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Health, work capacity and retirement in Sweden

Per Johansson
Lisa Laun
Mårten Palme

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Postal address: P.O. Box 513, 751 20 Uppsala
Visiting address: Kyrkogårdsgatan 6, Uppsala
Phone: +46 18 471 70 70
Fax: +46 18 471 70 71
ifau@ifau.uu.se
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Health, work capacity and retirement in Sweden[a]

by

Per Johansson[b], Lisa Laun[c] and Mårten Palme[d]

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Abstract

Following an era of a development towards earlier retirement, there has been a reversed trend to later exit from the labor market in Sweden since the late 1990s. We investigate whether or not there are potentials, with respect to health and work capacity of the population, for extending this trend further. We use two different methods. First, the Milligan and Wise (2012) method, which calculates how much people would participate in the labor force at a constant mortality rate. Second, the Cutler et al. (2012) method, which asks how much people would participate in the labor force if they would work as much as the age group 50-54 at a particular level of health. We also provide evidence on the development of self-assessed health and health inequality in the Swedish population.

Keywords: SHARE, Health inequality
JEL-codes: I10, J26

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[b] Per Johansson is Professor of Statistics at the Department of Statistics, Uppsala University. E-mail: Per.Johansson@statistik.uu.se.
[c] Lisa Laun is Ph.D in Economics and researcher at the Institute for Evaluation of Labour Market and Education Policy (IFAU). E-mail: Lisa.Laun@ifau.uu.se.
[d] Mårten Palme is Professor of Economics at the Department of Economics, Stockholm University. E-mail: Marten.Palme@ne.su.se.

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1 Introduction

One of Sweden's former prime minister Fredrik Reinfeldt's most controversial statements during his time in office between 2006 and 2014 was that the sustainability of Sweden's welfare state depends on the ability of the work force to prolong their active time at the labor market. He added that people in the future should prepare themselves to stay in the work force until age 75. This question was put high on the policy agenda and a government committee was appointed to suggest measures to delay the labor market exit (see Statens offentliga utredningar, 2013).

Policy initiatives to delay retirement have also been implemented. The minimum mandatory retirement age increased from age 65 to 67 in 2001. In 2007, an additional earned income tax credit and a payroll tax reduction were introduced for workers above age 65, with the purpose of increasing labor supply at older ages. Laun (2012) shows that these reforms seem to have increased labor force participation past age 65.

One of the main issues in the subsequent public policy debate was to what extent the health status of the population would allow a delayed retirement age. Although life expectancy has increased rapidly over the last couple of decades, skeptics pointed out that the development of self-reported health is less unambiguous and that one can even see a slight deterioration in some health measures, such as the share of people with obesity (BMI > 29.9).[1]

This paper investigates what available micro data can tell us about whether or not and to what extent older workers in Sweden have the health capacity to extend their work lives. To address this question, we use two different methods. The first one estimates how much people with a given mortality rate today would work if they were to work as much as people with the same mortality rate worked in the past. This approach builds on the work by Milligan and Wise (2012). The calculations we make are based on plots of the relationship between employment and mortality over time. We use employment data from the LOUISE dataset, administered by *statistics Sweden*, and mortality data from the *cause of death register*, administered by the *Swedish board of health and welfare*. We focus on men and women aged 55-69 in 2009 and compare them to their counterparts in terms of mortality during the period 1985-2008 in this analysis.

[1] See Socialstyrelsen, 2013, for an overview.

The second method uses a regression framework and estimates how much people with a given level of health could work if they were to work as much as their younger counterparts in similar health. This approach builds on the work by Cutler et al. (2012). We use data from the *survey of health, ageing and retirement* (SHARE) to estimate the relationship between health and employment for younger workers of age 50-54, and use these estimates together with the characteristics of older workers of age 55-74 to predict the older individual's ability to work based on health.

Finally, we document potential heterogeneity in health capacity across education groups. We look at changes in the development of *self-assessed health* by age between 1991 and 2010. In particular, we study if there are different developments in different quartiles in the distribution of educational attainment measured as number of years of schooling.

The results show that the increase in employment between the years 1998 and 2009 among men has been very similar to the decrease in the mortality rate. However, since 1985, there has been a decrease in the employment rate among men in the age group 55-69 corresponding to more than three years at a constant mortality rate. Among females there has been no change in the employment rate in the age group 55-69 between 1985 and 2009 at a constant mortality rate, primarily due to the general increase in the female labor force participation rate. Our analysis of health and employment among older workers show very large potentials for increased employment of older workers. Finally, our results show no empirical evidence for increased health inequality in Sweden since the early 1990s.

The paper is organized as follows. We first document the recent development of labor force participation and health in Sweden. Section 3 presents the results from the Milligan-Wise method and Section 4 those from the Cutler et al. method. Section 5 presents the results on heterogeneity in the development of health across education groups. Finally, Section 6 concludes.

2 Trends in labor force participation and health in Sweden

Figure 1 presents the development of labor force participation rates for men between 1963 and 2014 in different age groups. The figure shows that the labor force participation rate has varied substantially over time and differently for different age groups.

The most dramatic development has been in the age group 60-64. For this group, participation fell from 85 percent in the early 1960s to 55 percent in the late 1990s. Since then the labor force participation rate increased consistently to above 70 percent in 2014. The developments in the other age groups 45-54 and 55-59 have followed a similar pattern, but have been less dramatic.

For men older than age 65, there was a marked decline in labor force participation rates until the mid-1970s. The decline in the age group 65-69 can primarily be attributed to the change in the normal retirement age from 67 to 65. In recent years, since the mid-1990s, there has been a trend towards a higher labor force participation rate in the age group 65-69. In 2014 it was almost 27 percent, which is more than the double compared to the rate in the mid-1980s.

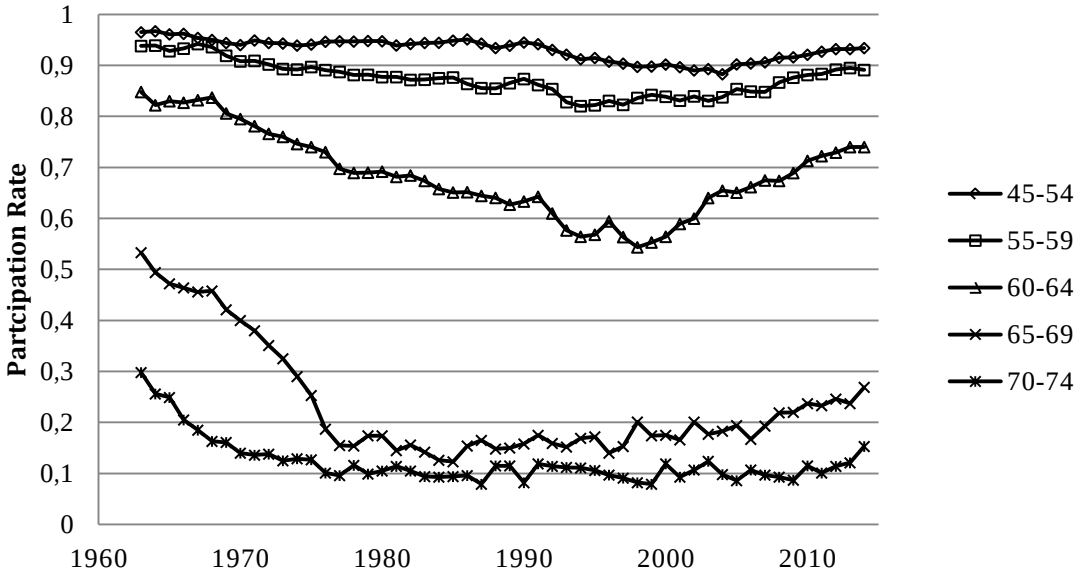

Figure 1 Men's labor force participation by age group, 1963–2014

Source: *Swedish labor force survey, statistics Sweden*

Figure 2 shows the trends of labor force participation among women. Compared to men, there is a very different development. For the two youngest age groups, aged 45-54 and 55-59, there was a dramatic increase in labor force participation from the early 1960s until the early 1990s. Since then the rates have been quite stable at 90 and 80 percent, respectively. For women aged 60-64, there has been a steady increase in labor force participation, except for a period in the 1990s. In 2014, participation in this age group was almost 67 percent. As for men, there is an increase in labor force participation rates for the age group 65-69, although on a slightly lower level.

