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ORIGINAL INVESTIGATION

Early retirement in the day-care sector: the role of working conditions and health

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Abstract This article studies the role of working conditions and health for elderly female day-care teachers' decision to enter early retirement. Entry into retirement is analysed in a duration framework that allows for unobserved heterogeneity in the baseline hazard. Data are from a Danish longitudinal data set based on administrative register records for 1997–2006. Working conditions are measured by four indicators. First, work pressure is measured by the child-to-teacher ratio, which varies across municipalities and over time. Second, working conditions are measured by the proportion of children with a problematic social background. Third, the share of trained teachers is considered an indicator of working conditions. And fourth, the size of the institution is assessed as an indicator of working conditions. Regressions in a duration model framework show that there is no significant relationship between the child-to-teacher ratio or the size of the institution and early retirement. However, working conditions measured by the social background of the children and the share of trained day-care teachers have a significant effect on the probability of early retirement. Finally, a poor health condition is associated with a higher propensity to enter early retirement.

Keywords Retirement · Working conditions · Health · Day-care teachers

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Data has been available through Statistics Denmark's micro data base for researchers. See http://www.dst.dk/HomeUK/ForSale/Research/acces.aspx. Programs for data generation and estimation are available from the author upon request.

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Introduction

Over the last three decades, early retirement for the 60+ years old increased significantly in many European countries. Grace to increasing longevity and an increasing share of the population being 60+ years of age, policy makers are interested in reversing this trend. One important theme in the debate is if working arrangements can be improved to promote labour supply of the elderly. The research question investigated in this article is whether work pressure and health affect early retirement. The article investigates entry into the Danish early retirement pay (ERP) scheme which is a voluntary early retirement programme for the 60–64 years old. In Denmark, there has been a debate over more than a decade about whether this programme should be halted, and the government has recently decided to submit a proposal for a gradual phase-out of the programme for the younger groups in the labour market.[1]

The relationship between working conditions, health and workers' retirement decision has been the subject of extensive research (for a recent survey, see Haider and Loughran 2010). Working conditions are traditionally measured using two main approaches: First, a number of studies use self-reported assessment of working conditions or job satisfaction; these measures are subjective by nature.

[1] Presently, the proposal remains to be decided by the parliament.

Second, some studies use measures of work pressure where the researcher has assessed working conditions based on, e.g. sector-specific information; this assessment may be impacted by subjective beliefs of the researcher. Using sector-specific measures, the effect of working conditions is difficult to distinguish from workers' selection into different occupations. Hence, many studies of the role of working conditions rely on subjective (self-reported) measures of work pressure or general job characteristics. Analyses based on self-reported measures for working conditions and/or job satisfaction are generally at risk of suffering from justification bias in much the same way as in the case of self-reported health (Bound et al. 1999; Kapteyn et al. 2009; Datta Gupta and Larsen 2010).

The main contribution of this article is to use objective measures from Danish register data on working conditions and health. The article focuses on teachers in the Danish day-care sector where working conditions are generally measured by four main indicators: the child-to-teacher ratio, the size of the institution, the social background of the children and the education level of the colleagues at the workplace. These factors vary across institutions and municipalities and over time. Unique feature of the data is the information on the social background of the children in day care. Finally, health is known to be important for entry into retirement, and working conditions can also affect retirement through health (Grossman 1972; Siegrist et al. 2006). The analysis is performed in a duration framework which allows for unobserved heterogeneity in the baseline hazard through a piece-wise constant hazard specification.

Previous evidence

Based on data from the Retirement History Study, Quinn (1978) finds that individuals are more likely to retire from jobs with undesirable job attributes, and respondents with a health limiting condition are more sensitive to the job environment. Using the US Health and Retirement Study (HRS), Hurd and McGarry (1993) find that physical and mental job requirements have a rather small influence on prospective retirement, whereas measures of job flexibility are important determinants. Based on HRS data, Gustman and Steinmeier (2000) find that minimum hour constraints, firm characteristics and job difficulty or stress have limited implications for the retirement decision. French (2005) estimates a life-cycle model of labour supply in which future wages and health status are uncertain. Haider and Loughran (2010) combine information from the Current Population Survey and the HRS to conclude that job characteristics such as occupation and self-assessed stress levels have no impact on transitions into retirement. Using the Survey of Health, Ageing and Retirement in Europe (SHARE), Siegrist et al. (2006) conclude that factors reflecting poor psychosocial quality of work are positively associated with the intention to retire early. Moreover, recent SHARE data also reveal that job satisfaction and the level of education of a person compared to colleagues at the workplace (over- vs. under-education) affect exit of the labour market (Schnalzenberger et al. 2008). Friis et al. (2007) find that factors as low job influence, high workload and physical job demands marginally increase the probability of early retirement for nurses, while health, income, marital status and retirement status of a husband are much stronger predictors of exit into early retirement. Larsen (2008) finds that job demands lower, while earnings, work-hour satisfaction and the opportunity to use skills on the job increase the Danish retirement age.

