger the age difference is. With wife as the leading spouse it is more likely, compared to when the husband is the leading spouse, that the husband is older and has already retired. The older the husband is relative to the wife, the more likely it is that the wife prefers continue working rather than looking after her elderly husband at home.

Previous literature has found a positive correlation in the retirement behaviour of spouses; An et al. (2004), Hurd (1990), Henretta et al. (1983). In our case most of the non-qualifying spouses stay in their initial state over the modelled period and transitions are found only among the qualifying spouses. The raw transitions rates of Tables A.1 and A.2 show a slightly higher retirement percentage if the non-qualifying spouse is not working. In the model, a non-working spouse will have high leisure, so retirement of the qualifying spouse will increase both own and joint leisure. The coefficients for joint leisure, using the relevant level of age difference are generally negative. This means that retirement will be less attractive the larger the age differences, and thus less attractive with a non-working and considerably older or retired spouse than with working spouse, of same age.

A striking result is the impact of the push factor on the probabilities of retirement. Both in expanding and contracting private firms and public offices individuals have higher early retirement probabilities, than in firms with constant workforces. For men, and to some minor extent for women, the push factors have a stronger effect in contracting firms (relative to a stable working environment) than in expanding firms.

One interpretation is that firms are able to influence the retirement probability, for instance by adjusting or failing to adjust tasks and workloads for older persons in cases where this is needed. This may to some degree be used by firms to reduce the workforce, or to bring in new types of competence in an expansion. This seems to be a promising avenue of further research, provided suitable data are available.

Another interpretation of this result is that potential retirees may find it difficult to continue working when there are large changes in the workforce, irrespective of any specific policy from the firm. Adapting to or learning new tasks may be less attractive when retirement in any case is only a few years off, and this may increase the likelihood of retirement.

Hence, both expansion and contraction are bad news for potential retirees who want to continue working, and more so for women than for men. In Section 6 we will discuss the magnitude of the effect of push factors relative to the effect of economic incentives.

We observe that McFadden's rho ranges from 0.44 to 0.62, which are rather high values. The interpretation is that our models explain data around 44 to 62 percent better than models where all decisions are made at pure random.

(Table 5 about here)

In Table 5 we compare the observed fractions across the 9 possible states of spouses' combinations of work, pension and OLF with the predicted aggregate probabilities derived from the 3-period model. We observe that the predictions are reasonably good. Deviations between observed and predicted values are minor, with slightly poorer correspondence in the case of husband being the leading spouse and working in the private sector.

6. Policy simulations

In Table 6 we report the impact on the probabilities based on the full sample and aggregated over households, of eliminating the push factors and of a 10 percent increase in wage income before tax relative to the pensions before tax. In the calculation of these impacts we use the model and simulate the responses of each household and then we aggregate over the households. To eliminate the push factors we set the g-functions in the probabilities equal to 1. Of course, this elimination of the push factors is only meant to demonstrate how important they are for the retirement decision, given the estimated model. The model is estimated in an environment where these push factors operate and to eliminate them in a real world setting may require that other variables have to change like wage rates, pension etc.

(Table 6 around here)

Table 7 summarizes the impact of policy simulations on the marginal probability of working both for the leading spouse and the secondary spouse, and based both on the full sample of eligible age 62-66 and the reduced sample of eligible age 62-64. The predictions for the reduced sample are given in Table A.7. This sample includes only households in which the leading spouse became eligible after the reduction in the eligibility age to 62, *i. e*. after 1 March 1998. Differences in estimates (given in Tables A.1 – A.6) and predictions (Tables 8 and A.7) can therefore be interpreted as a combination of change over time and lower eligibility age.

(Table 7 around here)

The impact on the marginal working probability of the secondary spouse is negligible and we focus on the leading spouse. For households with leading wives, the impact of a 10 per cent wage increase is less than the impact of removing the push factors. When the husband is leading, the impact is much more similar, and it appears that the push factors are more important for females than for males, in particular in the private sector.

As noted above, the eligibility age in the early retirement programme has gradually been reduced from 65 in 1993 to 62 in 1998. Comparing the full and the reduced sample, we find that the economic incentives relative to the push factor have become more important, both for men and women, either over time or with lower eligibility age.