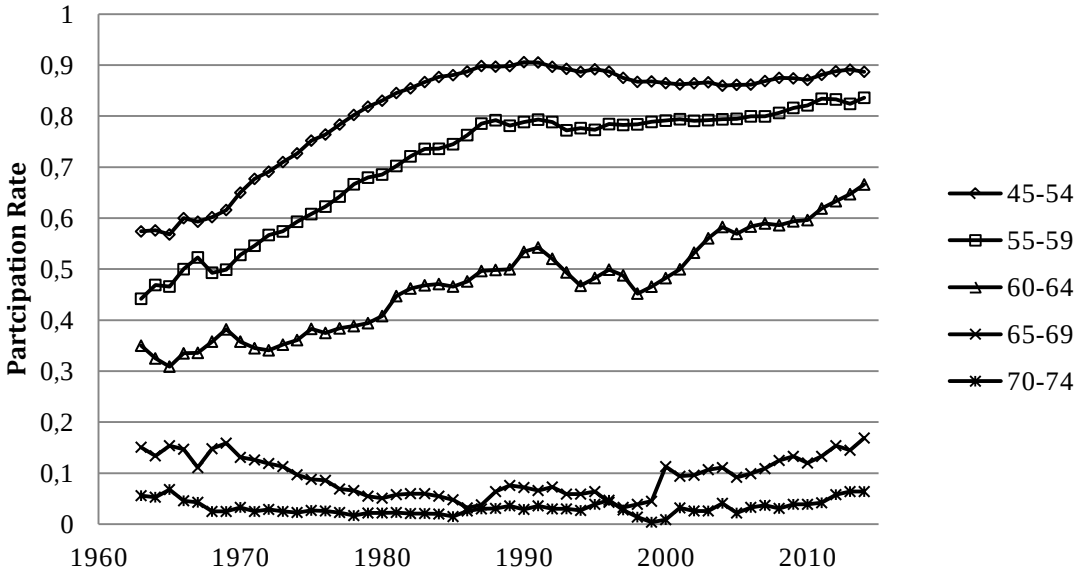

Figure 2 Women's labor force participation by age group, 1963–2014

Source: *Swedish labor force survey, statistics Sweden*

Figure 3 presents the trends in mortality for men aged 50-74 between 1985 and 2010. The mortality data comes from the *cause of death register* administered by the *national board of health and welfare*. There is a trend towards lower mortality rates over the entire period under study. In 1985, the mortality rate of men age 55 is about 0.8 percent. In 2009, that mortality rate is not reached until age 61.

Figure 4 presents *self-assessed health* by age for men aged 50-74 in 1991, 2000, and 2010, based on the *Swedish level of living survey* (LNU). This survey is managed by the *Stockholm institute of social research* (SOFI) at the Stockholm university and contains data on socio-economic characteristics and information on living conditions obtained through interviews along with register data for individuals aged 16-74 and permanently living in Sweden. The sample size is about 6,000 individuals, about 0.1 percent of the Swedish population in the age interval under study.

The series show the fraction of the population reporting fair or poor health. There is an age gradient in *self-assessed health*, with an increasing share of individuals reporting fair or poor health as they age. The main message in Figure 4 is that there is trend towards improved *self-assessed health*. Between 1991 and 2000, there are improvements primarily in younger ages, below age 58. Between 2000 and 2010, on the other hand, the improvement in health primarily occurs in older ages, above age 58. The average share reporting fair or poor health declined from around 0.4 on average to

around 0.25 above age 60 between 2000 and 2010, which is a quite substantial improvement over the last decade.

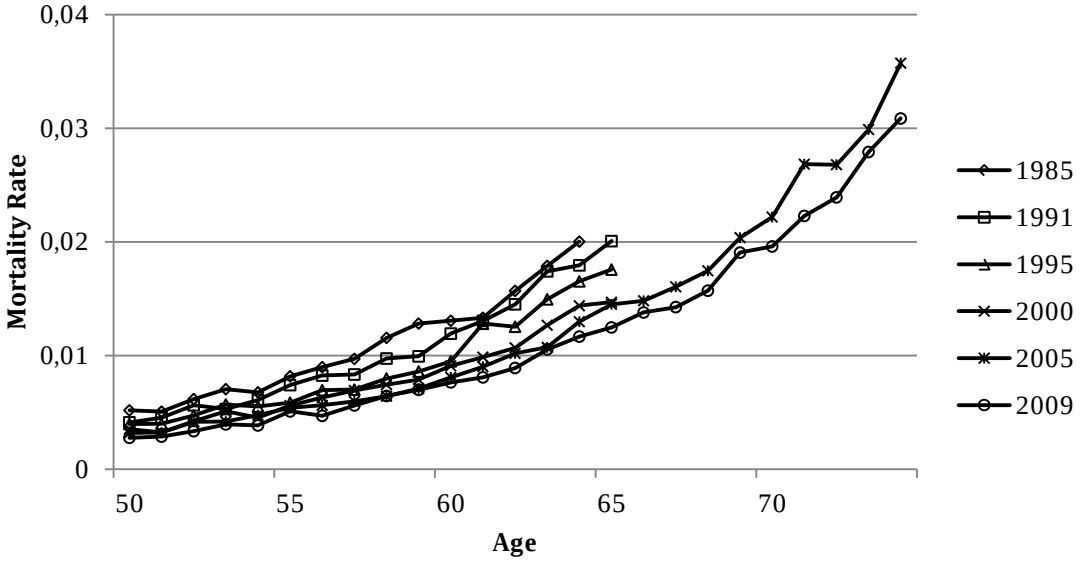

Figure 3 Mortality for men age 50–74, 1985–2010

Source: *Swedish cause of death register*.

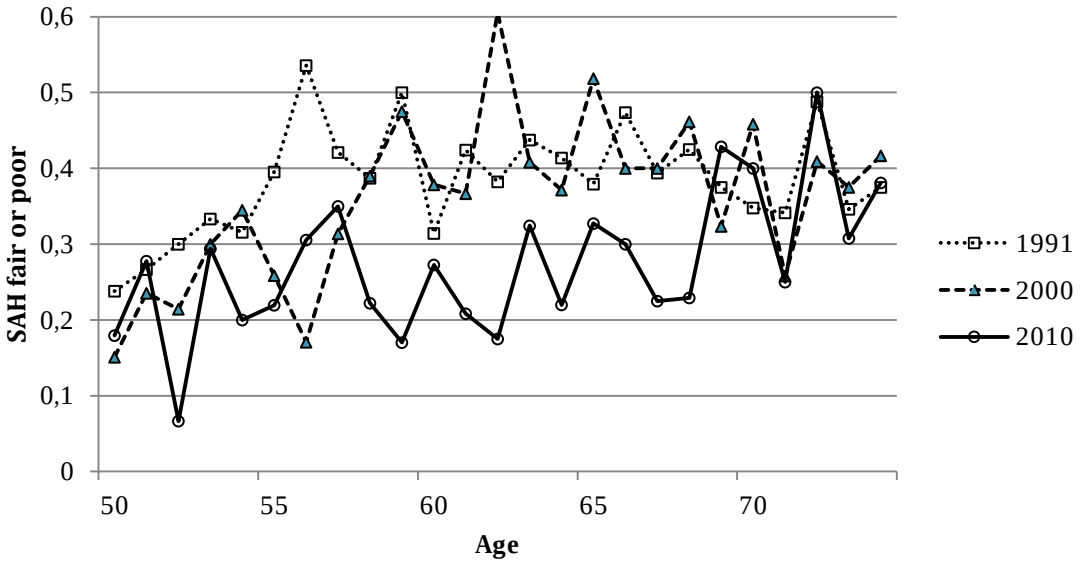

Figure 4 Self-assessed health fair or poor for men age 50–74, 1985–2010

Source: *Swedish level of living survey* (LNU).

3 Estimating health capacity to work using the Milligan-Wise method

Using a methodology suggested by Milligan-Wise (2012), we calculate how much people with a given mortality rate today would work if they were to work as much as people with the same mortality rate worked in the past. Advantages with using mortality data - rather than other measures of health that may be more related to an individual's work capacity - are that it can be very accurately measured and that it is available across countries, which facilitates comparisons.

The mortality data in this analysis comes from the *cause of death register* administered by the *national board of health and welfare*. Employment data is taken from the LOUISE (or SYS) register, administered by *statistics Sweden*. An individual is defined as employed if, in a given year, he or she has labor income above one price base amount.

The period we consider is 1985 through 2009. The restriction in historic time is given by the availability of data on employment. The data covers individuals up to age 64 for the period 1985-1989, to age 65 for the period 1990-2000 and to age 69 for 2001-2009. We calculate age-specific averages of the data on mortality and employment in three years: 1985, 1995 and 2009. The analysis displays the employment rate at each level of mortality for specific time periods and compares the curves across time.

Figure 5 and Figure 6 present the results on the employment-mortality curves for men and women, respectively, in 1985 and 2009. Figure 5 shows that even though the employment rate, as we saw in Figure 1, has increased slightly between 1985 and 2010, it has been far from enough to offset the rapid growth in life expectancy for men in order to maintain the relation between mortality and employment. For women, however, Figure 6 shows that the employment growth actually has kept up with the reduced mortality rate since the two curves essentially coincide.