Fischer and Sousa-Poza (2009) find—in a study based on the German Socio-Economic Panel—that there is a positive link between job satisfaction and subjective as well as more objective measures of health. Datta Gupta and Kristensen (2008) present evidence that a good perceived work environment is a highly significant determinant of worker health. Several studies (Datta Gupta and Larsen 2007, 2010; Danø et al. 2005; Rice et al. 2006) find that health impacts the retirement decision. Christensen and Lamb (2010) use detailed information on diagnosis codes to prove that objectively measured health status has a significant impact on exit into early retirement in Denmark.

Institutional background

The ERP scheme

The article analyses entry into the publicly financed ERP scheme. ERP was introduced in 1979 as a labour-market programme aimed at reducing unemployment and facilitating early retirement for worn-out workers. The ERP scheme was reformed in 1980, 1992 and 1999—the two latter reforms with the purpose of creating incentives for workers to postpone early retirement (Bingley et al. 2011). At the same time, the normal pension age for ordinary public pensions was reduced from 67 to 65. Hence, since 1999, ERP has been available for groups aged 60–64. The change of the scheme was gradually phased in after 1999. Eligibility for the ERP programme requires membership of an unemployment insurance scheme for a certain period of time. Until 1999, the required eligibility period was 20 years, and from mid-1999 the required membership period is 25 out of 30 years. The annual ERP rate is around 20,600€ if ERP is chosen at the age of 60 and 22,700€ if ERP is entered at 62 or older. Individuals on ERP are allowed to work for a maximum number of hours per year; labour income and private pensions are partially deducted from the ERP rate. From the age of 65, a universal public

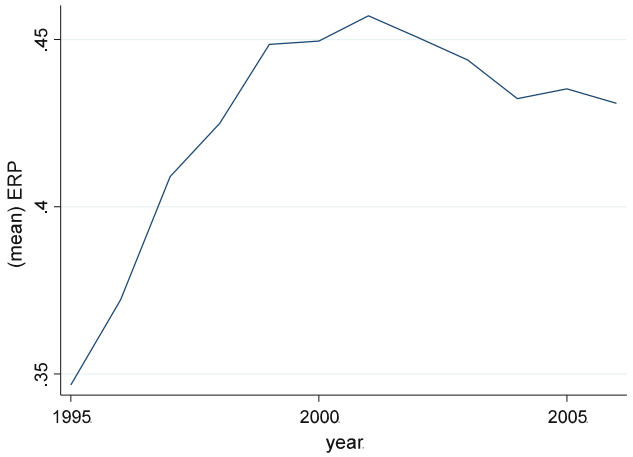

Fig. 1 Share of 60–64-year-old female day-care teachers on ERP. *Source* own calculations based on register data

old age pension is available for all elderly people, irrespective of former labour force attachment.

As in Danø et al. (2005), ERP is in this article regarded as the only general route to *voluntary* early retirement for the 60–64 years old. One other main early exit option exists, namely the Social Disability Pension. However, granting of a Social Disability Pension requires that a medical or other expert declares that the individual is unable to work due to health or social reasons. Disability pension can only be obtained if all attempts to improve the applicant's labour-market qualifications have been explored, including rehabilitation, treatment and active social policy. Since 2003, disability pension has only been granted to people who have experienced a significant decrease in their occupational skills, consequently being unable to become self-supporting in the future. In contrast to this, ERP is not awarded on the basis of health conditions, but depends on the degree of labour-market participation and unemployment insurance membership.

Among the group of early retirees, almost 94% retired on ERP, whereas 4% on a social pension and around 2% on other retirement schemes (Danø et al. 2005). Moreover, ERP is generally more generous than disability pension, possibly explaining why relatively few (less than 1%) of the 60–64 years old enter disability pension (Danish Economic Council 2005). The focus of this article is on ERP. Figure 1 depicts the share of female day-care teachers on ERP in each year over the period 1995–2006.

The day-care sector

Danish day-care institutions are directed at children aged ½–6 years. Municipalities can organise their day-care offerings quite differently. Day care usually comprises child-minding, nursery, preschool and age-integrated institutions. In some municipalities, the majority of day-care institutions are in the form of age-integrated institutions (for children aged ½–6 years) where nursery and preschool are combined in one institution. In other municipalities, the majority of children aged 3–6 are in traditional preschool. For the group of children aged ½–3 years, some municipalities offer institution-based nursery openings, whereas others rely on municipal organised child-minding. The analyses focus on institutions that are either nursery care or preschools.

