Identifying the Impact of Health on Individual Retirement Plans Employing a Wide Array of Health Measures

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RESEARCH DEPARTMENT OF EMPLOYMENT AND LABOUR MARKET ISSUES

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Abstract

A growing literature is finding that subjective self-reported health is reliable and exogenous and matters more for retirement planning than objective health, meaning self-reported objective measures. We reassess the impact of health on retirement plans of older workers by employing a wider range of health measures than previous studies which allow us to estimate the outer bounds of the true effect. By merging a Danish panel survey to the Danish National Patient Registry, we access self-reported subjective health, self-reported objective health and actual medical diagnoses for all patient contacts in clinical hospital departments. Results from random effects models accounting for unobserved heterogeneity show indeed that subjective health measures have a stronger impact than

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objective health measures. Our findings suggest that health effects on retirement are bounded between 0 and 1.2 years for men and between 0 and 0.6 years for women.

In terms of specific conditions, having heart diseases, back problems and myalgia significantly hasten male retirement, while heart diseases, back problems, osteoporosis and depression are conditions that significantly induce retirement among women. These effects are smaller than those found in the HRS possibly due to the Danish universal health care system or because workers tend to exit the labour market early in Denmark before severe health problems develop.

JEL Codes: J14, J26, I0

Keywords: Labour issues, health effects, retirement planning, medical diagnoses, unobserved heterogeneity.

Contents

1. Introduction

A number of previous studies have shown that health is an important determinant of preferences for retirement. Much of the available empirical evidence suggests that poor health causes workers to retire earlier (Bound, 1991; Anderson and Burkhauser, 1985, Bazzoli, 1985; Dwyer and Mitchell, 1999; McGarry, 2004). There is disagreement, however, as to the precise impacts of health on retirement. This is because biases may arise when health is proxied by way of survey-based self-reports or even by more objectively measured indicators (see for example Bound, 1991, Dwyer and Mitchell, 1999, Benítez-Silva et al., 2004, McGarry, 2004, and Baker et al., 2004).

Subjective reports of health made by those planning to retire or already retired potentially lead to justification bias. That is, failing health is used as a socially acceptable excuse for retirement, rather than an accurate description of the reason why individuals leave the labour market. This biases the impacts of health on labour market outcomes as well as the effects of any variables correlated with health. In fact, earlier US studies based on Retirement History Longitudinal Survey (RHS) data, found significant evidence of justification bias (such as Anderson and Burkhauser, 1985). Another consideration is that health may be endogenous to labour market outcome. This leads to over-estimation of the effect of health if, for instance, withdrawal from the labour market improves or worsens health. Generally, this is less of a problem when the labour supply measure is planned rather than actual retirement. An indirect effect is generated if unobserved differences across individuals correlate both with health and retirement behaviour, for example, differences in workers' time rate of preference. Inability to control for these variables could lead to omitted variable bias. Yet another problem may be reporting heterogeneity or incomparability across individuals of (ordered) self-assessed health, which varies systematically with characteristics such as gender and age (Lindeboom and Van Doorslaer (2004), Groot (2000)). This phenomenon too can be avoided if the separate analyses are conducted by age and sex.

Use of objective health measures might correct for these problems but in most cases, objective measures are proxies for general health or presence of health conditions rather than work incapacity. A measure such as subsequent mortality for example, suffers from this measurement error problem, particularly as mortality often occurs abruptly or following a short-lived serious illness. Conversely, many chronic

conditions such as arthritis may severely limit one's ability to work, but have less of an effect on life expectancy.

In fact, as subjective health measures potentially suffer from both endogeneity bias and attenuation bias and objective measures only from measurement error, the former may be preferable as the two types of bias cancel each other out (Bound, 1991). Still, many researchers prefer more objective self-reports on the presence of a disease condition, for example, than to use self-assessed health for reasons of greater reporting accuracy, insusceptibility to individual rationalization and greater comparability across individuals. Individual self-reports of the presence of a doctor-diagnosed illness are however, not error-free in themselves. A recent paper by Baker et al. (2004), which matches individuals, self-reports of medical conditions to their medical records, finds considerable error in these so-called "objective" self-reports. Furthermore, the reporting error is systematically related to labour market status and hence a source of justification bias.

No previous study in the area of health and retirement has had access to a purely objective measure of health such as those that can be obtained from medical records. In this paper we employ a wider range of health measures than previous studies by merging a unique Danish panel survey on older workers and retirees to information on hospital discharges on these individuals drawn from the Danish National Patient Registry (LPR, Landspatientregister).[1] This registry includes actual diagnoses made for all patient contacts with clinical hospital departments in Denmark during discharge, out-patient treatment conclusion or emergency room visit giving us a purely objective measure of health. Combining survey and register data, therefore, we have access to both self-rated physical health, health compared to others, self-reported objective work and functional limitations and diseases conditions as well as purely objective diagnoses of medical conditions. This rich spectrum of health measures allows us to provide outer bounds on

[1] The LPR contains information on all somatic hospital discharge (public or private) including date of diagnosis, actual diagnosis, treatment type and duration of stay. The diagnoses made in our sample period are classified according to the ICD10 system – International Statistical Classification of Diseases and Related Health Problems, 10th revision.

the "true" effect of health on retirement spanned by subjective, self-reported objective and purely objective measures.[2]

Our study also makes a few other contributions to the literature in this area: i) by using repeated observations on planned retirement age and covariates we can control for unobserved heterogeneity across individuals that may be correlated with both health and retirement, similar to McGarry (2004) and (ii) while most previous studies have concentrated on the impact of health on retirement behaviour of men, we conduct separate but symmetric analyses on samples of older men as well as older women, providing, for the first time, comparable estimates of the effects of health on female retirement.

Denmark provides an interesting setting to test this question because of the high take-up of early retirement. Although the normal age of retirement is 65, retirement at age 60 is widespread, systematized and socially acceptable, so no particular stigma would be attached to reporting a plan to retire early.3 This lessens the concerns of justification bias and allows us to obtain cleaner estimates compared to using US samples. More fundamentally, though, justification bias is minimized in this study as in McGarry (2004), as our sample consists of older workers who are currently employed.

One important difference between health care arrangements in countries such as the US and a Scandinavian welfare state, for example, is that health insurance is universal and access to most public health services is free for all regardless of economic situation. For example, health-related exit from the labour market is made possible in Denmark through the Social Disability Pension (SDP, førtidspension) program. These differences imply that we expect that health will be a less important factor in retirement planning in Denmark compared to countries such as the US. First, because older Danes in the labour force may be healthier than similar Americans due to costless access to preventive and neutralizing health care services. Second, because older Danes in the labour force probably constitute a more selected group than comparable Americans, as those with very poor health have already withdrawn themselves from the labour market via SDP.

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[2] This method has been suggested by Bound (1991) and has been implemented by Dwyer and Mitchell (1999) and Kreider and Pepper (2001, 2002).

[3] Among individuals still in the labor force in 2002, two out of three of the 57-year-old men and five out of six of the 57-year-old women planned to retire at age 60-62, cf. *Ældredatabasen* (for more information on these data, see Section 3).