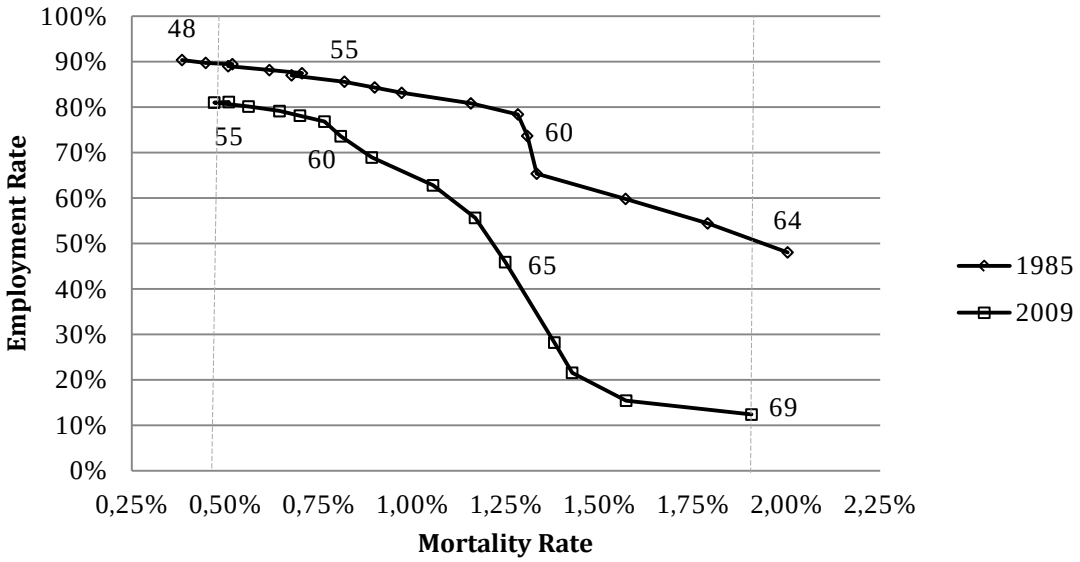

Figure 5 Mortality and employment in 1985 and 2009. Men

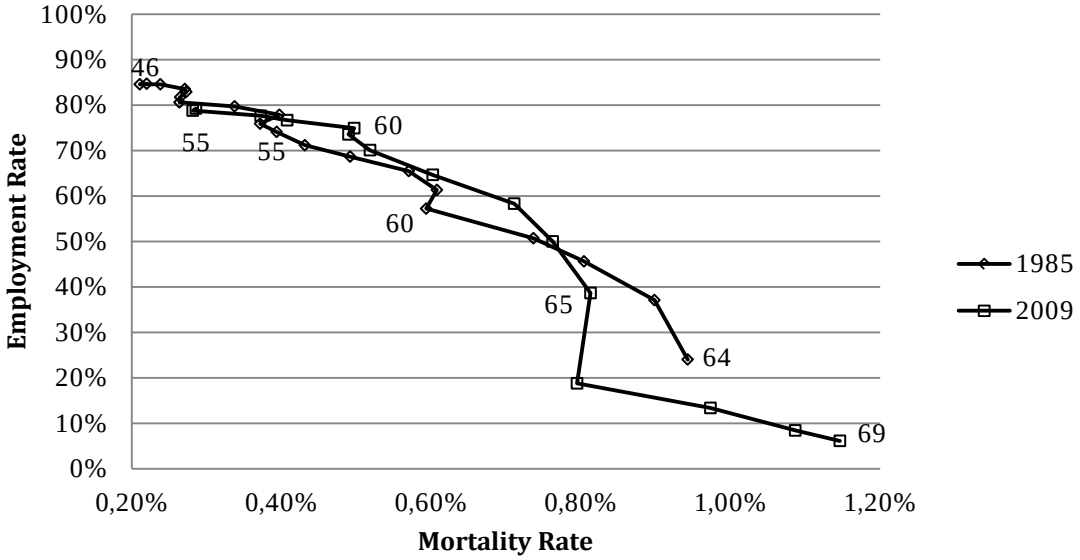

Figure 6 Mortality and employment in 1985 and 2009. Women

Table 1 presents the results from asking how much more men aged 55-69 in 2009 could have worked if they had worked as much as men with the same mortality rate worked in 1985. Table 2 shows the corresponding estimates for women. An additional 7.86 percentage points of men could have worked at age 55, which generates on average 0.0786 additional work years (one additional year for 7.86 percent of the 55-year-olds). Similarly, an additional 8.63 percentage points of men at age 56 could have worked for one more year.

If we repeat this analysis for each age through age 69 and cumulate the amounts, we get a total potential additional employment capacity of 3.17 years for men. This is equivalent to integrating between the two curves from one vertical line, indicating the starting age, to the next vertical line, indicating the last age group included, in Figure 5. The average amount of employment between ages 55 and 69 in 2009 is 8.61 years. This implies that an additional 3.17 years would represent an almost 37 percent increase over the ages 55 to 69.

Table 1 Additional employment capacity in 2009 using 1985 employment-mortality relationship. Percent. Men

Age	Mortality rate in 2009	Employment rate in 2009	Employment rate at same mortality rate	Additional employment capacity
55	0.51	81.11	88.97	7.86
56	0.47	80.99	89.62	8.63
57	0.56	80.12	88.56	8.44
58	0.65	79.11	87.92	8.81
59	0.70	78.11	86.76	8.65
60	0.77	76.80	86.11	9.31
61	0.81	73.58	85.68	12.10
62	0.89	68.91	84.43	15.52
63	1.06	62.79	82.08	19.29
64	1.17	55.64	80.60	24.96
65	1.25	45.91	79.05	33.14
66	1.38	28.22	64.25	36.03
67	1.43	21.58	63.14	41.56
68	1.57	15.45	59.77	44.32
69	1.91	12.40	50.93	38.53
Total years		8.61		3.17

Table 2 shows the results from a corresponding exercise on data for females. Due to the age restrictions described earlier, the estimates can only be obtained for women aged between 55 and 66 in 2009. The mortality counterpart in 1985 for women aged 67-69 was older than age 64 and therefore not included in our data. For men, the mortality gain was large enough between 1985 and 2009 for the mortality counterpart to be aged 64 or younger in 1985, which is covered by the data and enables us to compare all ages.

As is evident from the estimates in Table 2, there is a much more modest predicted gain in labor force participation for women compared to men: only a 0.02 years gain corresponding to 0.3 percent of the employment rate in the age interval. Some of the gender difference can be attributed to the fact that we were unable to include the age

group 67-69. However, the main background to this difference is the exceptional increase in female labor force participation rates that happened in the 1970s and 1980s and affected the birth cohorts that now are in the age groups 55-69. Since our focus in this study is to assess the potentials for prolonged work lives, the historical increase in the female labor force participation disturbs the comparison making our method less suitable for the female sub-sample.

Table 2 Additional employment capacity in 2009 using 1985 employment-mortality relationship. Percent. Women

Age	Mortality rate in 2009	Employment rate in 2009	Employment rate at same mortality rate	Additional employment capacity
55	0.29	79.25	80.33	1.08
56	0.28	78.79	80.38	1.59
57	0.37	77.63	75.84	– 1.79
58	0.41	76.67	73.01	– 3.66
59	0.50	74.92	68.45	– 6.47
60	0.49	73.55	68.76	– 4.79
61	0.52	70.09	67.59	– 2.50
62	0.60	64.66	56.83	– 7.83
63	0.71	58.33	51.89	– 6.44
64	0.76	50.01	48.79	– 1.22
65	0.81	38.68	44.84	6.16
66	0.80	18.82	46.33	27.51
67	0.97	13.40		
68	1.09	8.46		
69	1.15	6.17		
Total years		7.89		0.02

The Milligan-Wise method implicitly assumes that all gains in decreased mortality can be translated into additional work capacity. This is a strong assumption. It can be the case that decreased mortality is achieved through prolonged life, but with lost work capacity. A simple way to take this possibility into consideration is to assume that say two thirds of the gain in decreased mortality is translated into prolonged work capacity by simply multiply the figure above by two-thirds and arrive at an estimate of 2.11 years rather than 3.17 years for men.

Another question is which years to choose for comparison. As can be seen in Figure 1, the break in the trend towards decreased labor force participation among older men since the early 1960s happened in the mid-1990s. In Figure 7 and Figure 8, we replicate

the analysis from Figure 5 and Figure 6 but use data from 1995, when the labor force participation started to increase, instead of 1985.