7. Conclusions

In this paper we have estimated a structural random utility model on Norwegian household data, covering households where either the husband and/or the wife is eligible to retire early according to a programme that was introduced in 1989. In estimating the model we distinguish between which of the two, husband or wife, is the first to become eligible to retire early. Moreover we also distinguish between the private and the public sector.

We have access to a dataset where we match workers and their working place. This dataset covers the whole population that became eligible to retire early between 1992 and 2001. During this period the eligibility age was gradually reduced and in a way the individuals could not foresee. In addition to data about the working place of the individuals we also have detailed information about the labour market states, wage income and potential pension of the individuals. This information enables us to construct quite accurately the budget constraint the households face. We also observe the change in the number of employees at work-place right before the individuals become eligible to retire early.

Our model explains data rather well and the predictions of 11 different states of the household are remarkably close to observed values. A lively debated issue is whether individuals who are eligible to retire early are pushed out the working place or retire voluntarily due to the economic incentives related to income and leisure. We find that the push factors are important determinants of the propensities to retire early and more so for women than men. These push factors work in the same direction whether the working place has been expanding or contracting in the recent past, with a slight overweight to the push factors in contracting workings places. But also the economic incentives matter, in particular for men working in the private sector. Moreover we find that the economic incentives relative to the push factor have become more important, both for men and women, over the years when the eligibility age has been lowered from 65 in 1993 to 62 in 1998.

Appendix. Data, estimates, predictions and policy simulations.

Table A.1 Transfer matrix for households with husband leading (no of observations and percentages in each state)

Initial states for husband and wife	Destination state for wife and husband									
	Work Work	Work Pens	Work Out	Pens Work	Pens Pens	Pens Out	Out Work	Out Pens	Out Out	Total
Work Work	19220 44.58	190 0.46	852 1.98	6081 14.10	141 0.33	353 0.82	1657 3.84	29 0.07	145 0.34	28676 66.51
Work Pens	0 0.00	775 1.80	0 0.00	0 0.00	327 0.76	0 0.00	0 0.00	161 0.37	0 0.00	1263 2.93
Work Out	0 0.00	91 0.21	8609 19.97	0 0.00	28 0.06	3272 7.59	0 0.00	17 0.04	1160 2.69	13177 30.56
Total	19220 44.58	1064 2.47	9461 21.94	6081 14.10	496 1.15	3625 8.41	1657 3.84	207 0.48	1305 3.03	43116 100

Table A.2 Transfer matrix for households with qualifying wife (no of observations and percentages in each state)

Initial states for wife and husband	Destination state for wife and husband									
	Work Work	Work Pens	Work Out	Pens Work	Pens Pens	Pens Out	Out Work	Out Pens	Out Out	Total
Work Work	3320 23.41	205 1.45	189 1.33	895 6.31	103 0.73	75 0.53	195 1.38	22 0.16	31 0.22	5035 35.51

Work Pens	0 0.00	5128 36.16	0 0.00	0 0.00	1751 12.35	0 0.00	0 0.00	488 3.44	0 0.00	7367 51.95
Work Out	0 0.00	112 0.79	1134 8.00	0 0.00	46 0.32	375 2.64	0 0.00	11 0.08	100 0.71	1778 12.54
Total	3320 23.41	5445 38.40	1323 9.33	895 6.31	1900 13.40	450 3.17	195 1.38	521 3.67	131 0.92	14180 100