Thus, these system differences must be kept in mind when comparing our findings to recent US evidence based on the HRS, for example.

The rest of the paper is organized as follows: Section 2 presents an illustrative empirical model, Section 3 the data and Section 4 the estimation results. Section 5 concludes.

2. Empirical model

Following Bound (1991), Dwyer and Mitchell (1999) and other previous studies, we consider a model of the retirement decision of individuals approaching retirement age, in which the (continuous) planned retirement age of individual i at time t, Rit, depends on economic factors, health status and demographic variables:

$$R_{it} = \beta w_{it} + \gamma H^{*}_{it} + \lambda Z_{it} + \varepsilon_{it}$$

H* is unobserved health status, w are economic incentive variables, Z are demographic factors and ε is a random disturbance term. Although H* is unknown, we observe alternative proxies for underlying health, a subjective measure, Hs, and an objective measure, Ho. The subjective measure depends on underlying health status H* and on economic incentive measures w such that:

$$H^{s}_{it} = \delta^{s} w_{it} + \theta^{s} H^{*}_{it} + \mu^{s}_{it}$$

An alternative objective measure also depends on both H* and w.

$$H^{o}_{it} = \delta^{o} w_{it} + \theta^{o} H^{*}_{it} + \mu^{o}_{it}$$

Assume that H* is orthogonal to ε, μs and μo. If justification bias is present, then ε and μs are correlated. For example, individuals planning to retire earlier than average, may try to justify this by reporting themselves to be in worse than average health, leading to simultaneity bias. Another problem is that as Hs is not a perfect predictor of H*, measurement error will bias the coefficient to H*, γ. Bound (1991) shows that as long as the correlation between ε and μs is positive, it will tend to bias the coefficient to H*, γ, upwards, while variance in μs leads to the classic errors-in-variables problem and will tend to bias it downwards. The net effect on γ depends on the relative magnitudes of these two biases, but even if on balance they cancel out, there will in general still exist a downward bias on β arising from the dependence of Hs on w i.e. δs. This means, that while the

coefficient to the subjective proxy despite the rationalization problem may end up in practice close to the true effect of health on retirement, the coefficients to the economic variables will tend to be smaller than they should be.

There are problems inherent in using the objective measures as well. Here, as justification bias is not present, μo is uncorrelated with ε, but as long as Ho is not a perfect predictor of underlying health, the use of it will tend to underestimate the effect of health and overestimate the effects of economic variables. On the other hand, the dependence of Ho on w i.e. δo, will bias the effects of these economic factors downwards, so in sum, the economic variables may be correctly estimated in this case.

Typical solutions to identification in retirement studies involve limiting the analysis to a sample of workers only (McGarry, 2004) or instrumenting subjective measures by objective ones (Bound, 1991), or finding suitable instruments for both the subjective and the objective measure (Dwyer and Mitchell, 1999). Finding plausible instruments (for example which affect health but not retirement) are a difficult task resulting more often than not in controversial exclusion restrictions. At best, even when IVs are based on truly randomly occurring natural experiments, these events are so rare and specialized, that they may be difficult to generalize from (Heckman, 1999, Rosenzweig and Wolpin 2000). Our identification strategy is to restrict the sample to workers only, but more importantly, to try to capture the true effect of health by exploiting a wide spectrum of health measures. That is, the true effect should lie between the subjectively and objectively measured effects.

More recently, as subsequent waves of the HRS have become available, some authors have applied longitudinal data to the question of the effect of health on retirement plans. McGarry (2004) estimates a fixed effects model of the subjective probability of continued work on workers only and finds strong effects of subjective measures of health even on a sample for which justification bias is purportedly low. While the use of longitudinal data in itself does not solve the identification issues that arise in the cross section, it does allow purging the data of unobserved individual effects, which may be correlated with health and retirement such as the individual's time-rate of discount, tastes for work or even time-constant measurement error in health. We also apply panel data to this question, but our chosen approach is the random effects model. The reason for this is simply that as we have only two waves of data at our disposal, the fixed effects approach is costly in terms of degrees of freedom lost. The fixed effects model, however, allows for

correlation between the unobserved component and the observed variables while the random effects model does not, therefore, fixed effects results are reported in an appendix for comparison, see Appendix A3.

3. Data and descriptions.

The primary data used in this study are obtained from a longitudinal database of elderly people (Ældredatabasen), a survey, which was fielded and collected by SFI-SURVEY. The database consists of two waves of survey data from 1997 and 2002. Thus, repeated observations over time enable us to obtain knowledge about how individuals update their retirement plans when new information arrives, particularly with respect to health. The survey data are merged with longitudinal register data from 1993 to 2001 in order to supplement the database with information on individuals' labour market characteristics (the economic variables). Objective health measures are merged in from the National Patient Registry, which has collected data on all somatic hospital admissions since 1977 and since 1995, on out-patients and emergency patients as well. Data on contacts with psychiatric hospital departments have been included since 1995. For each contact, there is information on the hospital department admitting the patient, diagnoses, and surgical procedures, date of admission, date of discharge and mode of admission (acute/non F acute).

In 1997, a representative sample of individuals born every fifth year from 1920 to 1945 consisting of 5,864 individuals was interviewed face-to-face in their homes. The response rate was 70 per cent. In 2002, the same respondents were contacted primarily by phone for a second interview. 79 per cent of the first wave respondents participated in the second wave. Thus, 4,634 individuals form part of both waves. In order to minimize sample selection due to retirement, we limit the sample to individuals born in 1940 and 1945. That is, people aged approximately 52 and 57 years in 1997, which corresponds to 2,259 individuals, who are observed again in 2002. We also restrict the sample to individuals who were in the labour force in the first wave, because we lack key information on some health measures and many relevant economic characteristics (see Appendix A2) for these individuals. Thus, one source of potential sample selection is omission of individuals who were already retired in 1997. This exclusion can be problematic if transition to SDP and early retirement schemes are self-chosen. Early retirement through the Transitional Benefit Program (TBP, overgangsydelse), which was opened in the mid-

nineties and targeted people of exactly the sample age, constitutes a particular problem in this context because access to the program did not depend on health criteria.[4] In fact, the existence of the TBP program implies that we expect the impact of the health on retirement planning to be underestimated in our study because relatively many healthy individuals are excluded from the study – individuals who might develop poor health after going on early retirement. Further, since the take up rate of TBP benefits was particular high for women, we expect the underestimation of the impact of health to be larger for women than for men.

To try to assess the potential for sample selection mentioned above, a full comparison of means is made of those in the labour force in Wave 1 to those out of the labour force in Wave 1 in Appendix A2. Note that we do include individuals who retired between the two waves in our sample, as we have full information on all covariates on these individuals.[5] These restrictions leave us with a sample of 1,834 individuals. Finally, since we compare retirement plans in 1997 and 2002 we can only include individuals who report a planned retirement age in both years. Unfortunately, a large share of individuals does not meet this demand[6]. We end up with a sample consisting of 1,156 individuals, 51 per cent of the original sample.