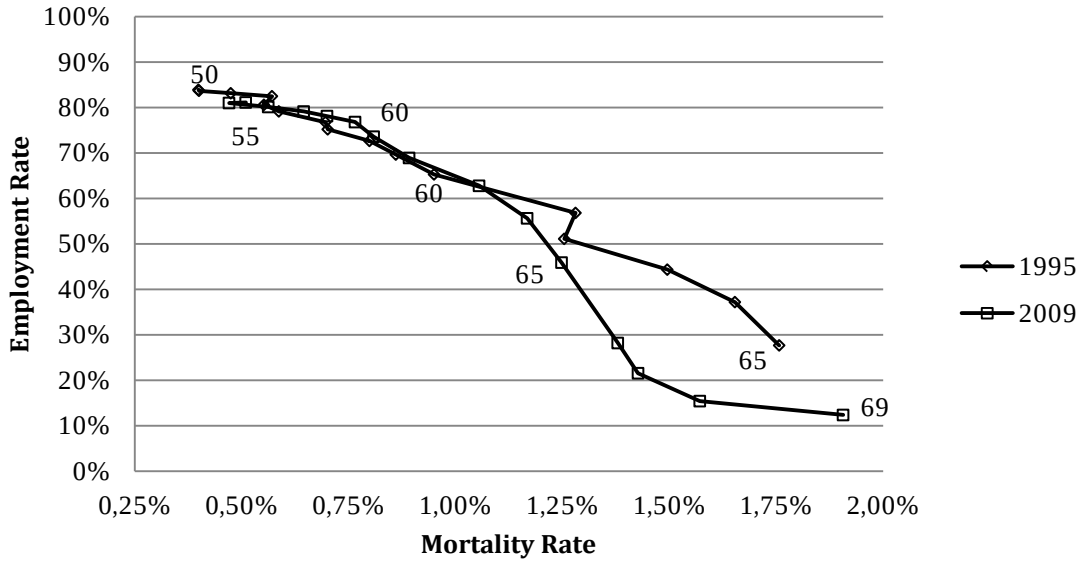

Figure 7 Mortality and employment in 1995 and 2009. Men

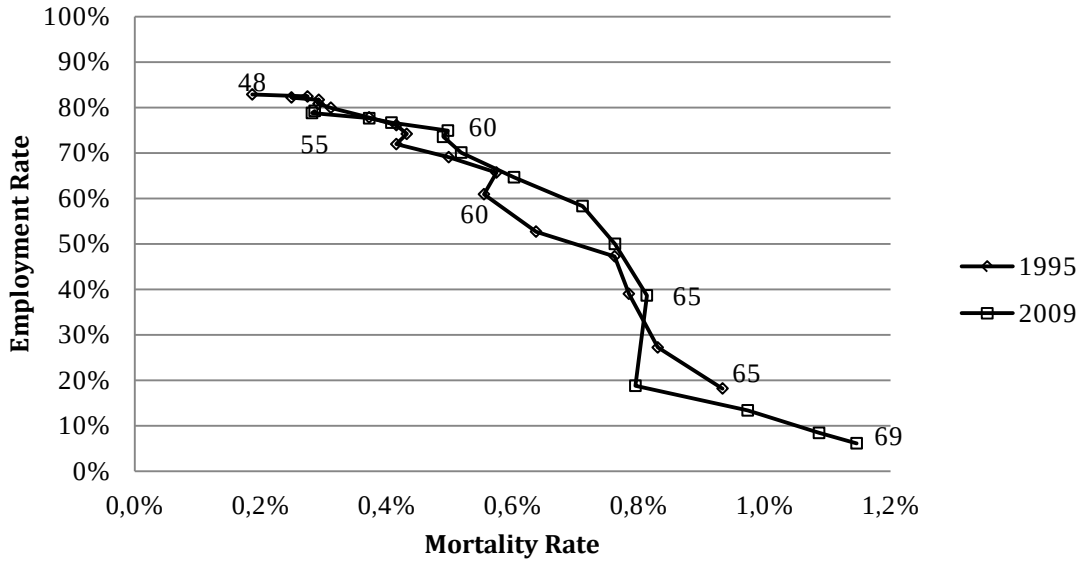

Figure 8 Mortality and employment in 1995 and 2009. Women

From the data shown above we know that the mortality rate was lower in 2009 than in 1995 at all ages and the employment rate was higher in 2009 than in 1995. The fact that the curves for the two periods in Figure 7 lie very close to each other suggest that the employment increase for men is large enough to keep up with the decreased mortality. For men in the very oldest ages, however, with the highest mortality rates and the

lowest employment rates, there is a slight divergence between the curves. For women, Figure 8 shows that the curves again lie very close to each other, implying that the increase in employment was proportional to the mortality gains between the two years.

Figure 9 presents the estimated additional employment capacity in 2009 as a function of the comparison year used for males and females, respectively. Because of the age restriction described above, it is not always possible to obtain a comparable employment estimate for all ages up to age 69 in 2009. This will slightly affect the comparison over time, but the patterns should still be informative.

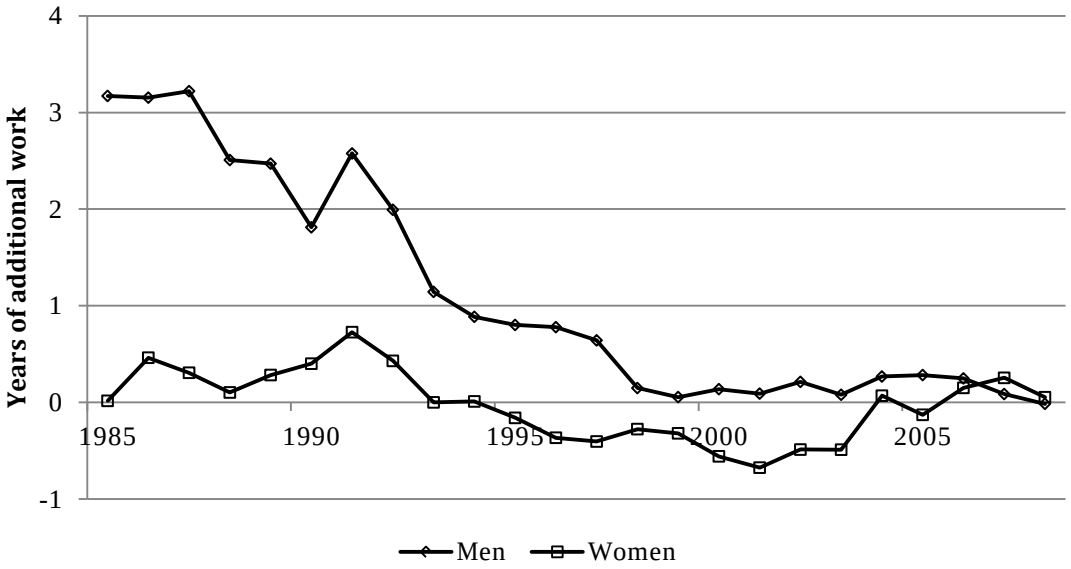

Figure 9 Estimated additional employment capacity in 2009 by year of comparison for men and women

For males, the estimated additional employment capacity is small compared to all years in the period between 1998 and 2009, since the mortality decrease is accompanied with an employment increase during this era. However, compared to years in the 1985-1990 period, the estimated additional capacity is substantial. As noted above, the situation for females is very different because there is an effect across cohorts towards a higher labor force participation rate.

We also use data on *self-assessed health* (SAH) and activity limitation (cannot run 100 meters) from the *Swedish level of living survey* (LNU) to measure subjective health in 1991, 2001 and 2010, respectively. The total sample size is 0.1 percent of the Swedish population aged 16-75, i.e., about 6,000 individuals. This means that we have around 35 to 60 men for each one year birth cohort in ages 55-75. Figures 10-13 present the results from the approach used in Figure 5 and Figure 6 with SAH and activity

limitation in place of mortality. Whereas the employment data is for 2009, the subjective health data is from 2010. The horizontal axis shows the share of individuals who report themselves to be in fair or poor health (Figure 10 and Figure 11) and the share who report that they cannot run 100 meters (Figure 12 and Figure 13).

As the sample size for each age is small the graphs are quite noisy. However, the same pattern of health improvement over time is seen as shown for mortality in Figure 5 and Figure 6. For example, in 1991, 40 percent of 55-year-olds were in fair or poor health, as compared to 22 percent of 55-year-olds in 2009. The equivalent figures for activity limitations are 21 percent in 1991 and 10 percent in 2009.

In short, estimates based on the Milligan-Wise method suggest a significant amount of additional work capacity for men. We estimate that the additional capacity from ages 55 to 69 is 3.17 years using the 1985 employment-mortality curve as a comparison, or 0.8 years compared to 1995. For women, however, this method suggests that the additional work capacity is limited when using previous cohorts as a benchmark. The results also suggest that the largest potential for additional employment capacity can be found among the oldest, primarily older than age 65. This is due to the large drop in employment after age 65 that cannot be related to a sudden change in health status of older individuals.

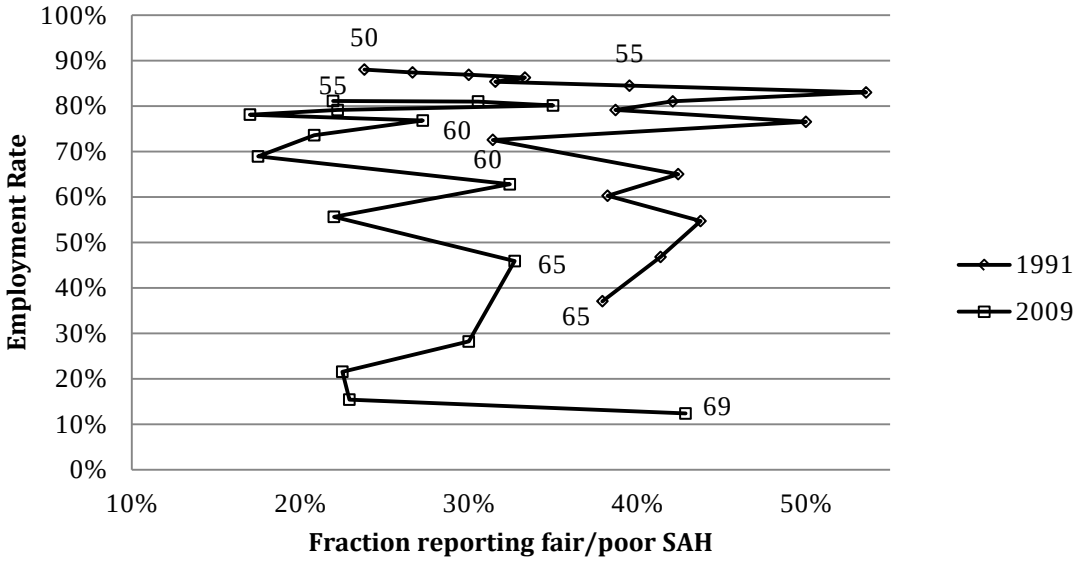

Figure 10 Self-assessed health (share reporting fair or poor) and employment in 1991 and 2009. Men

Source: *Statistics Sweden* and the *level of living survey*. SAH for year 2009 is in fact from year 2010.