One central measure of working conditions is the child-to-teacher ratio, calculated at the municipal level as the number of children per full-time day-care employee occupied with child care (teachers and assisting teachers with pedagogical functions). Consequently, staff occupied with kitchen duties, cleaning, maintenance, repair, etc. are not part of the child-to-teacher ratio. The child-to-teacher ratio varies across municipalities and over time. As discussed in the introduction, the advantage of using the child-to-teacher ratio as measure of work pressure is that it is fairly objective. The number of children in day-care institutions and number of full-time employees in day-care institutions at the municipal level is from Statistics Denmark (www.statistikbanken.dk). For 1995–2003, the number of both employees and number of children enrolled in day-care institutions were reported in March, while for 2004–2006, reporting was carried out in September. Moreover, between 2000 and 2001 the reporting of the number of employees changed in the official statistics. Thus, the child-to-teacher ratio cannot necessarily be compared across the three periods, 1995–2000, 2001–2003 and 2004–2006. Figures 2 and 3 depict the development and geographical variation in the child-to-teacher ratio over the period 1995–2006. On average, the child-to-teacher ratio in nursery care was 3–3.5 children per teacher or assistant teacher over the period 2001–2006, see Fig. 2. In preschool (children aged 3–6), the child-to-teacher ratio was 6–7 over 2001–2006 (Fig. 3). In general, municipalities have a fairly constant child-to-teacher ratio over time.

Child-minding and age-integrated institutions are disregarded in the analysis due to a lack of consistent figures for child-to-teacher ratio. Consequently, the empirical analysis focuses on day nursery (children aged ½ upto 3) and preschool (children aged 3–6).

Data

The data set employed for the empirical analysis is a large micro panel based on administrative registers from Statistics Denmark. The population in the data is restricted to female day-care teachers who were employed in Danish preschools and nursery care at the age of 59 sometime over

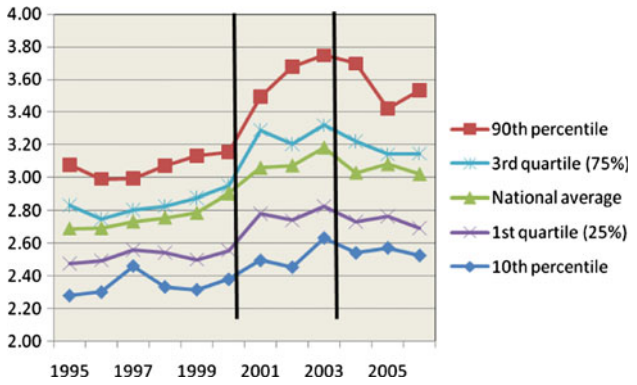

Fig. 2 Child-to-teacher ratio in nurseries, 1995–2006

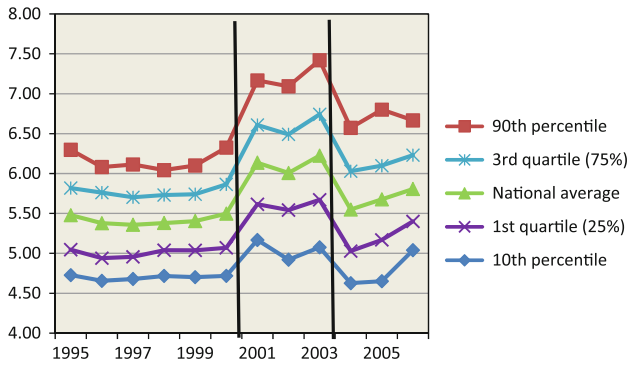

Fig. 3 Child-to-teacher ratio in preschool, 1995–2006. *Source* for Figs. 2 and 3, Statistics Denmark micro data and own calculations. *Note* for Figs. 2 and 3, The child-to-teacher ratio cannot necessarily be compared across the three periods, 1995–2000, 2001–2003 and 2004–2006

the period 1996–2006. The analysis focuses on female day-care teachers, since more than 90% of the day-care teachers approaching retirement are women. Moreover, the analyses focus on individuals aged 60–64 (since 1999 the eligibility age for ERP).

The data contains detailed information on annual labour-market status, i.e. information on the institution of employment, unemployment periods, retirement or other periods outside the labour force and use of health care, e.g. visits to general practitioner (GP), specialists, hospitalisation and medical diagnoses. Managers at the institution level usually hold a day-care teacher degree and are part of the pedagogical staff. More than 90% of trained day-care workers above 55 are women, so for simplicity, the article focuses on female day-care workers (teachers and assistants). The sample consists of more than 7,000 observations over 1996–2006. At the age of 59, around ¼ were employed in nursery care, while ¾ were employed in preschool.

Special attention is paid to the role of health in prompting early retirement. Poor health is measured by a dummy variable which takes the value 1 if an individual had more than ten visits to their GP and more than five visits to a specialist in somatic or psychiatric diseases or had visited a psychiatric specialist. According to this definition, around 18% of all observations in the sample are in poor health. This share is a bit higher for individuals on ERP, namely 19.3% (with a standard deviation of 39.5%), while the share of individuals in poor health who are still working is 16.9% (standard deviation 37.5%). This difference is statistically significant.

Unique feature of the data is the possibility to identify children enrolled in specific day-care centres. Due to data limitations, Statistics Denmark could not link all day-care institutions to one workplace. Approximately 53% of the day-care teachers are linked with their child group at the institution level. Based on this subset (4,800 observations), the importance of children's family background for teacher retirement is investigated.

