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Department of Economics

The effect of changes in the replacement rate on partial retirement in Sweden

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THE EFFECT OF CHANGES IN THE REPLACEMENT RATE ON
PARTIAL RETIREMENT IN SWEDEN

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The effect of changes in the replacement rate on partial retirement in Sweden *

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Abstract

Knowledge about how elderly workers react to changes in pension benefits is important in guiding the design of social security systems. This paper contributes to this knowledge by examining the effect of changed replacement rates on part-time retirement behaviour in Sweden. During the 1980s, older workers had the option of partial retirement with an income replacement of 65 percent. The replacement rate was lowered to 50 percent in 1981 and subsequently increased back to 65 percent in 1987. Estimates using a linear probability model with register data from the LINDA database suggest that fewer men and women chose part-time retirement after the reduction in benefit levels in 1981. There was an approximate 4 percentage point drop in the partial retirement propensity among eligible 60-year old men, and a 5.7 percent drop among women. This corresponds to proportional reductions in the retirement propensity by about 29 and 36 percent respectively. The probability of part-time retirement increased among men by about 3.5 percentage points once benefit levels were increased again, whereas the partial retirement probability of women remained largely unchanged.

Keywords: Retirement, Labour supply, Pensions
EconLit Subject Descriptors: H550, J260

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1 Introduction

Reforms in the Swedish partial pension system provide excellent opportunities to estimate how labour supply responds to changes in the generosity of retirement benefits. Improved knowledge in this area may help policymakers in the design of social security systems. Sweden implemented a partial retirement plan for older workers in 1976 that continued until the end of year 2000. Initially benefits were generous, eligible workers had the option of reducing their work hours with a gross income replacement of 65 percent, subject to various restrictions. The replacement rate was reduced to 50 percent in 1981 and then raised back to its original level in 1987. This paper estimates the effects of these two reforms by comparing the behavior of a treatment group of eligible employees turning 60 (the minimum age of eligibility) the year after the change, to a comparison group of people who turned 60 prior to the reforms.

2 Previous Literature

Identifying the link between social security benefits and retirement can be difficult. Krueger and Pischke (1992) examine the effect of changes in the Social Security act of 1977 on early retirement in the US. The change resulted in lower benefits for individuals born between 1917-1921 as compared to older generations. Using aggregate data from the Current Population Survey on 60-68 yearolds, they do not find any evidence that changes in social security wealth affects labour force participation. Many previous studies such as Burtless (1986) found a negative relationship between social security wealth and retirement age but this was arguably a spurious relationship between two trending series. A similar study to this one has been conducted by Wise (1990), who studied the introduction of the Swedish partial pension system and the effect of the benefit reduction of 1981. Using aggregate data, she compared part time work rates among all 60-64 yearolds compared to those aged 55-59. Her findings are consistent with those of this study, that there was a reduction in participation after the 1981 reform. She also found a general increase over time in the number of hours worked among those partially retired. The current study is an improvement on these findings, because the use of individual level data makes it possible to control for the effect of changes in unemployment and cohort characteristics. Furthermore, by focusing only on 60 yearolds, it is possible to avoid the confounding effect of anticipatory behavior among older cohorts which was large in particular at the time of the first reform.

The current study also examines the effect of the second reform of 1987, which

was essentially the opposite of the first. A comparison of these benefit changes of the same magnitude provides evidence as to whether individuals react similarly to increases as well as reductions in replacement rates, and whether behavioral changes at the time of reforms may have been merely coincidental.

3 The Partial Pension System

From 1976 employees aged 60-64 could apply for partial retirement benefits. To be eligible one had to have earned some pension qualifying income during at least ten years since the age of 45. Retirees had to reduce work hours by at least five hours per week, and continue working at least 17 hours per week. The benefit was initially only available to employees, but as of January 1980, the self employed could also apply.

The government compensated 65 percent of lost gross income, up to a cap of 7.5 basic price amounts (BPA). The benefit was included in the calculation of old-age pension qualifying income, so the effect of the reduction in work hours on an individuals subsequent old age pension was limited. Although there was a cap in compensation at incomes above 7.5 BPA, many collective agreements gave compensation beyond this level. The system was especially generous since high marginal tax rates at the time implied that the after tax replacement rate was actually substantially higher than 65 percent. In her study of flexible retirement in Norway and Sweden, Ginsburg (1985) found that Swedish blue collar workers initially were more likely than white collar workers to partially retire but that the difference fell in the early 1980s. She also found that the partial pension was more popular in Stockholm county than in northern regions. The most popular option among those in partial retirement was to work about 17 to 24 hours a week by working fewer days rather than working shorter hours each day. Readers interested in a more detailed description of the partial pension system are referred to that study, as well as Wadensjö (2003), Sundén (1994), and Wadensjö (2006).

Only two specific events are of interest in this study. The first is the reduction of the replacement rate to 50 percent on January 1st 1981, and the second is the increase to the original 65 percent level on July 1st 1987. Several other changes to the system were made subsequently but these are not of interest here; They were largely a result of the economic crisis in the early 1990s, and were contemporaneous with widespread changes in the Swedish labour market.

3.1 The Reforms

The benefit reduction in 1981 was anticipated in advance. Importantly, those who applied for the benefit before the reduction could retain the higher replacement rate for the entire retirement period. A large number of people took advantage of this possibility by applying in late 1980. Rumors about a possible reduction in benefit levels came with an article in the daily newspaper *Dagens Nyheter* on the 1st of July 1980, entitled "*The Partial Pension Became too Popular*" and more concretely in the paper *Arbetaren*¹ in August, bearing the title "*Partial Pensions in Danger*". The decision to reduce compensation was taken in December 1980 but the government bill was presented already on October 2 of that same year. There was a rush to apply for the partial pension before the reform, and the rush turned into an avalanche by December. An interesting account of these events is given by Roine (1997). A comparison between application propensities between 1980 and 1981 would obviously be misleading, because the number of partial retirees was unusually elevated in 1980 due to anticipatory behaviour.

It is unlikely, however, that the change was anticipated in 1979. The cohort that became eligible for partial retirement in 1979 can, therefore, be used as a control group in a comparison to the group subjected to the treatment of a 15 percent drop in the replacement rate in 1981, i.e. those who turned 60 in 1981. These individuals could not apply for the higher level of compensation.

The increase in the replacement rate to 65 percent in 1987 affected everyone irrespective of when the application was made. However, when the reform became known, individuals who would not have applied at the lower benefit level may have applied early anyway as they expected a higher replacement rate after the summer of 1987. Since the reform took place mid-year, the most relevant comparison to make are the cohorts that turned 60 in 1986 and 1988, respectively, but a comparison of the 1986 and 1987 cohorts may also be of interest.