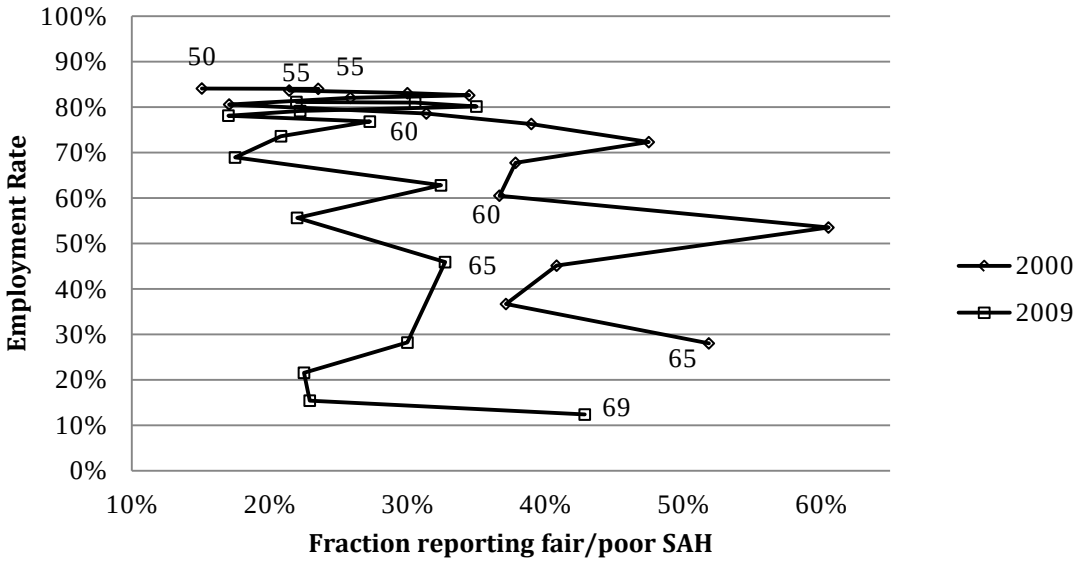

Figure 11 Self-assessed health (share reporting fair or poor) and employment in 2000 and 2009. Men

Source: *Statistics Sweden* and the *level of living survey*. SAH for year 2009 is in fact from year 2010.

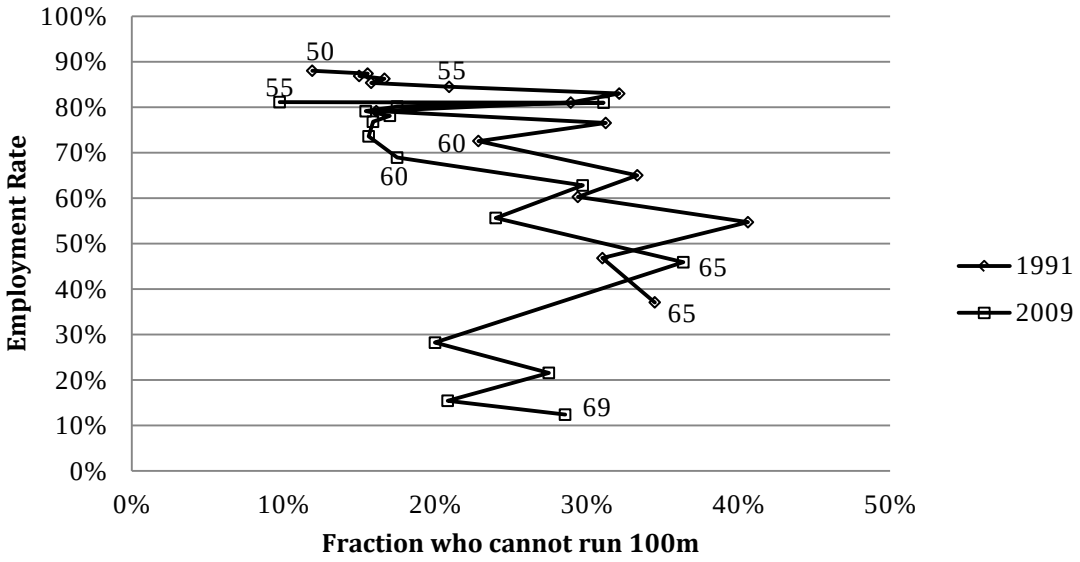

Figure 12 Activity limitation (share who cannot run 100m) and employment in 1991 and 2009. Men

Source: *Statistics Sweden* and the *level of living survey*. Activity limitation for year 2009 is in fact from year 2010.

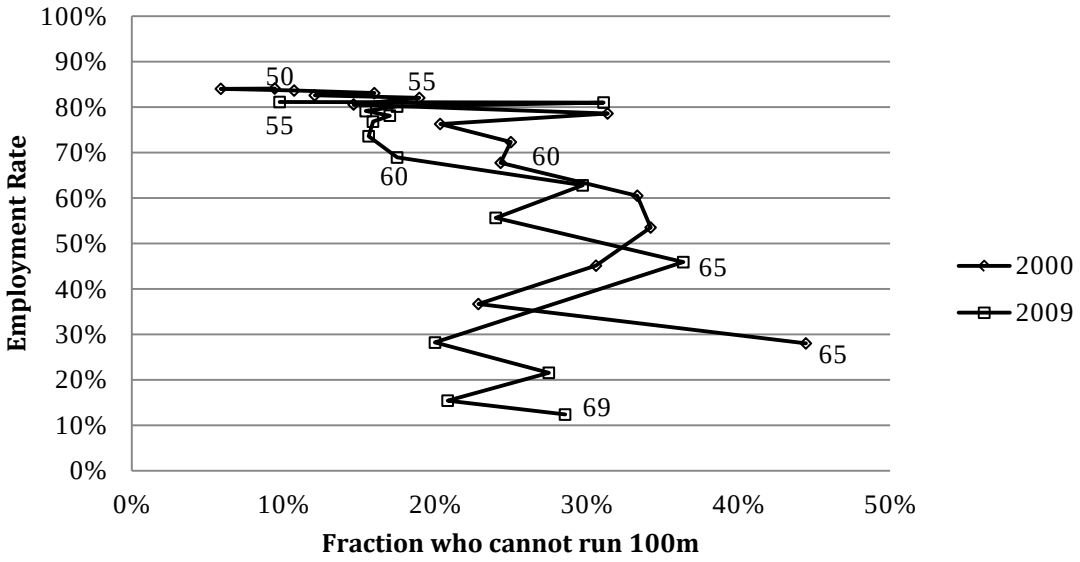

Figure 13 Activity limitation (share who cannot run 100m) and employment in 2000 and 2009. Men

Source: *Statistics Sweden* and the *level of living survey*. Activity limitation for year 2009 is in fact from year 2010.

4 Estimating health capacity to work using the Cutler et al. method

In this section we investigate the work capacity of older workers by asking how much they would work if they work as much as their younger counterparts in similar health. The method we use was originally suggested by Cutler et al. (2012). The analysis is done in two steps. First, we estimate the relationship between health and employment for a sample of workers whose decision to exit from the labor market is driven by health considerations rather than preferences for leisure. We use the age group 50-54, since previous research (see e.g. Johansson et al., 2013) has shown that workers in this age group almost exclusively use the *disability insurance* program or *sickness insurance* for their labor market exit. This age group is also far from being able to claim benefits from the public old-age pension program at age 61. Second, we use the coefficients from the estimated regressions and the actual characteristics of individuals aged 55 to 74 to predict the older individuals' ability to work based on health.

The data used in the analysis is taken from the *survey of health, ageing and retirement in Europe* (SHARE). We use *wave 1*, *wave 2*, *wave 4* and *wave 5*, conducted in 2004, 2007, 2011 and 2014, respectively. The numbers of observations are 2,997;

2,711; 1,945 and 4,531. The SHARE survey collects rich data on health, as well as data on employment and demographics and is therefore well suited for this analysis.