Planned retirement age is the dependent variable in our analyses. We treat this as a continuously distributed variable, but in other analyses (not reported here) we do sensitivity analysis in which this variable is grouped to reflect pension policy rules and eligibility criteria. Obviously, planned age is not necessarily coincidental with actual retirement age since changes in e.g. individual characteristics such as health or marital status might induce individuals to retire earlier or later than expected (Disney and Tanner, 1999). Nonetheless, the analysis is permissible if the two are strongly positively correlated. A comparison of the cumulative distribution of planned retirement age in wave 1 and actual

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[4] This program was available for people aged 55-59 years (from 1994 also 50-54-year-olds) who were members of an unemployment insurance fund and who had been unemployed for at least 12 out of the last 15 months.

[5] Planned retirement age is set equal to the actual retirement age (reported in the survey) for these individuals (30% of the sample). Replacing actual retirement age in wave 2 by planned retirement age in wave 1 for individuals who retire between the two waves makes no appreciable difference to the results.

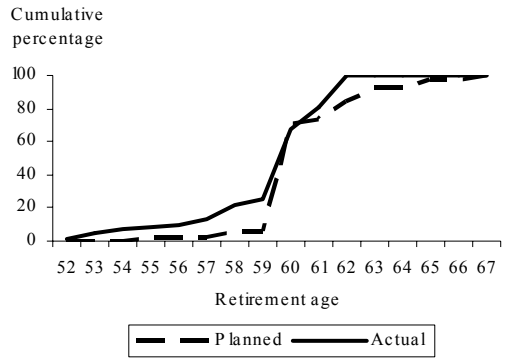
[6] Instead, their answer was "don't know" or "as long as possible". As a check of the robustness of the results, individuals who answered "as long as possible" were included, increasing the sample size from 1,156 to 1,393. A random effects Tobit regression was run in which the upper limit was tentatively set equal to 71. Results on the health variables in the Tobit specification were found to be qualitatively similar to those derived from the random effects model on the reduced sample.

retirement age in wave 2 for individuals that retire between the two waves suggests that a strong positive correlation actually exits (see Figure 1).

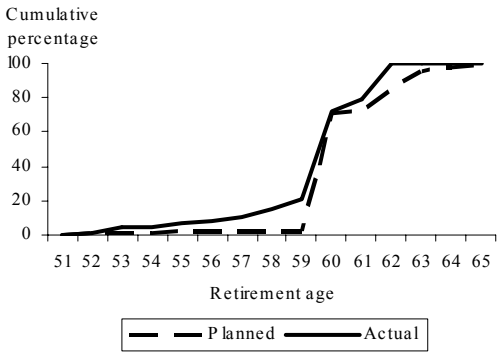
Figure 1.

Planned and actual retirement age, cumulative percentage, a) men and b) women.

a) Men



b) Women



Definitions of the explanatory variables included in the analyses are provided in Appendix A2. Poor health is proxied alternatively by 6 separate measures: 2 subjective and 4 objectives. The subjective variables are self-reported general health and self-rated health compared to others. Among the objective measures, we have access to self-reported objective measures such as the presence of work limitations, the presence of functional limitations and the presence of a disease condition and the purely objective measure, the presence of a medical condition diagnosed at the time of hospitalization, based on information obtained from LPR records and merged to the panel sample[7] A detailed description of health measures can be found in Appendix A1. Other key explanatory variables include individual labour market earnings and other income, wealth and a variable capturing pension wealth accrual measured as a replacement rate, the compensation rate[8]

[7] Instead of 0-1 dummies for the presence of a (any) condition, counts of disease conditions, diagnoses and work limitations have been tried and results remain robust to these alternative specifications.

[8] The compensation rate is estimated as the ratio of (potential) disposable income as a pensioner in year *t* to disposable income as a participant in year *t-1*:

$$Compensation\ rate_t = \frac{(potential)\ disposable\ income\ as\ a\ pensioner_t}{disposable\ income\ as\ a\ participant_{t-1}}$$

See Larsen and Datta Gupta (2004) for details.

Additional controls include birth cohort (1940 or 1945), vocational education, cohabitation status, age difference between partners, actual work experience, duration of unemployment, occupation, sector, tenure, hours of work, whether the job is physically demanding, level of job satisfaction and a dummy variable for missing compensation rate.

Descriptive statistics for these variables are also included in Appendix A2. Looking at in- versus out-of-the-labour force differences, we see that both men and women outside the labour force have significantly worse health as measured by all the self-reported subjective proxies, as well as in terms of having any functional limitation, disease or diagnosed condition (including heart conditions, strokes for men, and heart conditions, diabetes and arthritis for women). The finding of poorer self-reported health among individuals outside the labour force could be evidence in favour of justification bias. On the other hand, that fact that individuals outside the labour force tend to suffer more from underlying diseases and diagnosed conditions, imply, that to some extent, they probably are in worse health than individuals in the labour force. In addition, among both men and women the two groups differ with respect to age, education, family pattern, income, wealth and labour market experience.

In sum, there are sufficiently many differences between the two groups, indicating that our findings should be appropriately applied to individuals approaching retirement age rather than those who have already withdrawn themselves. On the other hand, the descriptive evidence also indicates that by excluding those already retired in Wave 1, the estimated impact of health on retirement is less likely to reflect justification bias.

Another potential problem is health-related attrition that could weaken the impact of health on retirement. 155 persons or 11.8% of Wave 1 respondents dropped out between the two waves. The survey contains information on the reason for attrition: refusals (72.3%), moved away (5.2%), could not be contacted (14.2%), emigrated (1.9%), illness (4.5%), death (1.3%). The combined effect of the last two gives a mere 5.8% or 9 persons in all. Although not conclusive, this suggests that only in a small percentage of cases is the primary reason for attrition either ill-health or death.

The health measures correlate to some extent and therefore, the various measures are treated as alternative proxies for underlying health[9]

4. Estimation Results

Results of the analysis of the factors that affect retirement planning are presented in Tables 1-8. In particular, we focus on the role of health compared to economic factors.[10]

4.1. Pooled OLS analysis

Pooled OLS retirement age models are estimated for men and women separately, as a benchmark case against a more general model that accounts for unobserved heterogeneity in Section 4.2. The findings from this simple specification in which the various health measures (subjective and objective) are treated as alternative proxies for underlying health H*, show that being in poor health in general reduces planned retirement age for men and women as almost all measures of poor health are estimated to have negative impacts on retirement age, cf. Table 1 and 2 below. In contrast, as may be expected, higher income increases planned retirement age for both men and women while greater wealth and a higher compensation rate of pensions reduce it for men. That is, individuals who were wealthy in the year prior to the survey year are more inclined to go into retirement than others. For women, while wealth in all cases has the usual negative effect, the compensation rate has positive effects on planned retirement age.[11] That is, increases in the compensation rate seem to delay women's retirement, which would seem to counter to intuition. A possible explanation may in fact be the policy changes that took place between