4 Method and Data

4.1 Method

The effects of the reforms are estimated using simple before/after analysis. No difference-in-difference strategy is possible as the reforms affected everyone in the age category, and no control group exists for the post reform period. This implies

¹*Dagens Nyheter* is a widely read paper whereas *Arbetaren* (The Worker) has a much more limited circulation.

very strict assumptions for any conclusions to be drawn from the results, as described below.

The equation:

$$y_i = \mathbf{X}_i\beta + \gamma D_i + \varepsilon_i \quad (1)$$

is estimated using a linear probability model. The equation is first estimated in separate regressions using as a sample a pool of those individuals turning 60 in the treatment year and the year preceding it. y is a dummy variable taking the value one if the individual partially retired, D_i is a year dummy for the post reform period, which at the time of the reform can be interpreted as a treatment dummy. It takes the value one for all individuals turning 60 after the reform and zero otherwise.²

Separate regressions are estimated for males and females. The control variables \mathbf{X}_i are described in the data section below. The regressions are estimated for two year samples from 1979 to 1989, which shows how partial retirement propensities changed from year to year, and how changes in non reform years compared to changes occurring at the time of the reforms. As an alternative approach, individuals over the entire period are pooled and year dummies are used to identify changes in the partial retirement propensity over time. This allows for the inclusion of time varying regressors to a greater degree. On the other hand, it does not allow the coefficients on the control variables to vary over time, as they do in the first regressions. The linear probability model is chosen in preference to non-linear models such as probit and logit since the latter yield inconsistent parameter estimates under heteroscedasticity.

The assumptions underlying identification are rather strict. The method can be seen as one of viewing different cohorts at different times as the same population facing an identical environment. The assumptions are that if there are any environmental or cohort differences aside from those controlled for, these differences shall be unrelated to the propensity of the individuals to choose partial retirement. This includes a requirement that individual specific characteristics that are related to the propensity of choosing partial retirement are unrelated to cohort membership. Time specific effects such as changes in the economic environment, or policy changes, are assumed to not affect the propensity to choose partial retirement. The inclusion of the control variables only remedies these assumptions to a very limited degree, and the requirements are unlikely to be met in practice.

If the variation in the propensity for partial retirement is very large during the reform period as compared to non-reform years this would indicate, but not prove, that there was a response to the reform.

²Since micro-data on work hours has not been available, it has not been possible to study the reform effect on hours worked.

4.2 Data

Data on individuals sampled in the LINDA database are used in the analysis. LINDA is a panel dataset consisting of a random representative sample of about 3 percent of the Swedish population, based on annual register data mainly from the tax authorities. The variables used as controls are:

- Month of birth
- Decile dummies of labour income at age 59
- Civil status. Dummy variable equal to one if the individual is married
- Municipal and county unemployment levels

All nominal money measures are deflated using the consumer price index published by Statistics Sweden with 1979 as the base year. In order to control for non-linear of prior income, partly caused by varying marginal tax rates, decile dummies for lagged labour income are included. Two measures of unemployment data are used. Unemployment at the municipal level as defined by the Swedish National Labour Market Administration is measured in percent as those individuals registered at the Swedish Labour Market Administration that could begin work immediately, divided by the Labour force. These data are only available from 1980. Unemployment at the regional (county) level as defined by the Labour Force Survey (LFS) is, therefore, used for the first reform. It is defined as the proportion of individuals unemployed in relation to the total number occupied and unemployed, measured in percent. This measure is subject to measurement error, as it is a sample survey, and there is a break in the series in 1986. The unemployment variable is a better control variable for the second reform estimation as it is both more accurate and measured on a finer geographical scale.

4.3 Sample selection

Those who were exclusively self employed, in the sense of not earning any income from employment other than self employment, are excluded from the analysis. This implies that some individuals who may have retired as self employed after 1980 even though they were also employees, are included. This may lead to an upward bias in the coefficient estimate on the effect of the first reform.

An attempt is made to exclude those individuals who were not eligible for partial pensions on the basis of the 10 year work experience requirement, and work

immediately before the decision. Work experience is determined by examining the pension points earned by individuals in the LINDA pension point dataset of 1995 (older datasets were not available). There is no information as to the eligibility of those individuals who died or left the country before 1995. This means that some individuals who were not eligible for the benefit are included in the sample, but none that were eligible have been excluded. This may cause a sample selection problem as later cohorts were more likely to survive until 1995, yielding higher exclusion rates for latter born cohorts which leads to higher estimated rates of partial retirement in the more accurately selected data. Furthermore, it is important to note that data on work hours is not available in the LINDA database for the period studied, and so it is difficult to remove individuals that could not partially retire because they already were working part time. As an approximate solution to this problem, those in the lowest three quartiles of labour income at age 59 are excluded under the assumption that their low income was a result of part time work. In most cohorts, none or very few of these individuals did in fact receive partial retirement benefits. Only about 0.14 percent of individuals in these income quartiles were partially retired as compared to an average of 10.7 percent among the rest. Table 1 shows the sample size of eligible 60-yearolds used in the estimation and the proportion of all non-self employed individuals in the LINDA sample that were eligible for partial retirement benefits according to my definition. Note that a smaller fraction of females than males were eligible. This was both because fewer females had the required work history and because more of them had part-time employment.