Methods

The retirement choice is modelled as a discrete choice between participating in the labour force and retiring with ERP. For the majority of individuals, ERP is considered an absorbing state until transition to ordinary public pension at 65 (67 until 1998). The duration framework is well suited for this analysis, as it specifically accounts for retirement usually being an absorbing state. The analysis focuses on teachers aged 60–64 employed as day-care teachers at the age of 59. These individuals are followed until they exit employment to enter ERP or until they turn 65. Individuals are censored at the age of 65 (the ordinary public pension age from 1999 and onwards).

The duration model accommodates fixed effects. The duration of the period from a day-care teacher becomes eligible for ERP (turns 60) until she exits employment and chooses ERP is characterised by a hazard function which is assumed to be a function of a finite-dimensional vector of observed covariates and unobserved heterogeneity. Many of the covariates that are considered relevant for the choice of ERP are time variant, e.g. child-to-teacher ratio, health status and spouse's retirement status. Information on ERP take-up as well as key explanatory variables and controls are measured on an annual basis. Due to ERP's incentives to choose retirement at specific ages, a piece-wise constant hazard model in discrete time is specified.

The probability of retiring in each time period, t, i.e. the hazard rate, h_{it}, is specified using a complementary log–log (clog–log) function, which is the discrete-time counterpart of the continuous-time proportional hazard model (Jones et al. 2007). The specification of the hazard rate allows for unobserved heterogeneity (frailty), μ. Failure to control for

unobserved heterogeneity can cause spurious negative duration dependence since those with a higher hazard rate tend to exit first (Van den Berg 2001). The hazard rate is specified as:

$$h_{it} = 1 - \exp(-\exp(WC_{it-1}\alpha + H_{it-1}\gamma + X_{it-1}\beta + \theta_i(t) + \text{year}(t) + \mu_i))$$

where WC_{it-1} is working conditions including the child-to-teacher ratio, size of institution, characteristics of the children in the institution and characteristics of the teacher group in the institution, H_{it-1} is a variable signifying poor health, X_{it-1} includes personal characteristics and μ_i is the unobserved heterogeneity (frailty) parameter, summarising the impact of omitted variables. μ_i is usually assumed to follow some parametric form like a Gamma distribution or a Normal distribution. Unobserved heterogeneity enters as a multiplicative term in the baseline hazard function. It is a crucial assumption that unobserved heterogeneity is distributed independently of WC, H, X and t. Estimations are performed using a piece-wise constant baseline hazard duration framework.[2] To ensure a piece-wise constant baseline hazard specification, a dummy variable to represent each of the discrete-time periods, $\theta_i(t)$, enters the hazard function (corresponding to including age dummies, as hazard rates are assumed to be constant within each year of age due to age specific incentives in the ERP programme).

When assessing whether the effects we may find are truly causal, one has to consider sources of endogeneity. Two potential sources of endogeneity exist. The first stems from the fact that municipalities with favourable working conditions may attract teachers with better qualifications, better health, more energy and devotion to work. Hence, a positive correlation between the child-to-teacher ratio and retirement may reflect that teachers employed in municipalities with a high child-to-teacher ratio (high work pressure) have a relatively higher preference for leisure. A crucial question is whether employers can reveal whether a potential new employee is the "early-retirement type" at the time of the job interview. As median seniority of individuals in the sample is 13 years, and median work experience is 25 years, more than half of the elderly employees in day care approaching retirement were hired for their present job in their mid-1940s. Whether employers are able to predict, at the time of recruitment, if a potential employee is likely to retire early, is questionable. Consequently, one could argue that working conditions are exogenous to retirement. Unobserved heterogeneity in the hazard function (e.g. preferences for leisure) is to a certain extent addressed in the duration framework, although this does not allow for correlation between the unobserved individual factor and explanatory variables as, e.g. the child-to-teacher ratio. If this is not the case, the parameter estimate of the effect of the child-to-teacher ratio may be biased upwards and identify an *upper bound* for the "true" causal relationship between the child-to-teacher ratio and retirement; see Manski and Pepper (2000) for a discussion.

A second form of endogeneity arises if municipalities experiencing a high (aggregate) rate of early retirement respond by reducing the child-to-teacher ratio to retain elderly employees or to accommodate new, young and inexperienced teachers. This would imply a negative correlation between retirement and the child-to-teacher ratio. However, the model for individual retirement choice hypothesises a positive correlation in the sense that a high child-to-teacher ratio encourages day-care teachers to retire earlier (increase retirement). Thus, a positive relationship between child-to-teacher ratio and retirement may reflect a *lower bound* for the true causal effect.

Hypotheses

Primary parameters of interest are related to working conditions and health. Regarding working conditions, focus is on the effects of the child-to-teacher ratio, the size of the institution, institution characteristics such as the share of trained teachers and family background of the children in the institution. The inclusion of the child-to-teacher ratio as a measure for work pressure is rather straightforward. Many children per teacher increase the workload and may enhance stress levels.