[9] Specifications in which all health measures appear jointly are shown in Appendix A4. Tables showing correlations between the health measures are available on request.
[10] Estimated coefficients on the other explanatory variables are available and can be provided on request.
[11] Other factors also affect planned retirement age. In this case, the results are very similar for men and women. As expected, adjustment upwards takes place, when people approach retirement age, see e.g. Dwyer & Hu (1999). Not surprisingly, individuals with higher education are more inclined to increase their planned retirement age than those without, while a longer duration of unemployment over the last four years lower planned retirement age. Further, an increase in job satisfaction increases the planned retirement age as expected while an increase in the physical job demands decreases this age. Women living alone are more inclined to increase their planned retirement age than partnered women. Finally, planned retirement age is lower for men with a partner about the same age or younger. However, we do not model the jointness of couples' retirement decisions here as in Hurd (1990), Gustman and Steinmeier (2000) and Christensen and Datta Gupta (1994).

the two waves and which strengthened the incentives to retire at age 62.[12] Our results suggest that women's retirement behaviour to a greater extent than men's responded to these policy changes. Interesting, for both men and women, economic factors are highly stable and are estimated to have the same impacts irrespective of the health measure being considered. This indicates again that justification bias is low in the case of the subjective measures as the economic variables in this case do not appear to be biased downwards but instead are estimated to have the same effects as in the objective case, where they are on balance correctly estimated (see Section 2).

Table 1.
Pooled OLS estimates of the effect of health and economic factors on men's retirement age.

	Subjective health		**Objective health**			
	General health	**Health comp. to others**	**Work limitations**	**Functional limitations**	**Disease conditions**	**Diagnoses**
Poor health	-1.310***	-1.289***	0.190	-0.245	-0.695***	-0.372
	(0.185)	(0.331)	(0.184)	(0.409)	(0.169)	(0.240)
Individual	0.551***	0.580***	0.566***	0.571***	0.570***	0.566***
income	(0.144)	(0.146)	(0.147)	(0.147)	(0.146)	(0.147)
Wealth	-0.134**	-0.125**	-0.147**	-0.144**	-0.132**	-0.138**
	(0.062)	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)
Compensation	-0.236	-0.370	-0.411	-0.385	-0.375	-0.376
rate	(0.378)	(0.383)	(0.386)	(0.385)	(0.383)	(0.385)
Adjusted R2	16.1	13.8	12.8	12.8	13.9	12.9
Number of observations	1,272					

Note: Additional controls include birth cohort, education, and cohabitation status, age differences between partners, experience, and duration of unemployment in the last four years, occupation, sector, tenure, and hours of work, whether the job is physical demanding, job satisfaction level and dummy variable for missing compensation rate. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

[12] In 1999, a tax premium was given to individuals who were entitled to early retirement benefits at age 60 but who continued working until at least 62. The reform of 2002 further strengthened these incentives.

Table 2.

Pooled OLS estimates of the effect of health and economic factors on women's retirement age.

	Subjective health		**Objective health**			
	General health	**Health comp. to others**	**Work limitations**	**Functional limitations**	**Disease conditions**	**Diagnoses**
Poor health	-0.709***	-0.596*	-0.337**	-0.614**	-0.132	0.231
	(0.165)	(0.307)	(0.158)	(0.280)	(0.137)	(0.261)
Individual income	0.475**	0.500***	0.518***	0.487**	0.505***	0.507***
	(0.192)	(0.193)	(0.193)	(0.193)	(0.193)	(0.193)
Wealth	-0.077	-0.078	-0.094	-0.072	-0.098	-0.084
	(0.159)	(0.161)	(0.160)	(0.161)	(0.161)	(0.161)
Compensation rate	0.912**	0.930**	0.945**	0.925**	0.946**	0.937**
	(0.385)	(0.387)	(0.387)	(0.387)	(0.388)	(0.388)
Adjusted R2	16.9	15.7	15.8	15.8	15.5	15.5
Number of observations	1,040					

Note: See Table 1 for notes. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

The subjective health measures are in general highly significant, while the objective measures are, in general, not, and this holds for both men and women. The only objective measures that are significant are in fact the self-reported ones, such as having a disease condition for men, and the presence of work and functional limitations for women. Although concerns of justification bias are low in this sample and setting, this result could match the predictions by Bound (1991) that subjective measures tend to be inflated while objective measures are weakened by measurement error, giving credence to the strategy of treating the subjective and objective measures as outer bounds.

How does health compare to economic factors? To be able to compare the predicted estimates, we standardize changes in the continuous explanatory variables by computing the estimated impacts on planned retirement age of a one standard deviation change in each explanatory variable. For men, focusing only on the significant variables, a one standard deviation increase in (log) income increases planned retirement age 0.29 to

0.31 years, while a corresponding increase in wealth decreases it by 0.14 to 0.17. For women, one standard deviation increases in (log) income and compensation rate increases planned retirement by 0.20 to 0.21 years and 0.17 to 0.18 years respectively. Looking next at the estimated coefficients on the health measures that are significant, being in poor general health or being in worse health than others reduces men's planned retirement age by 1.3 years while having a disease condition reduces planned retirement age by 0.70 years. For women, being in poor general health or being in worse health than others reduces female retirement age by about 8 and 7 months respectively, while having at least one work or functional limitation reduces planned retirement age by 0.34 and 0.61 years respectively. Thus, health seems to have a larger impact than income. McGarry (2004) and Dwyer and Mitchell (1999) also find that health effects are larger than economic incentive effects in similar analyses based on cross-sectional HRS data. In the study by Dwyer and Mitchell (1999), those in poor health plan to retire about 2 years earlier than those in better health.[13] Thus, (general) health effects are about half as strong in Denmark. In other words, confirming our expectations that health seems to be a less important factor in retirement planning in Denmark than in the US.

4.2 Unobserved heterogeneity

Here, results from random effects specification are reported and compared to the simple pooled OLS model by way of Breusch-Pagan LM and likelihood ratio tests which are based on OLS and random effects residuals respectively. In all models considered, for both men and women, the Breusch-Pagan LM and the likelihood ratio test statistics reported in Tables 3 and 4 below clearly indicate that the null hypothesis of no unobserved heterogeneity is strongly rejected.

Results from the random effects specification on the health variables are qualitatively similar to those derived from a pooled OLS model, indicating that unobserved heterogeneity, although present, is not large in the case of the health variables, while it seems to be more important in the case of the economic variables. For example, for men, wealth and the compensation rate are now estimated to have smaller impacts than before. The relative importance of health to income is unchanged, while health becomes even

[13] According to McGarry (2004), those in poor health report on average a probability of continued work after reaching age 62 that is 18 percent lower than for those in excellent health.

more important compared to wealth and the compensation rate. The precise effects of health can be summarized as follows: For men, being in poor general health or having worse health than others reduces planned retirement age by 1.2 years, while having a diseases condition means that males adjust their planned retirement age down by about ½ a year.

Table 3.

Random affects estimates of the effect of health and economic factors on men's retirement age.