We estimate the following linear probability model:

$$Employment_i = \beta_0 + \beta_1 health_i + \beta_2 X_i + \varepsilon_i,$$

where *employment* is a dummy equal to 1 if the individual is employed; *health* is a vector of health measures that we describe in detail below; X is a vector of non-health personal characteristics, such as educational attainment and marital status. We estimate this equation using *ordinary least squares* (OLS).

In an alternative specification the *health* vector is summarized and replaced by a single index value. We follow the method suggested by and described in Poterba et al. (2013). They use the first principal component of 27 questions in the U.S. *health and retirement survey* (HRS), including self-reported health diagnoses, functional limitations, medical care usage, and other health indicators. Not all of these questions are included in the SHARE survey. For the sake of comparability we use the set of 24 variables that is also used in the US chapter of this volume. Each individual's index value is transformed to a percentile score. This means that the coefficient for the index value can be interpreted as the effect of moving one percentage point in the health distribution on employment probability.

Our analysis relies on three key assumptions:

1 Health is exhaustively measured by our health measure, i.e., there are no unmeasured or omitted dimensions of health. An important implication of this assumption is that the health measures should be consistent across ages. That is, for example the SAH measures should not be given an interpretation relative to a peer group of similar age as the respondent.
2 The health-employment relationship is independent of age, i.e., the relation estimated for the younger individuals (age 50-54) applies for the older ones (age 55-74).
3 Exit from the labor market is determined by health reasons only. Non-health-related retirement among our sample of younger individuals would cause a downward bias in the estimate of *health* on retirement. The choice of a relatively young age group helps avoiding this problem.

Table 3 and Table 4 present summary statistics for the male and female samples, respectively. The employment rate of men falls from 89 percent at ages 50-54 to 84

percent at ages 55-59, 70 percent at ages 60-64, 13 percent at ages 65-69, and 4 percent at ages 70-74. Employment rates for women are slightly lower in each age group: 84 percent at ages 50-54, 80 percent at ages 55-59, 60 percent at ages 60-64, 8 percent at ages 65-69, and 1 percent at ages 70-74. As expected, health measures decline with age. The share of men in poor or fair health rises from 8 percent at ages 50-54 to 24 percent at ages 70-74. As in most surveys, women report worse SAH, despite having lower mortality rates: 14 percent report fair or poor health in the age group 50-54 and 27 percent at ages 70-74.

Table 3 Summary statistics. Men. Pooled SHARE samples

	Age group				
	50-54	**55-59**	**60-64**	**65-69**	**70-74**
Employed	0.89	0.84	0.70	0.13	0.04
Health, poor	0.02	0.04	0.04	0.04	0.06
Health, fair	0.06	0.12	0.14	0.14	0.18
Health, good	0.30	0.28	0.33	0.34	0.34
Health, very good	0.32	0.29	0.28	0.28	0.22
Health, excellent	0.29	0.28	0.20	0.20	0.20
Physical limitations (=1)	0.09	0.11	0.12	0.18	0.17
Physical limitations (>1)	0.06	0.11	0.15	0.15	0.20
ADL any	0.04	0.03	0.06	0.06	0.08
IADL any	0.01	0.01	0.02	0.02	0.04
CESD (Depression index)	0.01	0.04	0.02	0.04	0.03
Heart	0.04	0.08	0.11	0.16	0.19
Stroke	0.01	0.03	0.03	0.04	0.06
Psychological problems	0.13	0.02	0.08	0.02	0.14
Lung diseases	0.02	0.02	0.05	0.07	0.09
Cancer	0.01	0.04	0.02	0.04	0.03
High blood pressure	0.15	0.23	0.34	0.42	0.42
Arthritis	0.03	0.04	0.05	0.05	0.04
Diabetes	0.04	0.06	0.12	0.15	0.14
Back pain	0.40	0.41	0.37	0.36	0.35
Weight, under	0.00	0.00	0.00	0.00	0.00
Weight, over	0.47	0.31	0.34	0.32	0.28
Weight, obese	0.24	0.43	0.44	0.43	0.44
Smoker, former	0.43	0.52	0.64	0.67	0.72
Smoker, current	0.51	0.63	0.70	0.70	0.73
Education, HS grad	0.21	0.15	0.10	0.09	0.07
Education, some college	0.25	0.15	0.13	0.12	0.13
Education, college	0.34	0.23	0.15	0.09	0.07
Married	0.68	0.56	0.43	0.45	0.41
N	394	719	823	850	706

Table 4 Summary statistics. Women. Pooled SHARE samples

	Age group				
	50-54	**55-59**	**60-64**	**65-69**	**70-74**
Employed	0.84	0.80	0.60	0.08	0.01
Health, poor	0.03	0.05	0.05	0.04	0.06
Health, fair	0.11	0.14	0.16	0.16	0.21
Health, good	0.30	0.30	0.31	0.33	0.37
Health, very good	0.31	0.26	0.26	0.26	0.24
Health, excellent	0.25	0.24	0.22	0.20	0.12
Physical limitations (=1)	0.15	0.18	0.16	0.19	0.22
Physical limitations (>1)	0.16	0.22	0.25	0.26	0.32
ADL any	0.04	0.05	0.07	0.07	0.09
IADL any	0.03	0.03	0.03	0.02	0.04
CESD (Depression index)	0.02	0.03	0.03	0.05	0.05
Heart	0.03	0.05	0.06	0.10	0.13
Stroke	0.00	0.02	0.03	0.02	0.04
Psychological problems	0.30	0.26	0.11	0.02	0.06
Lung diseases	0.02	0.05	0.05	0.07	0.08
Cancer	0.02	0.03	0.03	0.05	0.05
High blood pressure	0.19	0.26	0.29	0.37	0.45
Arthritis	0.04	0.09	0.11	0.11	0.11
Diabetes	0.05	0.05	0.06	0.07	0.09
Back pain	0.45	0.46	0.49	0.42	0.45
Weight, under	0.01	0.01	0.01	0.01	0.02
Weight, over	0.23	0.23	0.23	0.26	0.26
Weight, obese	0.31	0.45	0.47	0.45	0.44
Smoker, former	0.38	0.50	0.57	0.60	0.62
Smoker, current	0.56	0.62	0.75	0.77	0.79
Education, HS grad	0.19	0.14	0.12	0.10	0.08
Education, some college	0.21	0.14	0.12	0.14	0.13
Education, college	0.34	0.27	0.15	0.10	0.07
Married	0.62	0.51	0.40	0.36	0.32
N	565	954	959	1,010	719

As for the SAH measures, several indicators for functional limitation and diagnoses reflect health deterioration by age. The share of men with more than one limitation on their physical activity increases from 6 percent at ages 50-54 to 20 percent at ages 70-74. The corresponding values for women are 16 and 32 percent. The share with limitations in *instrumental activities of daily living* (IADLs) shows a similar trend although on a much lower level, rising from 1 to 4 percent for men. The corresponding shares for women are 3 and 4 percent. Diagnoses such as the share with high blood pressure rises from 15 percent at age 50-54 to 42 at age 70-74 for men.

Table 5 and Table 6 show the results from our regressions. Table 5 shows the results from the specification where we have included all health indicators separately in the

regression models and Table 6 shows the results where we have summarized the health indicators in health indices. The estimates show highly significant effects of the subjective health indicators on the probability of being employed, in particular for males. Men in fair (poor) health are 18 (57) percentage points less likely to be employed than those reporting excellent health. The corresponding estimates for women are 27 and 28. Having IADL limitations lowers men's (women's) employment by 44 (33) percentage points. Having *activities of daily living* (ADL) limitations limits women's activity with 22 percentage points.

The results shown in Table 6 are obtained from the index version of the model. The results show that the Poterba, Venti and Wise (PVW) index works very well for summarizing the health information in the data, since the coefficient for the index is estimated with high precision. A ten-percentage point increase in the index (e.g., being at the 60^{th} rather than 50^{th} percentile of health) raises the probability of employment by 3 percentage points for men and 4 percentage points for women.

Table 5 Employment regressions. All health variables

	Men 50-54			Women 50-54		
Variable	**Coefficient**	**s.e.**		**Coefficient**	**s.e.**	
Health, very good	0.02	0.04		-0.01	0.04	
Health, good	-0.04	0.04		-0.10	0.04	***
Health, fair	-0.18	0.07	***	-0.27	0.06	***
Health, poor	-0.57	0.11	***	-0.28	0.10	***
Physical limitations (=1)	-0.10	0.05	*	0.01	0.04	
Physical limitations (>1)	-0.02	0.07		-0.11	0.05	**
ADL any	-0.10	0.08		-0.22	0.08	***
IADL any	-0.44	0.18	***	-0.33	0.09	***
CESD (Depression index)	0.08	0.17		-0.13	0.09	
Heart	0.06	0.07		-0.08	0.09	
Lung disease	0.06	0.20		0.36	0.19	*
Stroke	-0.04	0.01	***	0.00	0.01	
High blood pressure	0.04	0.04		0.03	0.04	
Arthritis	0.09	0.09		0.06	0.07	
Diabetes	-0.02	0.07		0.02	0.07	
Back pain	0.01	0.03		0.04	0.03	
Weight, over	0.00	0.03		-0.04	0.04	
Weight, obese	0.07	0.05		0.01	0.04	
Smoker, former	0.08	0.04	**	0.07	0.04	*
Smoker, current	0.10	0.04	***	0.03	0.04	
Education, mandatory	0.01	0.05		0.02	0.05	
Education, some college	0.02	0.05		-0.03	0.05	
Education, college/univ	0.05	0.05		0.05	0.05	
Married	0.08	0.03	**	0.04	0.03	
N	393			564		

Note: * 10%,**5% and *** 1% significance. "Health, Excellent" excluded category.