The inclusion of the social background of the children is motivated by the observation that work pressure for day-care teachers may not only depend on the number of children, but also depend on the pedagogical challenges in the child group. For example, a high share of children with a disadvantaged social background, language difficulties or other challenges may enhance the work pressure of the employees. On the one hand, a high proportion of children with specific needs or challenges may induce more sickness or discontent among staff (directly or through selection) and lead to early retirement. On the other hand, a high proportion of disadvantaged children may promote dedication to work and attract and retain teachers with a high level of devotion to and engagement in their work. Both of these explanations can be at work simultaneously, and the direction of the net effect is mainly an empirical question. The article uses two indicators to capture the family background of the children in the institution. The first

[2] Estimations were performed in Stata. Two estimation procedures were used, xtcloglog which assumes that the unobserved heterogeneity is normally distributed and constant over time, and the pgmhaz8 estimation procedure which assumes Gamma-distributed unobserved heterogeneity, see Jenkins (1995) and http://www.iser.essex.ac.uk/iser/teaching/module-ec968.

indicator is the share of children with ethnic background other than Danish. The second indicator is the share of children with parents having only a short or no education (highest education of the two parents).

The direction of the empirical relationship between institution size and retirement is difficult to predict. On the one hand, large institutions may be more flexible in implementing senior policies and finding it easier to reallocate elderly employees from stressful to less demanding tasks. Flexibility may not be as prevalent for small institutions, leading to a negative relationship between size of institution and retirement. On the other hand, teachers in large workplaces may feel less responsible for the development in their institution, and they may even feel alienated from daily decisions and priorities at the workplace. Moreover, larger institutions with many children and employees create a noisier atmosphere than institutions with fewer children and employees. These arguments are in favour of a *positive* relationship between size of institution and early retirement.

The inclusion of the share of trained teachers as an indicator for working conditions is motivated by the hypothesis that this benefits the professional environment in general through, e.g. professional discussions, the ability to improve on pedagogical methods, adapt new principles and routines, and may stimulate professional discussions on work-related matters. This hypothesis is in accordance with Schnalzenberger et al. (2008) who find that the level of over-education stimulates entry into retirement.

Using the information in the data set on health care take-up allows an investigation of the impact of health status and interactions of health status and working conditions. Based on previous evidence, it is expected that poor health prompts early retirement. Spouses often coordinate their retirement behaviour (An et al. 2004). The estimations therefore include control dummy variables for having a partner and the partner's retirement status. Moreover, the estimations control for number of grandchildren, as grandmothers (and grandfathers) are considered a resource of support for many young dual-earner families in Denmark. In spite of high coverage of day-care offerings, short opening hours (especially on Fridays), closing days and illness of the grandchildren still provide a challenge to young working families, and many grandparents support their offspring by taking care of their grandchildren in these situations. Moreover, estimations control for the hourly net wage rate and experience.

Results

Estimations are carried out for the time period 1997–2006. Descriptive statistics of the data set are shown in Table 1. Tables 2 and 3 present the estimation results for models (1)–(8). Models (5)–(8) repeat models (1)–(4), but add the size of the institution measured by the (lagged) number of employees as well as (lagged) size of institution interacted with a dummy for the period post-2002 (due to the change in the measurement of number of employees in 2001 described in the section on Institutional background).

The child-to-teacher ratio is lagged one period. Models (1) and (5) (Tables 2, 3) include the lagged child-to-teacher ratio and five interaction variables: First, the lagged child-to-teacher ratio is interacted with dummies for the time periods 2002–2006 and 2005–2006, respectively (to take account of the structural breaks in the child-to-teacher ratio in 2001 and 2004 mentioned in the section on Institutional background). Second, each of these interaction effects is interacted with a dummy for preschool. This leads to six explanatory variables reflecting the effects of the child-to-teacher ratio.

Models (2)–(4) and (6)–(8) add controls for lagged health measured by a dummy for whether the individual was in poor health the previous year. Models (3), (4) and (7), (8) add interactions between the child-to-teacher ratio variables and the dummy for poor health.

Finally, models (3) and (7) control for the share of trained day-care teachers, and models (4) and (8) include the social background of the children in the institution. The latter is measured by the share of parents with ethnic minority background and the share of children in the institution where the parents had little or no education beyond primary school.