	Subjective health		**Objective health**			
	General health	**Health comp. to others**	**Work limitations**	**Functional limitations**	**Disease conditions**	**Diagnoses**
Poor health	-1.197***	-1.177***	0.163	-0.274	-0.537***	-0.301
	(0.194)	(0.343)	(0.183)	(0.422)	(0.173)	(0.224)
Individual income	0.540***	0.566***	0.553***	0.557***	0.569***	0.554***
	(0.148)	(0.148)	(0.149)	(0.149)	(0.148)	(0.149)
Wealth	-0.102	-0.097	-0.109	-0.107	-0.099	-0.104
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Compensation rate	-0.021	-0.133	-0.142	-0.121	-0.123	-0.111
	(0.350)	(0.352)	(0.354)	(0.353)	(0.352)	(0.353)
R2 (overall)	16.9	14.6	13.6	13.6	14.7	13.7
Breusch-Pagan $\chi 2$	103.0***	109.8***	112.0***	112.3***	106.2***	111.7***
Likelihood ratio test	118.8***	127.0***	130.0***	130.3***	123.1***	129.7***
Number of observations	1,272					

Note: The likelihood ratio tests are obtained from the maximum-likelihood random-effects estimator, which produce estimates that are very nearly the same as those produced by the full-information G2SLS estimator. See also Table 1 for notes. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

Table 4.

Random affects estimates of the effect of health and economic factors on women's retirement age.

	Subjective health		**Objective health**			
	General health	**Health comp. to others**	**Work limitations**	**Functional limitations**	**Disease conditions**	**Diagnoses**
Poor health	-0.641***	-0.544*	-0.286*	-0.554*	-0.160	-0.261
	(0.168)	(0.312)	(0.162)	(0.301)	(0.143)	(0.243)
Individual income	0.412**	0.425**	0.438**	0.415**	0.428**	0.431**
	(0.197)	(0.198)	(0.198)	(0.198)	(0.199)	(0.199)
Wealth	-0.126	-0.121	-0.133	-0.120	-0.142	-0.129
	(0.165)	(0.167)	(0.166)	(0.167)	(0.167)	(0.167)
Compensation rate	1.046***	1.053***	1.060***	1.045**	1.055***	1.056***
	(0.365)	(0.366)	(0.367)	(0.366)	(0.367)	(0.367)
R2 (overall)	18.3	17.1	17.2	17.2	16.9	16.9
Breusch-Pagan $\chi 2$	64.3***	67.0***	66.3***	66.4***	67.8***	67.8***
Likelihood ratio test	70.0***	73.1***	72.3***	72.4***	74.1***	74.1***
Number of observations	1,040					

Note: See Table 3 for notes. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

For women, purging the effects of unobserved heterogeneity makes the effect of wealth and the compensation rate somewhat larger, while the income effects are slightly smaller. Health effects remain roughly the same as before. The precise impacts are as follows: Being in bad health leads to a decrease in the planned retirement age by about 8 months, while work and functional limitations decreases this age by 0.29 and 0.55 years

respectively. As in the pooled OLS case, poor health affects men's retirement planning more strongly than it does women's.[14]

The wide spectrum of health measures employed in this study allow estimating the outer bounds of the true effect of health on retirement which are spanned by the most subjective and the most objective health measures. At the lower bound, the effect of health (diagnoses) on retirement planning does not differ appreciably from zero. The upper bound captured by the subjective health measures is about 1.2 years for men and 0.6 years for women.

4.3 Disaggregated disease conditions and diagnoses

We run separate random effects estimations disaggregated by specific conditions and diagnosed diseases in order to obtain information on whether particular illnesses can affect retirement plans. The results of these analyses are given in Tables 5-8 below. For men, myalgia and back problems significantly lower planned retirement age by respectively 8 months and a year, while for women, diseases conditions such as back problems, osteoporosis, and depression significantly hasten retirement, particularly the two latter conditions, by 6 months, 2 years and nearly a year respectively.

Being hospitalized for a serious condition does not appear to exert any appreciable effect, except in the case of heart diseases, which is significant for both men and women and lowers planned retirement age by 8 months and more than two and a half years respectively. [15] The limited effect of diagnoses might be due to measurement error i.e. that getting diagnosed for a serious disease does not necessarily imply work incapacity. As the diagnoses employed here have been made during hospitalization episodes for serious medical conditions, a significant degree of work incapacity is to be expected. There could, therefore, be a number of other explanations.

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[14] The random effects model makes the restrictive assumption that the X's are uncorrelated with the unobserved individual-specific effect. Yet, the fixed effects model does not work well given that the sample size is small and we have only two waves at our disposal. For comparison, however, fixed effects estimates are shown in Appendix A3.

[15] In comparison, McGarry (2004) does not find that specific conditions are significantly related to the probability of working beyond the age of 62, while Dwyer and Mitchell (1999) find that limitations of daily living, back problems, head injuries and circulatory problems lower planned retirement age. Mental health (which is broader than depression) does not have a significant effect in their study and conditions such as osteoporosis and myalgia are not defined in their data. Thus, in part differences in findings are due to differences in data definitions and availability but back problems appear important in both their study and ours.

Table 5.

Random effects estimates of the effect of disaggregated diseases conditions and economic factors on men's retirement age.

	Diseases							
	High blood pressure	**Diabetes**	**Bronchitis/ asthma**	**Osteo-arthritis**	**Myalgia**	**Osteoporosis/ decal-cification of bones**	**Back problems**	**Depression**
Poor health	-0.881	1.249	-0.166	-0.352	-0.660**	-2.030	-0.994***	-0.363
	(0.543)	(0.846)	(0.502)	(0.242)	(0.264)	(2.159)	(0.250)	(0.600)
Individual income	0.571***	0.559***	0.558***	0.557***	0.551***	0.557***	0.566***	0.560***
	(0.149)	(0.149)	(0.149)	(0.149)	(0.149)	(0.149)	(0.148)	(0.149)
Wealth	-0.104	-0.108	-0.107	-0.104	-0.111	-0.106	-0.086	-0.110
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Compensation rate	-0.135	-0.108	-0.123	-0.128	-0.107	-0.133	-0.102	-0.119
	(0.353)	(0.353)	(0.353)	(0.353)	(0.353)	(0.353)	(0.352)	(0.353)
R2 (overall)	13.9	13.8	13.5	13.9	14.4	13.6	15.0	13.6
Breusch-Pagan $\chi 2$	110.0***	111.0***	112.2***	109.0***	106.1***	111.5***	108.1***	111.2***
Likelihood ratio test	127.8***	129.0***	130.3***	127.0***	123.3***	129.6***	125.2***	129.3***
Number of obs.s	1,272							

See Table 3 for notes. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

Table 6.

Random effects estimates of the effect of disaggregated diseases conditions and economic factors on women's retirement age.