4.4 Descriptive Statistics

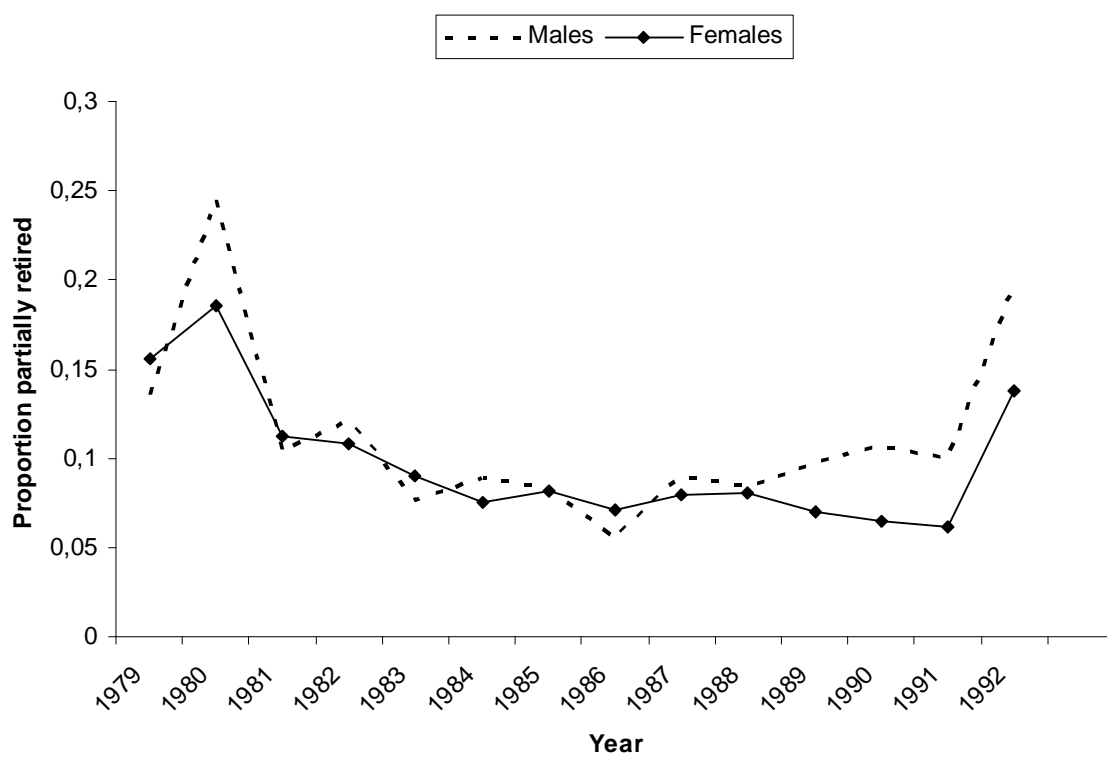
The estimation sample varies from about 600 to 900 females and 1200 to 1400 males for different years. The proportion of eligible 60 year old employees choosing partial retirement over time is shown in Figure 1. The total number partially retired 60 year old males varies from as low as 59 to 347. Females number from 51 to 168, see Table 8 for details. As discussed in Roine (1997), the spike in 1992 was most likely caused by the government proposal to abolish partial retirement altogether. This proposal was subsequently blocked, but by that time a large number of individuals had already gone into partial retirement.

Real lagged income, i.e. real labour income of the sampled individuals as 59 yearolds was substantially higher for males than females. Female earnings remained roughly constant throughout the early 1980s but rose towards the end of the period. Males' real labour income fell during the early 80s but recovered somewhat later on. The sample proportion married remained around 72 to 75 percent.

Table 1: Proportion eligible and sample size by year and sex

Year	Males		Females	
	Proportion eligible	Eligible sample	Proportion eligible	Eligible sample
1979	0.82	1234	0.41	604
1980	0.84	1419	0.49	904
1981	0.85	1349	0.50	907
1982	0.81	1229	0.51	834
1983	0.82	1218	0.53	824
1984	0.83	1193	0.55	868
1985	0.81	1151	0.58	922
1986	0.79	1066	0.59	901
1987	0.80	1021	0.58	804
1988	0.82	1092	0.61	894
1989	0.79	1079	0.62	867
1990	0.81	1050	0.62	934
1991	0.79	1033	0.61	837
1992	0.77	991	0.63	874

Figure 1: Proportion of eligible aged 60 entering partial retirement, by sex



5 Regression analysis

5.1 The first reform, 1981

These regressions use the Labour Force Survey unemployment figures at the county level, and are based on samples containing two cohorts with their 60th birthday in two different years, with a dummy variable indicating membership in the younger cohort / later year.

The point estimates should be interpreted as follows: Reading from the 1981 year dummy estimate in the column labeled "79,81" in Table 3, males turning 60 in 1981 had an approximate 4 percentage points lower probability of choosing partial retirement in 1981 than the probability that those who turned 60 in 1979 partially retired in 1979. This difference is rather large if one considers that the overall proportion of 60 yearolds choosing partial retirement among males in 1979 was about 13.6 percent (see Table 8 in the Appendix). Thus, the estimate represents an approximate proportionate reduction in the probability of choosing partial retirement at age 60 by more than a quarter.

The partial retirement behavior of different cohorts of males varied greatly around the time of the reform. An increase of almost 10 percentage points occurred between 1979 to 1980, probably due to individuals applying in anticipation of the reform. This was followed by a drop of 14 percent the subsequent year. Note that there was also a large and statistically significant drop in applications of about four percent in 1983 as compared to 1982, which is of the same magnitude as the change between 1979 and 1981. So although the change in applications during the reform year of 1981 was relatively large, it was not much larger than the change occurring in one of the non-reform years, which casts some doubt on the hypothesis that the reform as such was an important influence on partial retirement behavior. Females show the same pattern of behavior. An increase of about 3 percent from 1979 to 1980 was followed by a decrease of 8 percent in 1981, and the net change between 1979 and 1981 was approximately negative 5.7 percent. Changes after this point are small and statistically insignificant. Bias corrected and accelerated bootstrap confidence intervals give very similar to the usual t -based intervals.

Because the sampling period is on an annual basis, it is important to note that individuals that retire at age 60 but in the calendar year of their 61st birthday are counted as non-retired in the dataset. By including the month of birth variable in the regression, possible variation in the timing of birthdays between cohorts is controlled for, albeit with an assumption of a linear relationship between month of birth and partial retirement propensity. The coefficient on month of birth is negative, which

simply reflects the fact that among individuals in the same cohort, those whose birthday is later in the year are younger and thus less likely to partially retire in any particular year compared to their older counterparts. Most of these estimates imply that being born half a year later reduces the partial retirement probability by about 5 percentage points. It is reassuring to compare these effects to the sample mean of partially retired in Table 8, as they correspond to a proportional reduction in partial retirement by close to a half for all regressions aside from the 1979-1981 samples. This exception is very interesting as it suggests that the rush to partial retirement affected individuals differently as the 1981 reform became known in 1980. It means that many younger individuals partially retired earlier than they would have done in absence of the first reform: Sufficient relative numbers of younger individuals choose partial retirement in 1980 to offset the usual month of birth/age effect. Unemployment seems to be unimportant for the choice of partial retirement except for females in 1979-1980.