All models control for dummy for preschool (interacted with subperiods), a partner dummy, the local unemployment rate, a dummy for trained teacher, experience in years and number of grandchildren. Models (2)–(4) and (6)–(8) add controls for compensation rate and a dummy for whether the information on compensation rate was missing in the data. The compensation rate reflects the relationship between the ERP rate and labour-market related income (lagged). The calculation of the compensation rate follows Larsen and Datta Gupta (2004). Models (3), (4) and (7), (8) also control for retirement status of the partner. All estimations include year dummies to take account of common shocks to the propensity to choose ERP as for example reforms of the pension system or business cycle effects.[3]

The baseline child-to-teacher ratio parameter estimate, which corresponds to the effect for nursery care for the

[3] Standard errors in models (1), (2) and (5), (6) are bootstrapped (500 replications) to accommodate clustering in municipalities of the child-to-teacher ratio (see Cameron et al. 2008). Bootstrapping was not feasible for models (3), (4) and (7), (8) due probably to a large set of interaction terms, but given that there were only minor differences between default standard errors and bootstrapped standard errors in the estimation of models (1), (2) and (5), (6), the use of ordinary standard errors seems acceptable.

Table 1 Summary statistics (nursery care and preschools)

	Mean	SD	Min	Max
Child-to-teacher ratio	4.867	1.382	1.610	11.320
Size of institution	9.988	2.782	2.600	33.200
Dummy poor health	0.177		0.000	1.000
Share of teachers in institution	0.390		0.000	1.000
Share ethnic minority parents[a]	0.090		0.000	1.000
Share parents with short education[a]	0.216		0.000	1.000
Unemployment rate	5.737	1.943	2.200	14.800
Trained teacher	0.457		0.000	1.000
In experience	3.048	0.493	0.068	3.761
Number of grandchildren	2.276	2.034	0.000	12.000
Dummy preschool	0.751		0.000	1.000
Compensation rate	0.633	0.243	0.218	1.497
Missing compensation rate	0.118		0.000	1.000

[a] Selected sample

period 1997–2001, is not significant. The five variables following the baseline child-to-teacher ratio effect in Table 2 reflect the child-to-teacher ratio interacted with time periods, i.e. post-2002 and post-2005, and interaction with the dummy for preschool. These five interaction variables are not significant either.

Models (2)–(4) and (6)–(8) add controls for health status. From models (2) and (6), it appears that poor health is associated with a significantly higher probability of entering early retirement. When also including interactions between child-to-teacher ratio and health in model (3), (4) and (7), (8), no significant effects are found for the combination of poor health and the child-to-teacher ratio.

Models (3) and (7) include the share of trained teachers in the institution, and models (4) and (8) further include additional indicators for working conditions measured by characteristics of the children's parents. Estimations of models (4) and (8) are performed on a selected sample of observations with information on children linked to the day-care centres (see the Data section for an explanation). The share of trained teachers is negatively and significantly related to early retirement, indicating that early retirement is lower if the share of trained personnel is higher. The share of ethnic minority parents is insignificant, while the share of parents with no or short education seems to affect retirement in a positive, although only marginally significant, direction. This is weak evidence in favour of the notion that not only the size, but also the composition of the child group has implications for the work pressure and hence the probability of early retirement.

As models (5)–8) indicate, the size of the institution is not significantly associated with the probability of retirement.

Experience (which is highly correlated with age) has a positive and strongly significant effect on retirement. The compensation rate has a statistically significant impact on the probability of choosing ERP, suggesting that the economic side plays an important role when selecting into early retirement. The dummy for missing compensation rate is insignificant.

As expected, the unemployment rate is positively correlated with the probability of entering early retirement, suggesting that a higher local unemployment rate prompts early retirement. Significance of the frailty term was tested using the likelihood ratio test. The frailty term is generally significantly different from 0.

Having a partner has a positive and strong impact on the probability of early retirement, especially if the partner is already retired. Thus, couples coordinate their retirement. This result confirms prior findings (An et al. 2004; Friis et al. 2007). Also, the number of grandchildren is positively associated with the probability of early retirement.

Discussion

This article investigates the importance of working conditions for the decision to choose early retirement. The main contribution of the article is to exploit longitudinal data with objective information on working conditions for a large sample of employees working in the same sector. Four indicators for working conditions are examined: (1) The child-to-teacher ratio which is comparable across municipalities and over time and is an objective measure of work pressure; (2) Work pressure measured by the social background of the children cared for in each institution; (3) The share of trained teachers in the institution and (4) The size of the institution.

The analyses find no significant effect of the child-to-teacher ratio on retirement. However, there is a positive and significant relationship between the proportion of children in institutions having parents with no or short education and the teachers' hazard rate into early retirement. Hence, the pedagogical challenges related to social background of the