	Diseases							
	High blood pressure	**Diabetes**	**Bronchitis/ asthma**	**Osteo-arthritis**	**Myalgia**	**Osteoporosis/ decal-cification of bones**	**Back problems**	**Depression**
Poor health	-0.147	0.357	-0.237	-0.005	-0.059	-2.205***	-0.474**	-0.954**
	(0.414)	(1.962)	(0.398)	(0.187)	(0.177)	(0.521)	(0.213)	(0.400)
Individual income	0.429**	0.433**	0.433**	0.430**	0.431**	0.427**	0.453**	0.416**
	(0.199)	(0.199)	(0.199)	(0.199)	(0.199)	(0.197)	(0.198)	(0.198)
Wealth	-0.131	-0.133	-0.134	-0.133	-0.137	-0.160	-0.134	-0.127
	(0.167)	(0.167)	(0.167)	(0.167)	(0.167)	(0.165)	(0.166)	(0.166)
Compensation rate	1.048***	1.046***	1.046***	1.048***	1.049***	1.002***	1.008***	1.062***
	(0.367)	(0.367)	(0.367)	(0.367)	(0.367)	(0.364)	(0.367)	(0.366)
R2 (overall)	16.9	16.8	16.8	16.8	16.8	18.4	17.4	17.5
Breusch-Pagan $\chi 2$	66.9***	67.5***	67.6***	67.3***	67.6***	66.5***	65.9***	66.0***
Likelihood ratio test	73.2***	73.8***	73.8***	73.6***	73.6***	72.6***	71.7***	71.9***
Number of obs.s	1,040							

See Table 3 for notes. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

Table 7.

Random affects estimates of the effect of disaggregated diagnosed conditions and economic factors on men's retirement age.

	Diagnoses						
	Heart Conditions	**Strokes**	**Cancers**	**Lung diseases**	**Diabetes**	**High blood pressure**	**Arthritis**
Poor health	-0.639*	0.109	-0.348	-1.075	-0.916	-0.739	0.456
	(0.376)	(1.123)	(0.601)	(0.708)	(1.007)	(0.749)	(0.370)
Individual	0.559***	0.556***	0.556***	0.557***	0.553***	0.555***	0.558***
income	(0.149)	(0.149)	(0.149)	(0.149)	(0.149)	(0.149)	(0.149)
Wealth	-0.100	-0.107	-0.107	-0.110	-0.108	-0.107	-0.108
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Compensation rate	-0.122	-0.120	-0.117	-0.124	-0.124	-0.127	-0.135
	(0.353)	(0.353)	(0.353)	(0.353)	(0.353)	(0.353)	(0.353)
R2 (overall)	13.7	13.5	13.6	13.9	13.5	13.6	13.6
Breusch-Pagan $\chi 2$	112.3***	112.1***	112.2***	107.5***	112.5***	112.5***	112.5***
Likelihood ratio test	130.2***	130.3***	130.3***	125.8***	131.0***	130.7***	130.7***
Number of observations	1,272						

See Table 3 for notes. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

Table 8.

Random affects estimates of the effect of disaggregated diagnosed conditions and economic factors on women's retirement age.

	Diagnoses				
	Heart conditions	**Strokes**	**Cancers**	**Lung Diseases**	**Arthritis**
Poor health	-2.620***	-0.870	-0.165	-0.170	0.187
	(0.770)	(1.345)	(0.366)	(0.673)	(0.405)
Individual income	0.423**	0.433**	0.431**	0.430**	0.431**
	(0.198)	(0.199)	(0.199)	(0.199)	(0.199)
Wealth	-0.152	-0.135	-0.131	-0.134	-0.135
	(0.166)	(0.167)	(0.167)	(0.167)	(0.167)
Compensation rate	1.054***	1.048***	1.051***	1.048***	1.046***
	(0.365)	(0.367)	(0.367)	(0.367)	(0.367)
R2 (overall)	17.5	16.8	16.8	16.8	16.8
Breusch-Pagan $\chi 2$	69.7***	67.7***	67.6***	67.4***	67.6***
Likelihood ratio test	73.4***	74.0***	73.9***	73.6***	73.9***
Number of obs.	1,040				

Note: All the values for the diagnoses diabetes and high blood pressure are missing because none of the women in the sample have been hospitalized due to these diseases. See also Table 3 for notes. * Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

The insignificant effect of diagnoses on retirement could arise due to the fact that individuals who have been hospitalized receive neutralizing treatment, enabling them to continue working. Another potential explanation could be that people who suffer from a serious condition may in fact be advised by their doctors (or choose themselves) to continue working because of the potential therapeutic effects of engaging in a challenging and rewarding activity, the social contact with colleagues etc. Finally, a third explanation might be that individuals' retirement plans are affected by receiving diagnoses but we are unable to capture this effect as the incidence of diagnoses is low in this small sample. The finding that hospitalization for heart diseases has a much stronger impact for women's retirement than for men's is surprising since heart diseases according to Case and Paxson (2004) are more likely to result in hospitalization and death for men. However, the fact that heart disease is less frequently seen among women might imply that women who are diagnosed for it perceive themselves as being more ill compared to others in their reference group.

5. Conclusions

Using a wide array of alternative health measures including both self-reported and diagnostic measures extracted from the Danish National Patient Registry records, we compare the role of subjectively versus objectively measured health as a determinant of retirement planning, after controlling for income, labour market, and job and background characteristics. The sample consists of older workers and retirees drawn from two waves of a Danish panel survey 1997 and 2002, which is merged to longitudinal register data. Compared to previous studies, we have access to a wider array of health measures including self-assessed subjective health, self-reported objective measures as well as purely objective measures of health based on actual medical diagnoses made at the time of hospitalization.

Extending the existing literature, we estimate a model of retirement planning that controls for unobserved heterogeneity. In addition, we estimate separate models for men as well as women. We find that self-rated health is an important predictor of retirement. Even models that correct for unobserved heterogeneity show that self-rated physical health is an important predictor of retirement planning, in fact at least as important as economic factors, both among men as well as among women. However, as expected, health seems to be less important for retirement planning in Denmark compared to the US perhaps due to the subsidized and fully-covered nature of the Danish health care system and the easier access to health-related exit or because Danish workers tend to exit the labour market early, possibly before severe health problems develop.

Health also seems to be relatively more influential in men's retirement planning. One possible explanation of this gender difference is that men to a greater extent are employed in jobs that are inconsistent with poor health.[16] Another explanation might be that the gender difference is due to sample selection. That is, more women than men were excluded from the study because they retired before the sample period. Of particular importance is the exclusion of relatively many women who take early retirement through the TBP program, which was opened in the mid-nineties and targeted the sample age. Since

[16] Tentatively, we have tested this hypothesis by interacting each of the eight health measures with dummy variables for private sector (which is male-dominated) and physical demanding job respectively. However, no systematic differences between men and women appeared.

access to this program did not depend on health criteria, we expect that more excluded women than men retired before they got sick.

Our results also suggest that the true effect of health on retirement spanned by subjective, self-reported objective and purely objective measures lies between 0 and 1.2 years for men and between 0 and 0.6 years for women.

If the identified effect of health on retirement planning in Denmark reflected an exploitation of the Danish welfare system by individuals in the labour force using failing health as an excuse for early retirement, our conclusions would lead to the policy recommendation of a less generous welfare system as a way of delaying retirement. However, the effect of health identified in this study is most likely real since concerns of justification bias are minor in a sample of workers. Further, the fact that only selected, and not all health measures are found to have significant effects supports this interpretation. Therefore, based on our findings, the recommendation would be to expand preventive and neutralizing health care services. A particular effort should be directed toward preventing and/or neutralizing diseases that most strongly induce retirement such as osteoporosis, back problems, myalgia, depression and heart diseases.