Table 2: LPM regressions, first reform, females: Robust t -statistics in parentheses

	79,80	80,81	79,81	81,82	82,83	83,84	84,85
Married	-0.0379 (1.77)	-0.0351 (1.84)	0.0083 (0.44)	0.0145 (0.87)	0.0256 (1.57)	0.0226 (1.49)	0.0326 (2.35)
Month of Birth	-0.0055 (2.07)	-0.0041 (1.81)	-0.0104 (4.51)	-0.0086 (4.18)	-0.0084 (4.07)	-0.0080 (4.30)	-0.0070 (4.08)
County Unemployment	0.0242 (1.76)	-0.0013 (0.14)	0.0073 (0.74)	-0.0098 (1.28)	-0.0096 (1.43)	-0.0082 (1.45)	0.0005 (0.09)
4th lag income decile	-0.0824 (4.05)	-0.0849 (5.38)	-0.0349 (1.95)	-0.0702 (5.07)	-0.0844 (6.11)	-0.0723 (5.90)	-0.0748 (5.94)
5th lag income decile	0.0319 (1.16)	0.0013 (0.06)	0.0291 (1.31)	-0.0381 (2.31)	-0.0459 (2.63)	-0.0276 (1.60)	-0.0359 (2.16)
7th lag income decile	0.1831 (5.12)	0.1838 (5.90)	0.1913 (5.96)	0.1504 (5.09)	0.0958 (3.20)	0.0439 (1.75)	0.0369 (1.59)
8th lag income decile	0.1219 (3.05)	0.1150 (3.47)	0.1429 (4.19)	0.0938 (3.25)	0.0652 (2.32)	0.0852 (2.98)	0.0996 (3.43)
9th lag income decile	0.1182 (2.79)	0.1650 (4.19)	0.1396 (3.75)	0.1596 (4.15)	0.1313 (3.49)	0.1088 (3.21)	0.0622 (1.96)
10th lag income decile	0.1315 (1.90)	0.1263 (2.17)	0.1111 (1.98)	0.1632 (2.99)	0.1421 (2.68)	0.0468 (1.11)	0.0168 (0.44)
1980 Year Dummy	0.0309 (1.59)						
1981 Year Dummy		-0.0801 (4.74)	-0.0572 (3.06)				
1982 Year Dummy				0.0072 (0.47)			
1983 Year Dummy					-0.0168 (1.17)		
1984 Year Dummy						-0.0149 (1.13)	
1985 Year Dummy							0.0073 (0.57)
constant	0.1258 (3.14)	0.1985 (6.16)	0.1515 (4.66)	0.1461 (4.99)	0.1605 (5.11)	0.1431 (4.63)	0.0932 (3.08)
N	1508	1811	1511	1741	1658	1692	1790
R^2	0.06	0.08	0.07	0.07	0.07	0.05	0.05
F	11.63	19.82	10.07	15.13	15.76	15.19	12.48

Table 3: LPM regressions, first reform, males: Robust t -statistics in parentheses

	79,80	80,81	79,81	81,82	82,83	83,84	84,85
Married	0.0197 (1.02)	0.0294 (1.69)	0.0007 (0.04)	0.0131 (0.86)	0.0104 (0.70)	0.0009 (0.06)	-0.0098 (0.66)
Month of Birth	-0.0041 (1.95)	-0.0057 (2.82)	-0.0085 (4.82)	-0.0101 (5.73)	-0.0080 (4.89)	-0.0086 (5.83)	-0.0110 (6.74)
County Unemployment	-0.0006 (0.07)	0.0012 (0.16)	0.0069 (0.93)	0.0042 (0.71)	-0.0004 (0.09)	-0.0070 (1.41)	-0.0026 (0.44)
4th lag income decile	-0.0962 (3.06)	-0.1515 (6.04)	-0.0575 (1.73)	-0.0822 (3.55)	-0.0512 (3.83)	-0.0491 (3.82)	-0.0325 (1.53)
5th lag income decile	-0.0112 (0.34)	-0.0704 (2.12)	-0.0238 (0.80)	-0.0332 (1.16)	-0.0238 (1.04)	-0.0313 (1.50)	-0.0304 (1.44)
7th lag income decile	0.1491 (5.23)	0.1129 (4.18)	0.0536 (2.12)	0.0539 (2.34)	0.0938 (4.26)	0.0802 (3.69)	0.0589 (2.84)
8th lag income decile	0.0623 (2.38)	0.0233 (0.96)	0.0040 (0.17)	0.0320 (1.48)	0.0760 (3.72)	0.0466 (2.42)	0.0448 (2.38)
9th lag income decile	0.0120 (0.49)	0.0122 (0.52)	-0.0459 (2.26)	-0.0078 (0.40)	0.0207 (1.16)	0.0192 (1.12)	0.0498 (2.74)
10th lag income decile	-0.0125 (0.54)	-0.0247 (1.08)	-0.0180 (0.86)	0.0109 (0.53)	0.0269 (1.45)	0.0094 (0.57)	0.0298 (1.81)
1980 Year Dummy	0.0980 (6.55)						
1981 Year Dummy		-0.1400 (9.75)	-0.0399 (3.04)				
1982 Year Dummy				0.0109 (0.83)			
1983 Year Dummy					-0.0409 (3.37)		
1984 Year Dummy						0.0095 (0.84)	
1985 Year Dummy							-0.0033 (0.28)
constant	0.1242 (3.63)	0.2408 (7.96)	0.1873 (6.37)	0.1355 (4.92)	0.1241 (4.82)	0.1304 (5.04)	0.1404 (5.08)
N	2653	2768	2583	2578	2447	2411	2344
R^2	0.04	0.06	0.02	0.02	0.03	0.03	0.03
F	11.70	19.23	5.66	7.15	19.00	16.39	7.39

5.2 The second reform, 1987

These regressions use the AMS unemployment data at the municipal level as a control variable. The conclusions are slightly different as compared to the first reform. The behavior of males is more varied over time than females. Males' partial retirement seems to increase slightly in the reform year of 1987, as well as 1988 as compared to 1986, but because changes of similar and greater magnitude, but in the opposite direction, seem to have occurred in 1986 and 1983 there is little reason to assume that this change was caused by the reform. It could have been random variation in cohort characteristics or other economic events that caused the change. The estimates for females are small and statistically insignificant, indicating that they did not respond to the change in replacement rate to any great degree.