Table 6 Employment regressions. PVW health index.

	Men 50-54			Women 50-54		
Variable	**Coefficient**	**s.e.**		**Coefficient**	**s.e.**	
PVW index	0.003	0.001	***	0.004	0.001	***
Education, mandatory	0.046	0.057		0.042	0.061	
Education, some college	0.066	0.056		-0.016	0.060	
Education, college grad	0.101	0.055	*	0.079	0.057	
Married	0.113	0.037	***	0.022	0.038	
N	333			457		

Note: * 10%,**5% and *** 1% significance

Table 7 reports the results from a simulation where we have used the two versions of our model to predict employment for 5-year age groups in the age interval 55 to 75 for males and females, respectively. To facilitate interpretation of the results we report key outcomes in Figure 14 and Figure 15. Since the estimation of the model using the PVW index turned out so well and predictions from a parsimonious specification is preferred, we present the predictions from the model using the PVW index in Figure 14 and Figure 15.

Table 7 Simulation of work capacity

		Use all health variables			Use PVW health index			
Age group	N	Actual % Working	Pred. % Working	Estimated work capacity, %	N	Actual % Working	Pred. % Working	Estimated work capacity, %
				Men				
55-59	719	83.87	90.38	6.40	542	83.03	87.98	4.95
60-64	823	69.50	89.08	19.58	617	70.34	83.93	13.59
65-69	849	12.94	89.49	76.54	662	14.50	82.56	68.05
70-74	703	4.11	88.08	83.95	540	4.26	81.00	76.74
				Women				
55-59	953	80.19	83.56	3.29	712	80.76	81.98	1.22
60-64	959	60.38	83.56	23.18	695	62.30	80.38	18.08
65-69	1010	7.52	83.53	76.00	764	8.25	79.62	71.37
70-74	719	0.97	80.41	79.43	569	0.86	76.06	75.20

Note: Actual working in *all health* and PVW models vary due to differences in sample sizes.

The health index model predicts the share of men (women) employed to be 88 (82) percent at ages 55-59, 84 (80) percent at ages 60-64, 83 (80) percent at ages 65-59, and 81 (76) percent at ages 70-74. This decline can of course be attributed to the deterioration of health by age. The share of men (women) that is actually working declines more rapidly with age than do our predictions, from 83 (81) percent at ages 55-59 to 70 (62) percent, 15 (8) percent, and 4 (1) percent in the older age groups. For the males (females) the capacity is 4.95 (1.22) percent at ages 55-59, 13.59 (18.08) percent

at ages 60-64, 68.05 (71.37) percent at ages 65-69, and 76.74 (75.20) percent at ages 70-74.

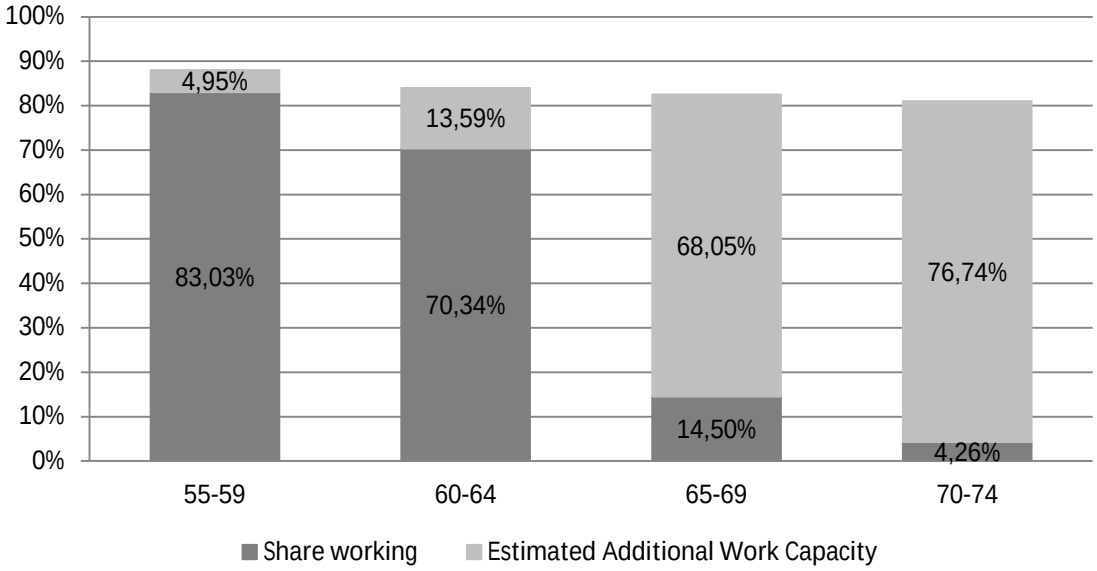

Figure 14 Share of SHARE men working and additional work capacity, by Age

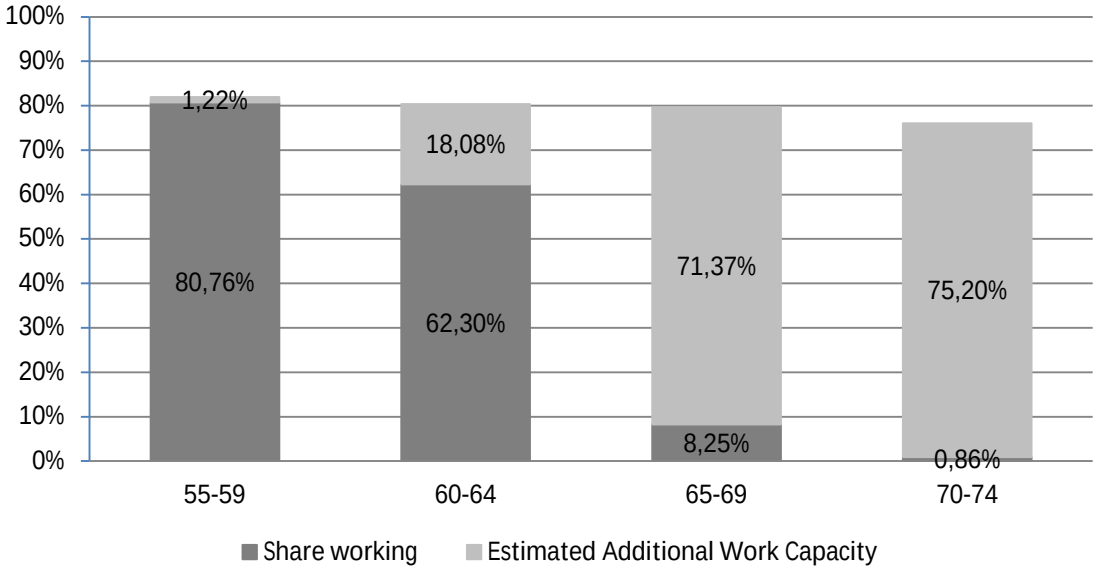

Figure 15 Share of SHARE women working and additional work capacity, by Age

A concern often heard in the public policy debate is that low educated blue-collar workers with physically demanding jobs are less able to postpone their exit from the labor market for health reasons. To examine this argument more closely, we will look at heterogeneous effects by dividing the sample into two groups: those with a high school (HS) education or more and those without a high school education (<HS).

Our simulations of work capacity by education group and gender are shown in Table 8 and Table 9 and in Figure 16 and Figure 17. The results show very small differences in both actual and predicted share working for both males and females between the two groups with high and low educational attainments, respectively.

Table 8 Work capacity by education (single regression). Men

Education	All health variables			PVW model		
	Actual Working	Pred.	Estimated % WC	Actual % Working	Pred.	Estimated WC
			Age 55-59			
< High school	81.88	88.41	6.53	79.14	82.96	3.82
HS or college/univ	87.13	93.64	6.18	87.12	93.26	6.14
			Age 60-64			
< High school	69.98	88.67	18.69	71.76	80.01	8.25
HS or college/univ	68.26	90.15	21.89	67.86	90.83	22.97
			Age 65-69			
< High school	13.17	88.87	75.68	15.29	79.44	64.15
HS or college/univ	12.09	91.77	79.68	12.36	91.04	78.68
			Age 70-74			
< High school	4.81	87.85	83.02	5.22	78.35	73.13
HS or college/univ	1.38	88.93	87.54	1.45	88.71	87.26

Note: Actual % working in *all health* and PVW models vary due to differences in sample size.