Table A.3. Estimates when wife is leading and work in the private sector

		2 periods all, eligible at 62-66		3 periods all, eligible at 62-66		3 periods, eligible at age 62-64	
Variable	Coefficient	Estimates	t-values	Estimates	t-values	Estimates	t-values
Consumption							
Constant	α	6.0926	4.7	6.0370	4.7	6.3271	4.5
Exponent*	λ	0.5442	4.5	0.5458	4.5	0.5544	4.3
Leisure,leading spouse							
Constant	a_1	1.2288	4.0	1.2274	4.0	1.2742	3.5
Eduaction	a_2	0.0830	3.2	0.0830	3.3	0.0773	2.5
Leisure, secondary spouse							
Constant	b_1	1.4115	1.9	1.4146	1.9	1.0787	1.3
Education	b_2	0.0758	1.1	0.0758	1.2	0.0947	1.3
Joint leisure							
Constant	f_1	-0.6352	-3.2	-0.6352	-3.2	-0.4893	-2.0
Age-diff	f_2	-0.0211	-6.0	-0.0212	-6.1	-0.0256	-6.1
Age-diff squared	f_3	0.0001	3.7	0.0001	3.6	0.0001	4.1
Company characteristics							
Disappearing company	g_1	0.4253	3.4	0.4243	3.4	0.3344	2.2
Contracting company	g_2	0.8950	8.5	0.8937	8.5	1.0829	8.8
Growing company	g_3	0.6388	5.2	0.6365	5.2	0.6736	4.7
No of observations	N		2789		2789		2026
McFaddens	Rho		0.443		0.443		0.451

* When $\lambda \to 0$,the consumption part of the deterministic part of the utility function becomes log linear in consumption.

Table A.4. Estimates when wife is leading and work in the public sector

		2 periods all, eligible at 62-66		3 periods all, eligible at 62-66		3 periods, eligible at age 62-64	
Variable	Coefficient	Estimates	t-values	Estimates	t-values	Estimates	t-values
Consumption							
Constant	α	10.4551	11.2	10.4548	11.2	9.4428	9.5
Exponent	λ	0.7228	13.8	0.7228	13.9	0.7115	11.5
Leisure,leading spouse							
Constant	a_1	2.8985	19.2	2.8985	19.2	3.2420	17.2
Eduaction	a_2	-0.0437	-4.4	-0.0437	-4.4	-0.0541	-4.3
Leisure, secondary spouse							
Constant	b_1	1.2407	3.3	1.2408	3.3	1.0209	2.5
Eduaction	b_2	0.0428	1.5	0.0428	1.5	0.0583	1.8
Joint leisure							
Constant	f_1	-1.0894	-10.4	-1.0893	-10.4	-0.8702	-6.6
Age-diff	f_2	-0.0197	-14.2	-0.0197	-14.2	-0.0236	-13.8
Age-diff squared	f_3	0.0001	11.1	0.0001	11.1	0.0001	11.9

Company characteristics							
Disappearing company	g_1	0.6373	9.8	0.6372	9.8	0.6168	6.8
Contracting company	g_2	0.6514	9.5	0.6514	9.5	0.8107	9.8
Growing company	g_3	0.4745	6.9	0.4745	6.9	0.5882	7.3
No of observations	N	10314		10341		7084	
McFaddens	Rho	0.516		0.517		0.533	

Table A.5. Estimates when husband is leading and works in the private sector

		2 periods all, eligible at 62-66		3 periods all, eligible at 62-66		3 periods, eligible at age 62-64	
Variable	Coefficient	Estimates	t-values	Estimates	t-values	Estimates	t-values
Log Consumption							
Constant	α	1.7320	35.7	1.2770	34.0	1.9095	34.8
Exponent	λ	0	-	0	-	0	-
Leisure,leading spouse							
Constant	a_1	-0.9523	-12.7	-1.0757	-17.9	-0.9848	-11.8
Eduaction	a_2	0.0724	12.0	0.0568	11.9	0.0567	8.4
Leisure, secondary spouse							
Constant	b_1	0.2948	1.8	-0.1922	-1.6	0.2846	1.6
Eduaction	b_2	0.0379	2.6	0.0302	2.8	0.0314	1.9
Joint leisure							
Constant	f_1	-0.4560	-9.6	-03819	-9.7	-0.6168	-11.2
Age-diff	f_2	0.0041	3.9	0.0037	4.6	0.0046	4.0
Age-diff squared	f_3	-0.0000	-1.7	-0.0000	-2.0	-0.0000	-1.6
Company characteristics							
Disappearing company	g_1	0.1477	3.2	0.0778	1.7	-0.0278	-0.5
Contracting company	g_2	0.4863	13.0	0.3933	10.5	0.4672	11.5
Growing company	g_3	0.2395	5.5	0.1439	3.3	0.1338	2.9
No of observations	N	21358		21538		17588	
McFaddens	Rho	0.501		0.503		0.503	