Table 4: LPM regressions, second reform, females: Robust t -statistics in parentheses

	80.81	81.82	82.83	83.84	84.85	85.86	86.87	87.88	88.89	86.88
Married	-0.0366 (1.92)	0.0134 (0.81)	0.0261 (1.60)	0.0225 (1.49)	0.0328 (2.38)	0.0254 (1.89)	0.0183 (1.31)	0.0313 (2.26)	0.0142 (1.01)	0.0117 (0.86)
Month of Birth	-0.0044 (1.99)	-0.0087 (4.24)	-0.0082 (4.01)	-0.0080 (4.29)	-0.0070 (4.08)	-0.0045 (2.73)	-0.0038 (2.23)	-0.0072 (4.14)	-0.0071 (4.06)	-0.0059 (3.50)
Municipal Unemployment	0.0011 (0.16)	-0.0057 (0.95)	-0.0064 (1.20)	-0.0055 (1.09)	-0.0011 (0.22)	-0.0049 (1.03)	-0.0069 (1.27)	-0.0090 (1.33)	-0.0128 (1.81)	-0.0146 (2.92)
4th lag income decile	-0.0830 (5.29)	-0.0680 (4.95)	-0.0847 (6.08)	-0.0724 (5.87)	-0.0749 (5.94)	-0.0679 (5.33)	-0.0754 (5.06)	-0.0664 (4.09)	-0.0460 (3.31)	-0.0479 (3.48)
5th lag income decile	0.0006 (0.03)	-0.0360 (2.19)	-0.0457 (2.61)	-0.0273 (1.58)	-0.0365 (2.21)	-0.0396 (2.56)	-0.0601 (3.74)	-0.0490 (2.83)	-0.0241 (1.49)	-0.0294 (1.92)
7th lag income decile	0.1856 (5.97)	0.1534 (5.21)	0.0981 (3.27)	0.0452 (1.79)	0.0365 (1.58)	0.0647 (2.73)	0.0509 (2.08)	0.0509 (1.95)	0.0698 (2.76)	0.0717 (2.88)
8th lag income decile	0.1170 (3.53)	0.0975 (3.36)	0.0662 (2.33)	0.0848 (2.96)	0.0989 (3.41)	0.0780 (2.86)	0.0117 (0.47)	0.0341 (1.26)	0.0821 (2.91)	0.0752 (2.77)
9th lag income decile	0.1672 (4.25)	0.1636 (4.23)	0.1328 (3.50)	0.1093 (3.21)	0.0614 (1.95)	0.0403 (1.36)	0.0462 (1.41)	0.0568 (1.79)	0.0663 (2.25)	0.0679 (2.25)
10th lag income decile	0.1285 (2.21)	0.1686 (3.10)	0.1446 (2.71)	0.0481 (1.14)	0.0160 (0.42)	0.0540 (1.07)	0.0619 (1.21)	0.0240 (0.54)	-0.0105 (0.30)	0.0738 (1.28)
1981 Year Dummy	-0.0814 (4.93)									
1982 Year Dummy		0.0060 (0.40)								
1983 Year Dummy			-0.0178 (1.23)							
1984 Year Dummy				-0.0144 (1.09)						
1985 Year Dummy					0.0067 (0.53)					
1986 Year Dummy						-0.0096 (0.79)				
1987 Year Dummy							0.0025 (0.19)			
1988 Year Dummy								0.0022 (0.17)		-0.0006 (0.05)
1989 Year Dummy									-0.0184 (1.37)	
constant	0.1957 (6.91)	0.1332 (5.14)	0.1483 (5.27)	0.1330 (4.60)	0.0988 (3.56)	0.1023 (4.35)	0.1124 (4.53)	0.1274 (4.78)	0.1294 (5.16)	0.1276 (5.47)
N	1807	1739	1654	1688	1789	1820	1701	1696	1760	1793
R^2	0.09	0.08	0.07	0.05	0.05	0.04	0.04	0.04	0.04	0.04
F	19.85	15.05	15.75	15.20	12.48	10.38	8.31	6.99	7.39	8.32

Table 5: LPM regressions, second reform, males: Robust t -statistics in parentheses

	80.81	81.82	82.83	83.84	84.85	85.86	86.87	87.88	88.89	86.88
Married	0.0300 (1.73)	0.0134 (0.88)	0.0099 (0.66)	0.0005 (0.03)	-0.0100 (0.67)	-0.0054 (0.39)	0.0012 (0.08)	0.0015 (0.10)	0.0093 (0.66)	0.0029 (0.22)
Month of Birth	-0.0058 (2.84)	-0.0101 (5.73)	-0.0079 (4.86)	-0.0087 (5.87)	-0.0110 (6.76)	-0.0081 (5.31)	-0.0052 (3.52)	-0.0073 (4.50)	-0.0098 (5.76)	-0.0081 (5.30)
Municipal Unemployment	-0.0008 (0.13)	0.0038 (0.71)	0.0029 (0.62)	-0.0040 (1.04)	-0.0009 (0.19)	0.0026 (0.52)	0.0001 (0.01)	-0.0002 (0.03)	-0.0019 (0.24)	-0.0022 (0.42)
4th lag income decile	-0.1500 (5.98)	-0.0811 (3.47)	-0.0504 (3.73)	-0.0514 (3.92)	-0.0328 (1.54)	-0.0285 (1.37)	-0.0516 (4.22)	-0.0539 (4.41)	-0.0337 (1.47)	-0.0501 (4.05)
5th lag income decile	-0.0688 (2.07)	-0.0329 (1.15)	-0.0240 (1.05)	-0.0315 (1.51)	-0.0304 (1.44)	-0.0512 (4.14)	-0.0154 (0.61)	-0.0015 (0.06)	-0.0424 (2.36)	-0.0317 (1.73)
7th lag income decile	0.1142 (4.22)	0.0541 (2.35)	0.0943 (4.28)	0.0808 (3.71)	0.0590 (2.84)	0.0520 (2.57)	0.0822 (3.77)	0.0804 (3.59)	0.0398 (1.88)	0.0457 (2.24)
8th lag income decile	0.0249 (1.02)	0.0321 (1.49)	0.0768 (3.76)	0.0477 (2.46)	0.0455 (2.40)	0.0212 (1.24)	0.0402 (2.17)	0.0681 (3.41)	0.0553 (2.69)	0.0296 (1.67)
9th lag income decile	0.0132 (0.56)	-0.0077 (0.39)	0.0211 (1.19)	0.0199 (1.15)	0.0498 (2.72)	0.0392 (2.21)	0.0206 (1.22)	0.0649 (3.41)	0.0803 (3.95)	0.0484 (2.68)
10th lag income decile	-0.0241 (1.04)	0.0115 (0.55)	0.0289 (1.56)	0.0107 (0.64)	0.0302 (1.82)	0.0182 (1.14)	0.0118 (0.73)	0.0075 (0.47)	0.0082 (0.47)	0.0004 (0.03)
1981 Year Dummy	-0.1388 (9.73)									
1982 Year Dummy		0.0110 (0.86)								
1983 Year Dummy			-0.0419 (3.45)							
1984 Year Dummy				0.0110 (0.97)						
1985 Year Dummy					-0.0034 (0.29)					
1986 Year Dummy						-0.0279 (2.61)				
1987 Year Dummy							0.0348 (3.02)			
1988 Year Dummy								-0.0057 (0.45)		0.0267 (2.26)
1989 Year Dummy									0.0130 (1.02)	
constant	0.2433 (8.58)	0.1367 (5.20)	0.1130 (4.56)	0.1196 (5.01)	0.1357 (5.32)	0.1120 (4.67)	0.0626 (2.65)	0.0982 (3.93)	0.1107 (4.16)	0.0911 (3.74)
N	2765	2577	2440	2402	2339	2212	2083	2111	2166	2154
R^2	0.06	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03
F	19.20	7.06	18.53	16.33	7.43	11.99	13.20	16.77	7.42	11.83

