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**Empirical Specification of
the Model in “Early
Retirement and Economic
Incentives”**

**Erik Hernæs
Steinar Strøm**



*Stiftelsen Frischsenteret for samfunnsøkonomisk forskning
Ragnar Frisch Centre for Economic Research*

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Abstract: This paper documents the empirical specification of the model in Hernæs, *et al.* (2000).

Keywords: Early retirement, multinomial logit model, taxes

Contact: erik.hernas@frisch.uio.no, www.frisch.uio.no, phone + 47 22 95 88 21

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1. Introduction

This paper documents the empirical specification of the model in Hernæs, *et al.* (2000). It is a revised version of the appendix in Hernæs, *et al.* (1999).

A1. Data Sources

The basis for the empirical 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 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.

A2. Definition of the States

The principles for classification of persons into states are set out in Table A.1. We classify in two steps. 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 A.1.

Table A1. Classification Principles for Labor Market Attachment each Year. All earnings amounts in NOK 1000 NOK (USD 128)

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

A3. 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 A2. Transition 1990 – 1992 for Persons Eligible for Early Retirement (AFP)

| <i>State in 1990</i> | <i>State in 1992</i> | | | <i>Total</i> |
|-----------------------|----------------------|-----------------------|-----------------------|--------------|
| | <i>Retired</i> | <i>Partly Retired</i> | <i>Full Time Work</i> | |
| <i>Retired</i> | 14 | 0 | 0 | 14 |
| <i>Partly Retired</i> | 272 | 153 | 11 | 436 |
| <i>Full Time Work</i> | 285 | 408 | 432 | 1125 |
| <i>Total</i> | 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. When estimating the model the 11 workers transiting from partly retired to full-time work are dropped from the sample.

A4. 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.

A5. 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 1990, potential income in that state in 1992 is assumed to be the same, whereas potential pension is predicted as described below. In section A.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 AFP pension depends on this sequence via the formulae below. The main structure is discussed in chapter 2 above.

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

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: $YO = (\text{Birthyear} - 1897)$ 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 in the private sector retiring under the AFP-scheme receive a tax-free lump sum, which in 1992 was NOK 11400. In the public sector, the lump sum was 20400, but taxed. The gross pension is taxed according to special rules, see section A.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 (t-values in parentheses):

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

$$(-53.237) \quad (227.426) \quad (53.763) \quad (-1.149)$$

$$R^2=0.62$$

in which *Educ12* is dummy variable for at least 12 years of education and *Female* is a dummy variable for females.

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 (t-values in parentheses):

$$Y_2 = \text{Potential earnings} + \text{Potential pension}$$

$$= 36555 + 0.3338 \bullet Earnings1990 + 0.2559 \bullet Y_1 - 7941.6 \bullet Educ12 - 46295 \bullet Age64$$

$$\quad (1.695) \quad (3.313) \quad (0.981) \quad (-0.687) \quad (-5.797)$$

$$24423 \bullet Age65 + 7632.4 \bullet Female - 12878 \bullet Married)$$

$$(-3.095) \quad (0.674) \quad (1.314)$$

$$-33372 + 0.2876 \bullet Earnings1990 + 0.2889 \bullet Y_1 + 922.9 \bullet Educ12 + 29071 \bullet Age64$$

$$(-2.278) \quad (4.204) \quad (1.1631) \quad (0.118) \quad (5.361)$$

$$+ 14887 \bullet Age65 - 797.6 \bullet Female + 8493.1 \bullet Married),$$

$$(2.778) \quad (-0.104) \quad (1.2786)$$

There are 408 observations. For the earnings regression $R^2 = 0.1855$ and for the pension regression $R^2 = 0.3532$

in which

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,

$$Y_2 = 3183 + 0.6214 \bullet \text{Earnings}_{1990} + 0.5448 \bullet Y_1 - 7018.7 \bullet \text{Educ}_{12} - 17224 \bullet \text{Age}_{64} \\ - 9536 \bullet \text{Age}_{65} + 6834.8 \bullet \text{Female} - 4384.9 \bullet \text{Married},$$

A6. 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 *et al.* (1998). Table A.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 (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 (USD 2 312 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 $\frac{3}{4}$ 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 A4. Average potential state-specific income, before and after tax

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

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**Ragnar Frisch Centre for Economic Research
Gaustadalléen 21
N-0349 Oslo, Norway
T + 47 22 95 88 10
F + 47 22 95 88 25
frisch@frisch.uio.no
www.frisch.uio.no**