Table A.6. Estimates when husband is leading and works in the public sector

		2 periods all, eligible at 62-66		3 periods all, eligible at 62-66		3 periods, eligible at age 62-64	
Variable	Coefficient	Estimates	t-values	Estimates	t-values	Estimates	t-values
Log Consumption							
Constant	α	7.3961	11.5	7.1251	13.6	7.7753	14.0
Exponent	λ	0.3958	7.1	0.3771	7.8	0.4411	8.9
Leisure,leading spouse							
Constant	a_1	0.8717	7.0	0.8753	7.0	0.6626	4.4
Eduaction	a_2	0.0468	5.4	0.0477	5.6	0.0598	5.8
Leisure, secondary spouse							
Constant	b_1	2.4451	8.8	2.4533	8.8	2.4471	7.7
Eduaction	b_2	0.0137	0.6	0.0142	0.6	0.0116	0.4
Joint leisure							
Constant	f_1	-0.7198	-7.2	-0.7256	-7.2	-0.6304	-5.1
Age-diff	f_2	-0.0030	-1.0	-0.0030	-1.1	-0.0026	-0.8
Age-diff squared	f_3	0.0000	1.9	0.0000	1.9	0.0000	0.9
Company characteristics							

Disappearing company	g_1	0.4621	8.9	0.4659	9.0	0.3981	5.9
Contracting company	g_2	0.5409	10.7	0.5425	10.8	0.5844	10.1
Growing company	g_3	0.1825	3.2	0.1838	3.2	0.2574	4.1
No of observations	N	18398		18398		13980	
McFaddens	Rho	0.608		0.608		0.620	

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Table 4. Key parameter estimates for the retirement probability the first 12 months after early retirement eligibility occurs. Three period models. Eligibility age 62-66.

		Wife leading				Husband leading			
		Public		Private		Public		Private	
Variable	Coefficient	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Consumption									
Constant	α	10.45	11.2	6.04	4.7	7.13	13.6	1.28	34.0
Exponent	λ	0.72	13.9	0.55	4.5	0.38	7.8	0	-
Leisure, leading spouse									
Constant	A_1	2.90	19.2	1.23	4.0	0.88	7.0	-1.08	-17.9
Education	A_2	-0.04	-4.4	0.08	3.3	0.05	5.6	0.06	11.9
Joint leisure									
Constant	f_1	-1.09	-10.4	-0.64	-3.2	-0.73	-7.2	-038	-9.7
Age-diff	f_2	-0.02	-14.2	-0.02	-6.1	-0.00	-1.1	0.00	4.6
Age-diff squared	f_3	0.00	11.1	0.00	3.6	0.00	1.9	-0.00	-2.0
Company characteristics									
Disappearing company	g_1	0.64	9.8	0.42	3.4	0.47	9.0	0.08	1.7
Contracting company	g_2	0.65	9.5	0.89	8.5	0.54	10.8	0.39	10.5
Growing company	g_3	0.47	6.9	0.64	5.2	0.18	3.2	0.14	3.3
No of observations	N		10341		2789		18398		21538
McFaddens	Rho		0.517		0.443		0.608		0.503

Table 5. Observed retirement fractions and predicted aggregate retirement probabilities the first 12 months after early retirement eligibility occurs. Three period models. Eligibility age 62-66, Percent.