5.3 Control variable estimates

The coefficient estimates on included covariates provide some descriptive information as to which individuals opt for partial retirement. The local level of unemployment seems to be relatively unimportant except for women towards the end of the observation period. The negative sign on the coefficient in the 1986,1988 regression is opposite to what is expected as it indicates that partial retirement is not a substitute for unemployment. In other cases the statistical insignificance of the unemployment coefficient may be explained by the fact that employees at the age of 60 generally have high job security. The correlation between take-up of partial retirement benefits and marital status varies substantially over time and between men and women. In most regressions there is a positive correlation between marital status and partial retirement for females, whereas this correlation is weaker for males. Note that the correlation is negative and statistically significant in the years prior to the first reform. This is in contrast to the assumption that the parameters on the control variables are constant over time, and that the reform did not differentially affect different groups in the population. This assumption is tested by estimation of the same regressions with interactions between all control variables and the year dummy³. With a few exceptions the interaction terms are statistically insignificant. The coefficients on real labour income dummies differ somewhat around 1979-1981 and in 1985, suggesting that some of the variation in partial pension propensities over time worked through labour income.

5.4 Pooled regressions

Estimation using the pooled data from 1979 to 1985 with year dummy variables yields the results reported in Table 6. As before, the dependent variable is a dummy taking the value one for individuals with partial pension. In these regressions GDP growth (data from Statistics Sweden) is also included as a regressor, but it is measured at the national level and so does not vary within cohorts, only between cohorts over time. For this reason both dummies for 1984 and 1985 are excluded to avoid collinearity, and the interpretation of the 1979 year dummy is the difference in the propensity for partial retirement in 1979 in comparison to that of the baseline period of 1984-1985. The estimate for 1979 shows that for both males and females, the propensity to retire was roughly 5.7 and 8.3 percent higher respectively in 1979 than the reference period, and these estimates are statistically significantly different from zero at high significance levels. However, an F test of equality between the coefficients for 1979

³Results are available from the author at request

and 1981 is not rejected for males, the p -value is 0.20. The null hypothesis is rejected for females however, with a p -value of 0.03.

Similar regressions for the second reform are presented in Table 7. The sample is a pool from 1981 to 1989, with dummies for the first two years omitted. In the second and fourth column, instead of year dummies, only a dummy for the post 1986 period is included. The effect of the second reform differs between males and females. There is a statistically significant difference between the year dummies of 1986 and 1987 for males (p -value of the F -test: 0.024). However the increase between 1986 and 1987 seems to be better explained by a drop in 1986 rather than an increase in 1987. The post 1986 dummy is small and statistically insignificant for males. For females the overall propensity for partial retirement is actually slightly lower after 1986 than previously, at odds with what theory would predict.

Coefficients on the control variables are similar to those in the separate regressions, only more statistically significant, probably because of the larger sample size. Being married is positively correlated with partial retirement for women but not for men. Likewise, unemployment is a relatively important determinant for women but not for men. A one percent higher unemployment rate is associated with a roughly 0.5 percent lower take-up of partial retirement benefits among women. The effect of economic growth is on the whole very small when all year dummies are included, but because there is only time variation in the growth variable, the power of any statistical test regarding this effect is rather low. There seems to be a hump-shaped relationship between lagged income and partial retirement that is more distinct for men than women. Take-up of partial pension benefits is most common in the 7th income decile for men and the 9th income decile for women.

Table 6: Pooled LPM regression, second reform: Marginal effects at mean: Robust t -statistics in parentheses

	Males	Females
Married	0.0084 (0.96)	0.0084 (0.92)
Month of Birth	-0.0079 (8.08)	-0.0073 (6.45)
County Unemployment	-0.0006 (0.16)	-0.0011 (0.27)
4th lag income decile	-0.0710 (5.06)	-0.0760 (9.26)
5th lag income decile	-0.0282 (1.80)	-0.0154 (1.45)
7th lag income decile	0.0899 (6.87)	0.1146 (7.28)
8th lag income decile	0.0463 (3.88)	0.0999 (5.98)
9th lag income decile	0.0162 (1.46)	0.1162 (5.87)
10th lag income decile	0.0064 (0.60)	0.1010 (3.58)
Growth	0.0022 (0.39)	-0.0035 (0.58)
1979 Year Dummy	0.0569 (4.65)	0.0835 (4.92)
1980 Year Dummy	0.1587 (10.29)	0.1027 (5.98)
1981 Year Dummy	0.0242 (1.13)	0.0180 (0.75)
1982 Year Dummy	0.0350 (2.23)	0.0235 (1.34)
1983 Year Dummy	-0.0072 (0.57)	0.0054 (0.37)
constant	0.1002 (4.26)	0.1094 (4.35)
N	8793	5863
R^2	0.05	0.07
F	25.71	31.51

Table 7: Pooled LPM regression: Second reform, robust t -statistics in parentheses