Table 2 Estimation, probability of retirement

	Model 1	Model 2	Model 3	Model 4
Child-to-teacher ratio				
Child-to-teacher ratio base	0.161	0.100	−0.006	−0.322
	(0.88)	(0.53)	(0.03)	(1.01)
Child-to-teacher ratio × post-2002	−0.007	0.066	0.169	0.265
	(0.02)	(0.24)	(0.61)	(0.69)
Child-to-teacher ratio × post-2005	−0.303	−0.279	−0.321	−0.323
	(1.08)	(1.03)	(1.15)	(0.78)
Child-to-teacher ratio × preschool	−0.171	−0.111	0.102	0.332
	(0.82)	(0.54)	(0.43)	(0.99)
Child-to-teacher ratio × preschool × post-2002	0.026	−0.041	−0.261	−0.257
	(0.08)	(0.14)	(0.87)	(0.64)
Child-to-teacher ratio × preschool × post-2005	0.379	0.329	0.391	0.300
	(1.26)	(1.18)	(1.33)	(0.70)
Health				
Poor health		0.149**	−0.570	−1.241
		(2.22)	(0.55)	(1.10)
Poor health × preschool			2.752**	3.398**
			(2.00)	(2.30)
Poor health × post-2002			0.673	1.598
			(0.44)	(1.02)
Poor health × post-2005			−32.296	−192.427
			(0.78)	(1.24)
Poor health × post-2002 × preschool			−3.658*	−4.145**
			(1.86)	(2.07)
Poor health × post-2005 × preschool			35.319	189.144
			(0.83)	(1.21)
Interaction child-to-teacher ratio and poor health				
Child-to-teacher ratio × poor health			0.296	0.584
			(0.78)	(1.40)
Child-to-teacher ratio × poor health × post-2002			−0.081	−0.423
			(0.15)	(0.75)
Child-to-teacher ratio × poor health × post-2005			10.651	64.788
			(0.76)	(1.46)
Child-to-teacher ratio × poor health × preschool			−0.711*	−0.972**
			(1.71)	(2.13)
Child-to-teacher ratio × poor health × preschool × post-2002			0.646	0.897
			(1.09)	(1.48)
Child-to-teacher ratio × poor health × preschool × post-2005			−10.948	−63.967
			(0.78)	(1.44)
Other working conditions				
Share teachers			−0.598***	−0.783***
			(2.65)	(2.92)
Share ethnic minority parents				−0.123
				(0.49)
Share parents no education				0.488*
				(1.85)

Table 2 continued

	Model 1	Model 2	Model 3	Model 4
Individual characteristics				
Dummy preschool	0.717	0.619	−0.158	−0.508
	(0.99)	(0.62)	(0.20)	(0.50)
Preschool × post-2002	−0.314	−0.225	0.736	0.413
	(0.30)	(0.24)	(0.73)	(0.34)
Preschool × post-2005	−1.308	−1.127	−1.505	−1.093
	(1.30)	(1.23)	(1.55)	(0.81)
Partner dummy	0.387*	0.412***	0.176**	0.176**
	(1.91)	(3.69)	(2.27)	(2.19)
Partner retired			0.521***	0.421***
			(7.64)	(6.36)
Unemployment rate	0.067**	0.071***	0.064***	0.031*
	(2.17)	(3.31)	(3.83)	(1.78)
Trained teacher dummy	−0.087	0.057	0.098*	0.071
	(1.26)	(0.99)	(1.67)	(1.16)
Experience	0.511***	0.892***	0.884***	0.763***
	(2.98)	(6.57)	(9.61)	(8.33)
Number of grandchildren	0.041**	0.051***	0.047***	0.028*
	(2.06)	(3.24)	(3.37)	(1.96)
Compensation rate		1.276***	1.298***	1.028***
		(5.36)	(7.55)	(6.47)
Compensation rate missing		0.015	−0.027	0.061
		(0.15)	(0.28)	(0.56)
Constant	−3.564***	−5.706***	−4.914***	−3.407***
	(2.98)	(5.96)	(6.99)	(3.73)
Number of observations	7068	7068	7010	4686
Log likelihood	−4445	−4397	−4308	−2888

Note control for time dummies and age dummies (for piece-wise constant hazards) and *t* values in parentheses. Standard errors in models (1) and (2) are bootstrapped with 500 replications

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

children matter for retirement. Moreover, the probability of choosing early retirement is lower if the share of trained teachers at the workplace is higher, suggesting that a professional environment with many formally trained colleagues contributes to a challenging and attractive work environment. This result is in line with Schnalzenberger et al. (2008) who show that over-education in the workplace is associated with a higher retirement probability. Finally, the size of the institution measured by number of teachers has no significant effect on early retirement.

The estimation results also point to the importance of family situation, in particular, the retirement status of the spouse and the presence of grandchildren. Hence, focusing merely on creating attractive working conditions for senior teachers may be inadequate in retaining older workers in the labour market.

Finally, the article finds that poor health is significantly associated with a higher probability of early retirement. This is consistent with a recent study on the impact of objectively measured health diagnoses on ERP take-up by Christensen and Lamb (2010). Hence, ERP may function as an alternative to disability pension for those whose health condition is not severe enough to permit a formal disability pension. Although a majority of the teachers are in good health, policy makers should be aware of the need for establishing alternatives to ERP for unhealthy workers as ERP is gradually phased out.