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Appendix

Appendix A1. Health measures

Both survey and register-based health measures are included in our data. Subjective health measures are obtained from the survey while objective health measures are obtained from both surveys and registers.

The subjective health measures from the survey are self-rated. These are:

- General health: "All in all, how would you assess you current health? This variable is equal to one, if the answer is "very poor", "poor" or "somewhat poor" and zero otherwise ("good" or "very good").
- Health compared to others: "How do you think your health is relative to others of your age?" This variable is equal to one, if the answer is "worse than others" and zero otherwise ("better than others" or "like others").

The objective health measures obtained from survey and registers are split into four categories: work limitations, functional limitations, doctor diagnosed diseases and hospitalization due to specific diseases:

- Work limitations: "Do you find it difficult to do your job due to impairment of memory or concentration, reduced sight or hearing, tiredness, low spirits or lack of sleep?" A dummy variable for work limitations is set equal to one, if the individual suffers from at least one of these problems.
- Functional limitations: A dummy variable is set equal to one if the individual normally has difficulty cutting toe nails, climbing stairs, walking around outdoors or inside the home, getting washed or putting on clothes or shoes.
- Diseases: "Has a doctor told you that you have – or within the last year have had – high blood pressure, diabetes, bronchitis/asthma, osteoarthritis, myalgia, osteoporosis/ decalcification of bones, back problems or depression?" If yes: "Does this disease bother you in normal everyday life?" A dummy for diseases is

set equal to one if at least one of these diseases bothers the individual in normal everyday life.

- Diagnoses: Information about diagnoses is obtained from registers. A dummy variable for diagnoses is set equal to one if the individual has been hospitalized for either heart conditions, stroke, cancer, lung disease, diabetes, high blood pressure or arthritis. [17]

[17] For the first survey year, which is 1997, diagnoses are recorded on the basis of information for the period 1993 to 1996, while in the case of the second survey year, which is 2002, diagnoses are recorded for the years 1998-2001. If retirement takes place between to two survey years, diagnoses are recorded based on information for the years between the first survey year and the retirement year.

Appendix A2.

Means of variables by labour force (LF) status, men and women (standard deviations in parentheses).

	In LF Wave 1				Out of LF Wave 1			
	Men		Women		Men		Women	
Planned Retirement Age	61.7 [g]	(2.67)	60.8	(2.20)	-	-	-	-
Poor health								
General health	0.18 [e]	(0.38)	0.18 [e]	(0.39)	0.64	(0.48)	0.55	(0.50)
Health compared to others	0.05 [e]	(0.21)	0.05 [e]	(0.21)	0.47	(0.50)	0.35	(0.48)
Work limitations	0.19	(0.39)	0.21	(0.41)	-	-	-	-
Functional limitations	0.03 [ge]	(0.17)	0.05 [e]	(0.23)	0.35	(0.48)	0.32	(0.47)
Diseases Conditions	0.22 [ge]	(0.42)	0.32 [e]	(0.47)	0.50	(0.50)	0.55	(0.50)
- High blood pressure	0.02 [e]	(0.14)	0.03 [e]	(0.16)	0.10	(0.29)	0.06	(0.23)
- Diabetes	0.01 [g e]	(0.08)	0.00 [e]	(0.03)	0.03	(0.18)	0.02	(0.14)
- Bronchitis/asthma	0.02 [g e]	(0.14)	0.03 [e]	(0.17)	0.06	(0.24)	0.11	(0.32)
- Osteoarthritis	0.11 [g e]	(0.31)	0.16 [e]	(0.37)	0.29	(0.45)	0.35	(0.48)
- Myalgia	0.08 [g e]	(0.28)	0.17 [e]	(0.38)	0.21	(0.41)	0.26	(0.44)
- Osteoporosis/ decalcification of bones	0.00 [g e]	(0.04)	0.02 [e]	(0.13)	0.01	(0.11)	0.07	(0.26)
- Back problems	0.10 [g e]	(0.29)	0.12 [e]	(0.32)	0.30	(0.46)	0.29	(0.45)
- Depression	0.01 [g e]	(0.12)	0.03 [e]	(0.16)	0.14	(0.35)	0.10	(0.30)
Diagnoses	0.09 [g e]	(0.29)	0.06 [e]	(0.24)	0.21	(0.41)	0.16	(0.37)
- Heart conditions	0.03 [g e]	(0.18)	0.01 [e]	(0.08)	0.09	(0.29)	0.03	(0.16)
- Strokes	0.00 [e]	(0.06)	0.00	(0.04)	0.03	(0.17)	0.01	(0.07)
- Cancers	0.01 [g]	(0.10)	0.03	(0.16)	0.01	(0.11)	0.03	(0.18)
- Lung diseases	0.01	(0.09)	0.01	(0.09)	0.02	(0.13)	0.02	(0.13)
- Diabetes	0.00 [g]	(0.06)	0.00 [e]	(0.00)	0.00	(0.07)	0.01	(0.11)
- High blood pressure	0.01 [g]	(0.08)	0.00	(0.00)	0.01	(0.11)	0.00	(0.04)
- Arthritis	0.03 [e]	(0.18)	0.02 [e]	(0.15)	0.07	(0.26)	0.08	(0.26)
Demographic characteristics								
Born in 1940	0.42 [e]	(0.49)	0.40 [e]	(0.49)	0.57	(0.50)	0.52	(0.50)
Vocational training	0.48 [g]	(0.50)	0.38 [e]	(0.49)	0.41	(0.49)	0.30	(0.46)
Higher education	0.23 [g e]	(0.42)	0.27 [e]	(0.44)	0.10	(0.31)	0.07	(0.25)

	In LF Wave 1				Out of LF Wave 1			
	Men		**Women**		**Men**		**Women**	
Living alone	0.11 [g e]	(0.31)	0.20 [e]	(0.40)	0.38	(0.49)	0.25	(0.43)
Partner of the same age/older[a])	0.48 [e]	(0.50)			0.31	(0.46)	-	-
Partner of the same age/older[a])			0.46 [e]	(0.50)	-	-	0.40	(0.49)
Financial and job characteristics								
Log income, aver. of year *t-1* and *t-2*[b]*)*	12.4 [g e]	(0.53)	12.1 [e]	(0.41)	11.7	(0.50)	10.8	(2.78)
Wealth in year *t-1* in 1,000,000 d.kr.	0.52 [g e]	(1.16)	0.20 [e]	(0.41)	0.22	(0.56)	0.13	(0.43)
Comp.rate in year *t*	0.47[c]) [g]	(0.20)	0.57[d])	(0.19)	-	-	-	-
Comp. rate is missing	0.11 [g]	(0.31)	0.17	(0.38)	-	-	-	-
Experience	38.7 [g e]	(5.52)	34.5 [e]	(6.34)	33.2	(8.10)	29.3	(8.27)
Duration of unemployment., last 4 years	0.14 [g e]	(0.44)	0.18 [e]	(0.52)	0.18	(0.52)	0.33	(0.68)
Self-employed etc.	0.13 [g]	(0.34)	0.09	(0.29)	-	-	-	-
Skilled, unskilled workers	0.34 [g]	(0.47)	0.16	(0.36)	-	-	-	-
Private sector	0.64 [g]	(0.48)	0.32	(0.47)	-	-	-	-
Tenure	17.6 [g]	(11.7)	16.5	(10.4)	-	-	-	-
Hours of work	40.7 [g]	(8.50)	34.2	(8.35)	-	-	-	-
Physical demanding job	0.48 [g]	(0.50)	0.58	(0.49)	-	-	-	-
Job satisfaction[e])	3.59	(1.46)	3.60	(1.45)	-	-	-	-
Number of observations	1272		1038		230[f])		548 [f])	