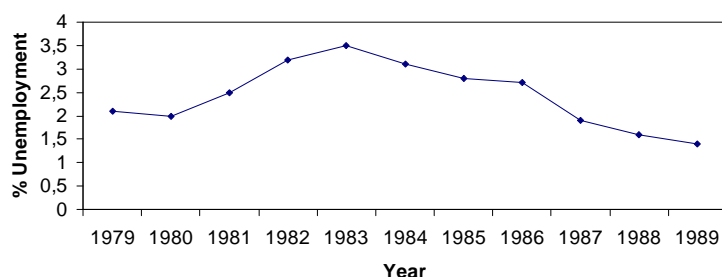
	Males	Males	Females	Females
Married	0.0039 (0.58)	0.0040 (0.59)	0.0200 (2.88)	0.0198 (2.95)
Month of Birth	-0.0086 (11.26)	-0.0087 (11.34)	-0.0069 (7.97)	-0.0069 (7.70)
Municipal Unemployment	0.0004 (0.17)	0.0009 (0.38)	-0.0064 (2.34)	-0.0050 (1.90)
4th lag income decile	-0.0501 (5.38)	-0.0503 (5.42)	-0.0655 (10.11)	-0.0654 (6.82)
5th lag income decile	-0.0347 (3.21)	-0.0342 (3.16)	-0.0362 (4.66)	-0.0359 (3.87)
7th lag income decile	0.0637 (6.15)	0.0645 (6.22)	0.0779 (6.38)	0.0776 (7.63)
8th lag income decile	0.0432 (4.58)	0.0434 (4.60)	0.0738 (5.60)	0.0743 (6.79)
9th lag income decile	0.0309 (3.48)	0.0311 (3.52)	0.0884 (5.65)	0.0889 (7.16)
10th lag income decile	0.0127 (1.51)	0.0129 (1.53)	0.0638 (2.88)	0.0653 (3.62)
Growth	0.0100 (1.12)	-0.0069 (2.90)	0.0031 (0.29)	-0.0083 (3.09)
1983 Year Dummy	-0.0483 (3.10)		-0.0189 (1.04)	
1984 Year Dummy	-0.0602 (1.68)		-0.0423 (1.02)	
1985 Year Dummy	-0.0433 (2.30)		-0.0310 (1.45)	
1986 Year Dummy	-0.0781 (3.26)		-0.0427 (1.55)	
1987 Year Dummy	-0.0496 (1.68)		-0.0427 (1.26)	
1988 Year Dummy	-0.0464 (2.01)		-0.0352 (1.34)	
1989 Year Dummy	-0.0340 (1.39)		-0.0529 (1.92)	
Post 1986 dummy		0.0112 (1.59)		-0.0085 (1.10)
constant	0.1319 (9.79)	0.1272 (9.89)	0.1432 (10.10)	0.1399 (10.86)
N	10377	10377	7809	7809
R^2	0.02	0.02	0.05	0.05
F	18.39	26.37	27.16	36.56

5.5 Other events during the period

It is not possible to say that the changes in retirement propensity at the time of the reform were exclusively caused by the changed replacement rate and not by some other contemporaneous events. This section discusses some important political and economic factors at the time that may have influenced behavior.

A law on gender equality was passed in 1979. Several new laws on employment regulation were passed in 1977: A new vacation law, work environment law, and a law on workers participation in certain corporate decisions (MBL) was passed in 1976. These changes probably did not affect retirement decision variability in the 1980s, although this cannot be ruled out. Unemployment rose from roughly constant levels during the early 1970's of around two to three percent in 1983 and then fell back to quite low levels in the late 1980s. Economic growth was negative at -0.3 percent in 1981, but higher both before and after as can be seen in figure 3. A series of large changes took place in Swedish industry at the time of the first reform, see Schön (2000) for details. A number of shipyards, wood pulp mills and mines were closed. An economic boom began first with the devaluation of the Swedish krona by 16 percent on the 8th of October 1982.

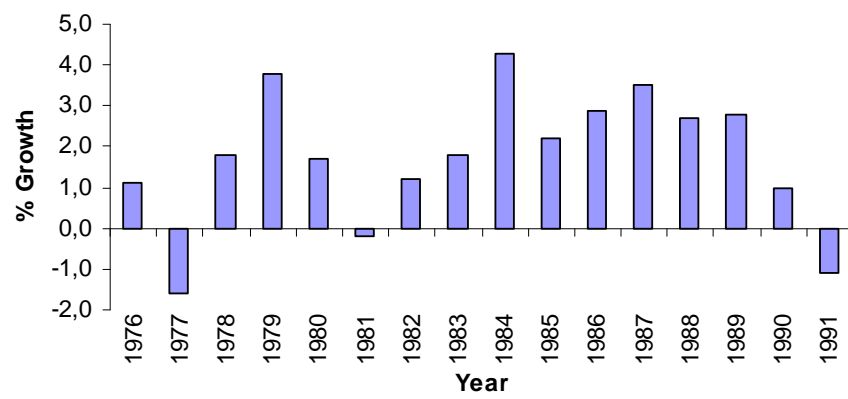
Figure 2: Unemployment



Source: The Labour Force Survey, Statistics Sweden

It is plausible that there is a negative relationship between partial retirement and economic growth. Partly because retirement is an alternative to unemployment, and partly because employers are likely to encourage partial retirement among their employees in times of low demand, and discourage it when demand is higher. If this was the case, one would expect lower propensities to retire in 1979 than the years 1980-1982. Thus, if the estimated effect on partial retirement of the first reform is biased due to concurrent changes, it is likely to be an upward bias. The data shows

Figure 3: Economic growth



Source: Statistics Sweden

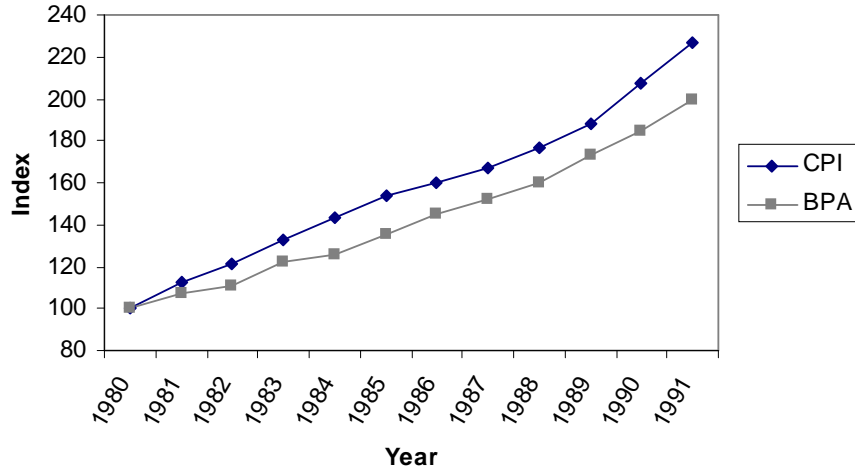
that there was a sudden drop in partial pensions in 1983 for males in particular. This could have been due to the boom beginning after the devaluation. On the other hand, the coefficient on the growth variable in the regressions was small and statistically insignificant, indicating a low responsiveness of partial retirement behaviour to changes in economic growth. The 1983 drop in partial pension propensity persists even after controlling for growth. One hypothesis that is in line with the results is that employers may have used the early retirement system as a way to flexibly control the amount of labour used in production early on in the business cycle. They may have encouraged elderly workers to partially retire as a way to reduce labour costs at the very early stages of the recession of 1981, and subsequently may have persuaded employees to work full time at the early stages of the recovery of 1983.

5.6 Changes affecting net pensions

No major changes in the tax system were made at the time of the reforms, marginal taxes remained roughly constant at a high level. The high level of marginal income taxes implied that the after tax replacement rate was much higher than the gross replacement rate of 65 to 50 percent. It also meant that the net effect on disposable income of the reform was rather small, so it is not surprising that the evidence of a responsiveness to it is rather weak.