Overall, the results suggest that working conditions are significant for entry into early retirement, although the evidence is mixed. While physical work pressure (child-to-teacher ratio) seems to matter less, the general work environment, including the social composition of the child group and the professional environment, are important. The results point to the need for ingenuity in establishing working conditions and work practices that can potentially create incentives for the elderly to remain in the labour market. Future research should be directed at disentangling

Table 3 Estimation, probability of retirement, with control for institution size

	Model 5	Model 6	Model 7	Model 8
Child-to-teacher ratio				
Child-to-teacher ratio base	0.233	0.154	0.048	−0.244
	(1.34)	(0.82)	(0.22)	(0.77)
Child-to-teacher ratio × post-2002	−0.043	0.058	0.162	0.236
	(0.16)	(0.21)	(0.58)	(0.62)
Child-to-teacher ratio × post-2005	−0.299	−0.283	−0.320	−0.301
	(1.11)	(0.96)	(1.16)	(0.75)
Child-to-teacher ratio × preschool	−0.211	−0.135	0.077	0.284
	(1.09)	(0.64)	(0.32)	(0.86)
Child-to-teacher ratio × preschool × post-2002	0.058	−0.032	−0.254	−0.232
	(0.21)	(0.11)	(0.85)	(0.59)
Child-to-teacher ratio × preschool × post-2005	0.379	0.339	0.395	0.282
	(1.31)	(1.09)	(1.36)	(0.67)
Health				
Poor health		0.150**	−0.588	−1.214
		(2.26)	(0.57)	(1.09)
Poor health X preschool			2.774**	3.377**
			(2.03)	(2.31)
Poor health × post-2002			−0.693	1.591
			(0.45)	(1.03)
Poor health × post-2005			−32.523	−189.482
			(0.76)	(1.29)
Poor health × post-2002 × preschool			−3.675*	−4.119**
			(1.89)	(2.08)
Poor health × post-2005 × preschool			34.554	186.124
			(0.81)	(1.27)
Interaction of child-to-teacher ratio and poor health				
Child-to-teacher ratio × poor health			0.304	0.576
			(0.81)	(1.40)
Child-to-teacher ratio × poor health × post-2002			−0.088	−0.420
			(0.16)	(0.76)
Child-to-teacher ratio × poor health × post-2005			10.385	63.762*
			(0.73)	(1.75)
Child-to-teacher ratio × poor health × preschool			−0.719*	−0.965**
			(1.74)	(2.15)
Child-to-teacher ratio × poor health × preschool × post-2002			0.652	0.891
			(1.12)	(1.49)
Child-to-teacher ratio × poor health × preschool × post-2005			−10.684	−62.927*
			(0.75)	(1.72)
Size of institution				
Size of institution	0.031	0.026	0.027	0.031
	(1.14)	(0.97)	(1.07)	(1.22)
Institution size × post-2002	−0.005	0.001	−0.001	−0.007
	(0.17)	(0.02)	(0.02)	(0.22)
Other working conditions				
Share teachers				−0.805***
				(3.02)

Table 3 continued

	Model 5	Model 6	Model 7	Model 8
Share ethnic minority parents				−0.093
				(0.37)
Share parents no education				0.433
				(1.64)
Individual characteristics				
Dummy preschool	0.872	0.723	−0.045	−0.307
	(1.23)	(1.10)	(0.06)	(0.30)
Preschool × post-2002	−0.413	−0.252	0.709	0.323
	(0.43)	(0.28)	(0.70)	(0.26)
Preschool × post-2005	−1.316	−1.167	−1.527	−1.046
	(1.40)	(1.18)	(1.59)	(0.79)
Partner dummy	0.360*	0.406***	0.170**	0.170**
	(1.82)	(3.95)	(2.21)	(2.13)
Partner retired			0.516***	0.417***
			(7.57)	(6.34)
Unemployment rate	0.063*	0.070***	0.064***	0.029*
	(1.94)	(3.70)	(3.80)	(1.70)
Trained teacher dummy	−0.082	0.056	0.097*	0.072
	(1.26)	(0.95)	(1.67)	(1.19)
Experience	0.493***	0.885***	0.877***	0.753***
	(3.24)	(6.79)	(9.52)	(8.26)
Number of grandchildren	0.039**	0.050***	0.047***	0.028**
	(2.10)	(3.20)	(3.36)	(1.99)
Compensation rate		1.260***	1.277***	1.012***
		(5.69)	(7.45)	(6.42)
Compensation rate missing		0.013	−0.033	0.057
		(0.13)	(0.35)	(0.52)
Constant	−4.034***	−6.154***	−5.365***	−3.966***
	(3.12)	(6.05)	(6.50)	(3.87)
Number of observations	7068	7068	7010	4686
Log likelihood	−4443	−4395	−4307	−2887

Note control for time dummies and age dummies (for piece-wise constant hazards) and *t* values in parentheses. Standard errors in models (5) and (6) are bootstrapped with 500 replications

* $p < 0.10$; ** $p < 0.05$; *** $p > 0.01$

the complicated interactions between health, working conditions and labour supply in general, thus identifying work amenities most crucial to older workers. A coherent and coordinated policy to design labour-market conditions that are attractive also for senior workers is an important task for policy makers and employers.

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