Leading spouse	Work	Work	Work	Pension	Pension	Pension	OLF	OLF	OLF	-
Secondary spouse	Work	Pension	OLF	Work	Pension	OLF	Work	Pension	OLF	-
Wife leading, private sector										
Observed fractions	23.4	37.9	8.9	8.6	16.9	4.3	0.0	0.0	0.0	100
Predicted aggregate probabilities	23.4	38.8	7.6	7.3	15.4	4.3	1.4	1.1	0.7	100
Wife leading, public sector										
Observed fractions	25.1	42.0	10.3	6.0	13.5	3.1	0.0	0.0	0.0	100
Predicted aggregate probabilities	25.1	43.7	8.1	5.00	12.1	3.8	0.9	0.8	0.5	100
Husband leading, private sector										
Observed fractions	42.5	2.2	24.5	17.8	1.3	11.7	0.0	0.0	0.0	100
Predicted aggregate probabilities	37.7	2.6	23.4	18.3	1.7	13.6	2.1	1.1	0.5	100
Husband leading, public sector										
Observed fractions	54.7	3.2	22.6	12.2	1.2	6.1	0.0	0.0	0.0	100
Predicted aggregate probabilities	54.8	4.4	21.1	11.2	0.7	6.8	0.8	0.0	0.2	100

Table 6. Policy simulations. Initial and predicted aggregate choice probabilities The first 12 months after early retirement eligibility occurs, following removal of push-factors or a 10 per cent gross wage increase, from the three period models. Eligibility age 62-66. Percent.

Leading spouse	Work	Work	Work	Pension	Pension	Pension	OLF	OLF	OLF	-
Secondary spouse	Work	Pension	OLF	Work	Pension	OLF	Work	Pension	OLF	-
Wife leading, private sector										
Initial predictions	23.4	38.8	7.6	7.3	15.4	4.3	1.4	1.1	0.7	100
No push factors	26.0	43.3	8.8	4.5	10.4	2.9	1.8	1.5	0.8	100
10 percent increase in gross wage	24.8	40.6	7.8	6.3	13.5	3.9	1.4	1.1	0.6	100
Wife leading, public sector										
Initial predictions	25.1	43.7	8.1	5.00	12.1	3.8	0.9	0.8	0.5	100
No push factors	26.8	47.3	9.0	3.4	8.3	2.7	1.0	0.9	0.5	100
10 percent increase in gross wage	26.7	45.6	8.3	4.2	9.9	3.4	0.8	0.7	0.4	100
Husband leading, private sector										
Initial predictions	37.7	2.6	23.4	18.3	1.7	13.6	2.1	0.1	0.5	100
No push factors	39.7	2.8	24.8	16.1	1.5	12.2	2.2	0.1	0.6	100
10 percent increase in gross wage	41.3	2.8	25.3	15.2	1.4	11.3	2.1	0.1	0.5	100
Husband leading, public sector										
Initial predictions	54.8	4.4	21.1	11.2	0.7	6.8	0.8	0.0	0.2	100
No push factors	57.4	4.5	22.5	8.6	0.5	5.3	1.0	0.0	0.2	100
10 percent increase in gross wage	57.4	4.3	21.6	9.5	0.5	5.8	0.7	0.0	0.2	100

Table 7. Marginal probabilities of working for each spouse without push factors and with reduced wage the first 12 months after early retirement eligibility occurs from the three period models. Eligibility age 62-66 and eligibility age 62-64. Percent.

	Marginal probabilities of working			
	Leading spouse	Other spouse	Leading spouse	Other spouse
	Full sample: Eligible age 62-66			
	Wife leading, private sector		*Wife leading, public sector*	
Baseline prediction	69.8	32.1	76.9	31.0
No push factors	78.1	32.3	83.1	31.2
Ten per cent wage increase	73.2	32.5	80.6	31.7
	Husband leading, private sector		*Husband leading, public sector*	
Baseline prediction	63.7	58.1	63.7	58.1
No push factors	67.3	58.0	67.3	58.0
Ten per cent wage increase	69.4	58.6	69.4	58.6
	Reduced sample: Eligible age 62-64			
‘	*Wife leading, private sector*		*Wife leading, public sector*	
Baseline prediction	69.1	37.9	78.9	37.7
No push factors	78.4	38.0	85.4	38.0
Ten per cent wage increase	75.8	38.7	85.1	39.1
	Husband leading, private sector		*Husband leading, public sector*	
Baseline prediction	75.9	65.1	81.3	70.4
No push factors	79.1	65.1	85.6	70.4
Ten per cent wage increase	81.4	65.5	86.9	71.8