Important changes in price indexation were made over the period studied, most often these were attempts to reduce the government deficit, but occasionally to raise pensions. Pensions and other benefits were indexed by the basic price amount. The Appendix provides a list of the changes that were made, and figure 4 shows how the price indexation of pensions evolved in relation to the consumer price index. In short, the reduction in the replacement rate of 1981 was concurrent with a worsening of the price indexation of pensions which was likely to have further reduced incentives to partially retire. Similarly, the increased replacement rate of 1987 was concurrent with changes to pension price indexation that increased benefits for retirees. Since the partial pension only applied for a maximum of five years for any individual, the changes to indexation rules, which only affected benefits subsequent to the first year of partial retirement, should not have had any greater impact upon the behaviour of 60-yearolds considering partial retirement.

Figure 4: Evolution of the price level and the price indexation of pensions



6 Conclusion

Due to the strict assumptions on identification, one should take great caution in drawing conclusions about the causality of the reforms from the results reported in this study. The regression estimates indicate that males who turned 60 in 1981, after the reduction of the replacement rate by 15 percent, had a 4 percent lower probability of partial retirement than those males turning 60 in 1979, who were unaware of the impending reform. This corresponds to an approximate proportional reduction by slightly more than a quarter, and is statistically significant. Although it is likely that at least a part of this change can be attributed to the changed replacement rate, it is not possible to determine how much. Because the estimates simply reflect the difference in behavior between two different groups at two different times, it is impossible to distinguish the time and demographic effects from the reform effect. Males do, however, appear to be more responsive to anticipated changes in the replacement rate than are females: In response to the government proposal to reduce replacement rates, the probability of partial retirement rose from 1979 to 1980 by almost 10 percentage points for men but only 3 percentage points for women.

In the second reform of 1987, the replacement rate was raised back to its initial level, and the proportion of males choosing partial retirement increased by about 3.5 percentage points, corresponding to a relative increase exceeding 50 percent. Females on the other hand did not respond to this reform. Point estimates actually

indicate that women turning 60 in years subsequent to the reform chose partial retirement to a lesser extent even though the benefit level had increased. Since high marginal tax rates meant that the net after tax change in benefits was rather small for most employees, it is perhaps more surprising that men changed their behaviour so much rather than the fact that women did not. The result that men and women reacted differently to the increase in benefits as compared to the reduction in benefits remains to be explained.

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Appendix

Changes to price indexation

Because real pension income depends on the price indexation rules, the changes to indexation during the 1980's may have been an important influence on retirement behavior. In the current study it is impossible to disentangle this effect from changes in the replacement rate, and so the reader should be aware of the following changes that were made at the time. The list is a summary of SCB (1986).

Before October 1980 Followed the CPI with monthly adjustment if the change exceeded 3 percent.

October 1980 - November 1982 Net Price index instead of CPI (Price changes excluding the effects of changed taxes and subsidies). Also excluded energy price changes.

1982 - Only updated annually instead of monthly from 1982 and onwards.

November 1982 - 1983 CPI again, but with a 4 percent reduction. (Because of a currency devaluation).

1983 An increase of the basic amount to compensate retirees and some other groups.

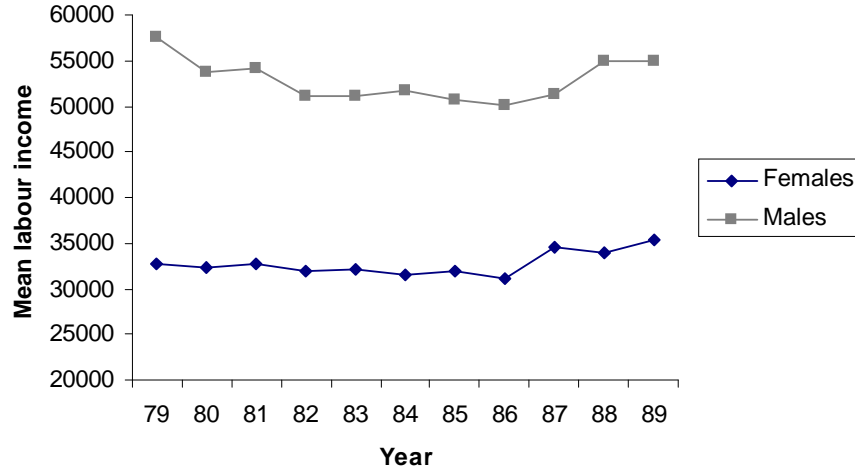
1983-1991 Unadjusted CPI, except for:

1987 Another increase to compensate retirees and some other groups

1991-1994 CPI with various adjustments for tax changes and currency depreciation

In 1999 the basic price amount resumed to follow the CPI directly without adjustments.

Figure 5: Evolution of Real Labour Income



Sample mean

annual labour income at age 59 in 1979 years prices

Table 8: The proportion and total number of partially retired of eligible employees aged 60 by year in the sample

Year	Whole sample		Males		Females	
	Proportion	Total	Proportion	Total	Proportion	Total
1979	0.143	262	0.136	168	0.156	94
1980	0.222	515	0.245	347	0.186	168
1981	0.107	242	0.104	140	0.112	102
1982	0.116	239	0.121	149	0.108	90
1983	0.082	167	0.076	93	0.090	74
1984	0.083	171	0.089	106	0.075	65
1985	0.083	172	0.083	96	0.082	76
1986	0.063	123	0.055	59	0.071	64
1987	0.085	156	0.090	92	0.080	64
1988	0.083	164	0.084	92	0.081	72
1989	0.086	167	0.098	106	0.070	61
1990	0.087	173	0.107	112	0.065	61
1991	0.082	154	0.100	103	0.061	51
1992	0.169	316	0.197	195	0.138	121

Table 9: Inflation and The Basic Price Amount

Year	Inflation	% Change in BPA
2006	1.4	0.761
2005	0.5	0.254
2004	0.4	1.813
2003	1.9	1.847
2002	2.2	2.710
2001	2.4	0.820
2000	1.0	0.549
1999	0.5	0.000
1998	-0.2	0.275
1997	0.5	0.276
1996	0.5	1.401
1995	2.5	1.420
1994	2.2	2.326
1993	4.7	2.077
1992	2.3	4.658
1991	9.3	8.418
1990	10.5	6.452
1989	6.4	8.140
1988	5.8	5.306
1987	4.2	5.150
1986	4.2	6.881
1985	7.4	7.389
1984	8.0	3.046
1983	8.9	10.674
1982	8.5	2.890
1981	12.1	7.453
1980	13.6	15.827

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