Notes: a) "Same age": +/- two years; baseline in each case is the most usual pattern b) In cases where earnings is less than zero, this information is replaced by information about surplus of own firm; c) 1138 observations; d) 861 observations; e) "Would choose the current job again": 1= yes, quite sure; 5 = no, certainly not; f) Number of observations differ for some variables due to missing values. g) Significant gender difference, $p<0.10$. e) Significant employed-not-employed difference, $p<0.10$.

Appendix A3.

Table A1. Fixed effects estimates of the effect of health and economic factors on men's retirement age.

	Subjective health		Objective health			
	General health	Health comp. to others	Work limitations	Functional limitations	Disease conditions	Diagnoses
Poor health	-0.746**	-0.664	0.099	0.019	-0.015	-0.184
	(0.304)	(0.523)	(0.249)	(0.635)	(0.254)	(0.274)
Individual income	0.261	0.265	0.260	0.262	0.263	0.259
	(0.221)	(0.222)	(0.223)	(0.223)	(0.224)	(0.222)
Wealth	-0.097	-0.112	-0.099	-0.099	-0.099	-0.106
	(0.121)	(0.122)	(0.121)	(0.121)	(0.121)	(0.122)
Compensation rate	-0.099	-0.164	-0.155	-0.140	-0.140	-0.134
	(0.426)	(0.428)	(0.430)	(0.428)	(0.428)	(0.428)
R2 (overall)	16.6	16.0	15.8	15.8	15.8	15.8
Hausman specification $\chi 2$	54.1***	51.9***	53.0***	52.7***	57.6***	53.2***
Number of observations	1,272					

Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

Table A2. Fixed effects estimates of the effect of health and economic factors on women's retirement age.

	Subjective health		Objective health			
	General health	Health comp. to others	Work limitations	Functional limitations	Disease conditions	Diagnoses
Poor health	-0.439*	-0.412	-0.059	-0.039	-0.256	-0.300
	(0.252)	(0.462)	(0.249)	(0.557)	(0.233)	(0.296)
Individual income	-0.061	-0.049	-0.038	-0.036	-0.053	-0.042
	(0.327)	(0.328)	(0.328)	(0.328)	(0.328)	(0.327)
Wealth	-0.531*	-0.518*	-0.522*	-0.525*	-0.542**	-0.539**
	(0.273)	(0.274)	(0.274)	(0.274)	(0.274)	(0.274)
Compensation rate	1.098**	1.090**	1.080**	1.078**	1.073**	1.103**
	(0.467)	(0.468)	(0.468)	(0.469)	(0.467)	(0.468)
R2 (overall)	15.0	14.6	14.5	14.5	14.7	14.7
Hausman specification $\chi 2$	24.2*	23.6*	23.8*	23.6*	23.5	23.5
Number of observations	1,040					

Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

Appendix A4.

Table A3. Random effects estimates of the effect of health and economic factors on men's retirement age (all health measures jointly entered).

	(1)	(2)	(3)	(4)	(5)	(6)
Subjective health						
General health	-1.197***	-1.092***	-1.130***	-1.161***	-1.102***	-1.093***
	(0.194)	(0.205)	(0.205)	(0.208)	(0.211)	(0.212)
Health comp. to others		-0.566	-0.615*	-0.684*	-0.589	-0.574
		(0.358)	(0.358)	(0.365)	(0.370)	(0.371)
Objective health						
Work limitation			0.334*	0.336*	0.356*	0.356*
			(0.182)	(0.182)	(0.182)	(0.183)
Functional limitation				0.433	0.432	0.436
				(0.433)	(0.432)	(0.432)
Disease conditions					-0.286	-0.288
					(0.179)	(0.179)
Diagnosis						-0.098
						(0.225)
Financial variables						
Individual income	0.540***	0.545***	0.539***	0.537***	0.543***	0.542***
	(0.147)	(0.147)	(0.147)	(0.147)	(0.146)	(0.147)
Wealth	-0.102	-0.098	-0.101	-0.101	-0.098	-0.098
	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)
Compensation rate	-0.021	-0.034	-0.075	-0.073	-0.081	-0.078
	(0.350)	(0.350)	(0.350)	(0.350)	(0.350)	(0.350)
R2 (overall)	16.9	17.0	17.4	17.5	17.8	17.8
Breusch-Pagan $\chi 2$	103.0***	103.5***	101.6***	100.6***	98.6***	98.7***
Number of observations	1,272					

Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.

Table A4. Random effects estimates of the effect of health and economic factors on women's retirement age (all health measures jointly entered).

	(1)	(2)	(3)	(4)	(5)	(6)
Subjective health						
General health	-0.641***	-0.615***	-0.585***	-0.562***	-0.588***	-0.586***
	(0.168)	(0.180)	(0.183)	(0.186)	(0.194)	(0.194)
Health comp.		-0.130	-0.103	-0.071	-0.086	-0.061
to others		(0.334)	(0.335)	(0.338)	(0.339)	(0.343)
Objective health						
Work limitation			-0.161	-0.146	-0.156	-0.157
			(0.165)	(0.166)	(0.168)	(0.168)
Functional				-0.216	-0.221	-0.208
limitation				(0.318)	(0.318)	(0.319)
Disease					0.075	0.079
conditions					(0.155)	(0.155)
Diagnosis						-0.135
						(0.247)
Financial variables						
Individual	0.412**	0.412**	0.417**	0.412**	0.412**	0.413**
income	(0.197)	(0.197)	(0.197)	(0.198)	(0.198)	(0.198)
Wealth	-0.126	-0.124	-0.125	-0.121	-0.116	-0.115
	(0.165)	(0.166)	(0.166)	(0.166)	(0.166)	(0.166)
Compensation rate	1.046***	1.047***	1.054***	1.052***	1.049***	1.053***
	(0.365)	(0.365)	(0.365)	(0.365)	(0.365)	(0.366)
R2 (overall)	18.3	18.3	18.4	18.5	18.5	18.5
Breusch-Pagan $\chi 2$	64.3***	64.3***	63.9***	63.8***	63.2***	63.2***
Number of observations	1,040					

Significant at a 10% level, ** significant at a 5% level, *** significant at a 1% level.