Table 9 Work capacity by education (single regression). Women

Education	All health variables			PVW model		
	Actual Working	Pred.	Estimated % WC	Actual % Working	Pred.	Estimated WC
			Age 55-59			
< High school	77.02	82.88	5.72	76.28	79.01	2.73
HS or college/univ	84.90	84.58	-0.31	84.70	84.58	-0.11
			Age 60-64			
< High school	59.40	83.82	24.42	61.37	78.90	17.53
HS or college/univ	63.04	82.84	19.80	64.05	83.16	19.11
			Age 65-69			
< High school	7.78	83.30	75.52	9.14	78.16	69.01
HS or college/univ	6.69	84.27	77.57	6.14	83.05	76.91
			Age 70-74			
< High school	0.69	80.71	80.01	0.45	75.67	75.22
HS or college/univ	2.10	79.18	77.07	2.17	77.32	75.15

Note: Actual % working in *all health* and PVW models vary due to differences in sample size.

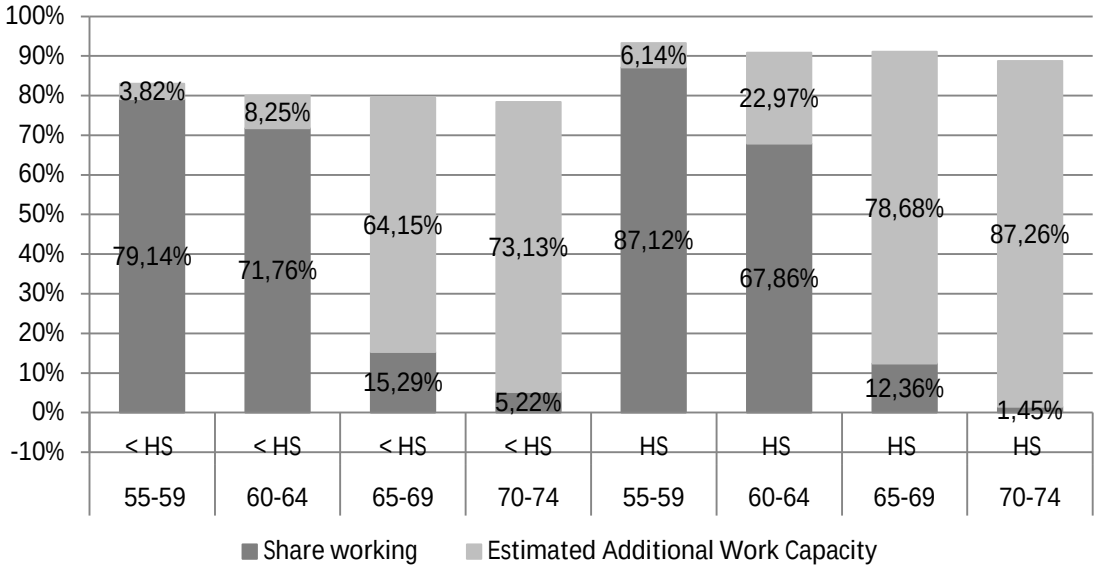

Figure 16 Share of SHARE men working and additional work capacity, by age and education

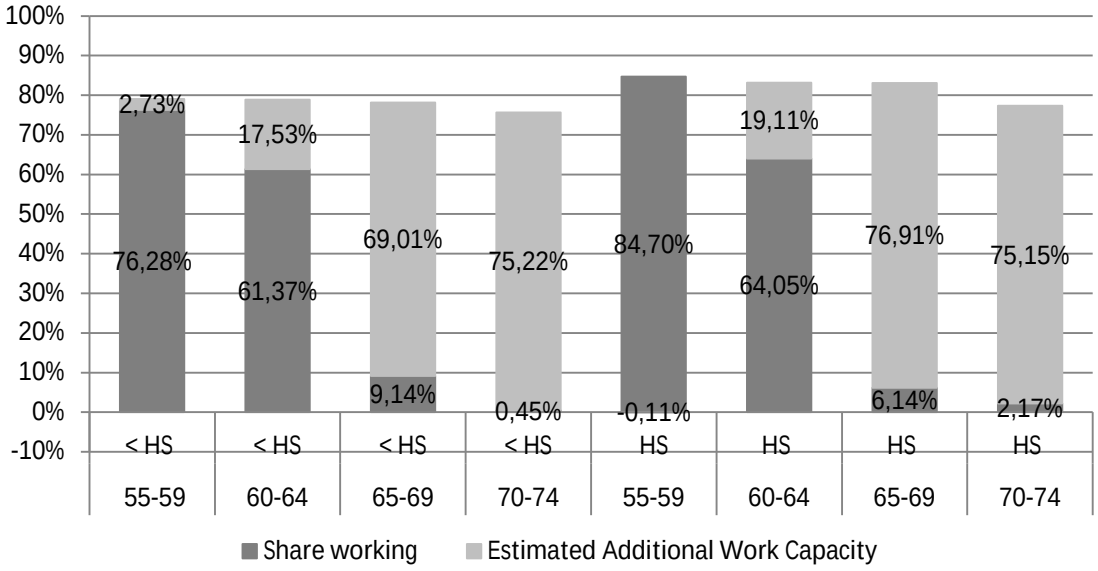

Figure 17 Share of SHARE women working and additional work capacity, by age and education

5 Changes in self-assessed health by education level over time

In this section we investigate the changes in *self-assessed health* (SAH). We use data from the *Swedish level of living survey* (LNU), briefly described in Section I. In addition to the overall development we will look at the development by educational group separately considering the fact that in Sweden, like in most other developed countries, there has been a substantial increase in the average educational attainment

across birth cohorts. This implies that the selection into educational levels may have changed.

Figure 18 shows the development of the average number of years of schooling along with the first and third quartiles by birth cohort groups for those born by the end of the 19th century to those born in 1980. There is a steady increase, with an accelerating path for at least the average, starting with those born in the early 1940s. Over the entire period shown in the graph the average number of years of schooling increases from about 6.5 to 15 years.

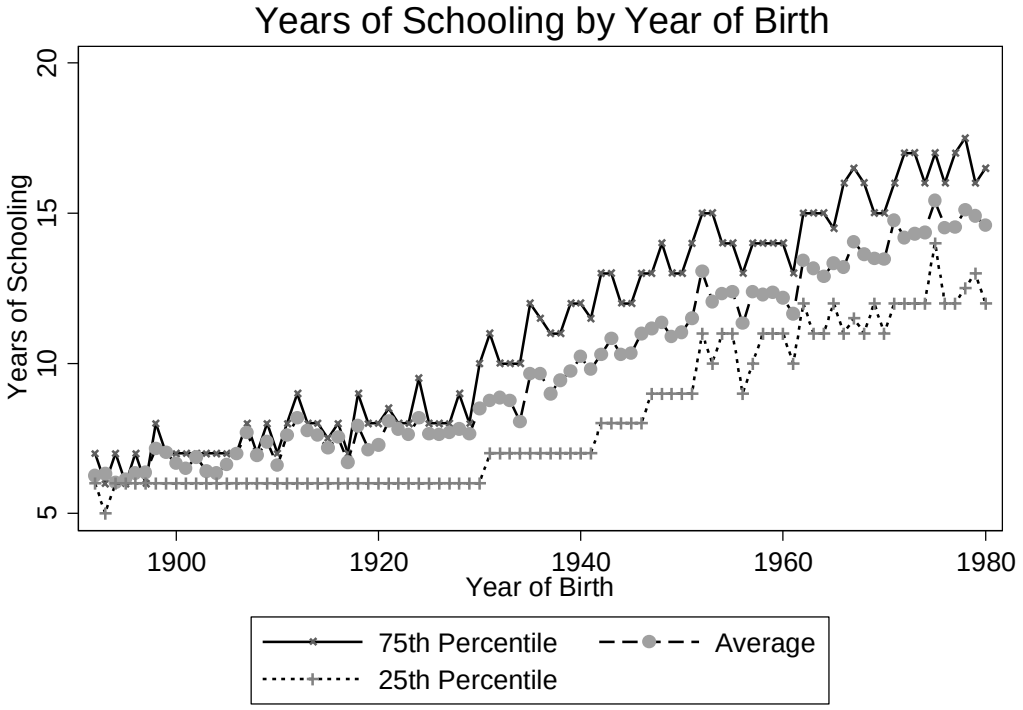

Figure 18. The Development of average number of years of schooling along with the first and third quartiles by year of birth

Source: *Swedish level of living survey.*

Figure 19 shows *self-assessed health* by age between age 50 and 75 for the survey years 1991, 2000 and 2010. The sample size for each one-year age group is quite limited (between 50 and 100). The graphs are therefore noisy and we have added smoothed graphs to ease comparisons. The upper panel shows the results for both gender groups combined and the lower ones for males and females separately.

As expected, Figure 19 shows a decline in SAH with age. For the 2010 sample, around 25 percent of the 50 year olds reported poor or fair health compared to above 40

percent of the 75 year olds. More interestingly, Figure 19 also shows a marked improvement in SAH primarily between 2000 and 2010. When splitting up the graphs in separate ones for males and females in the lower panel of Figure 19 it can be seen that the improvement is primarily attributed to males in the age group 60-70.

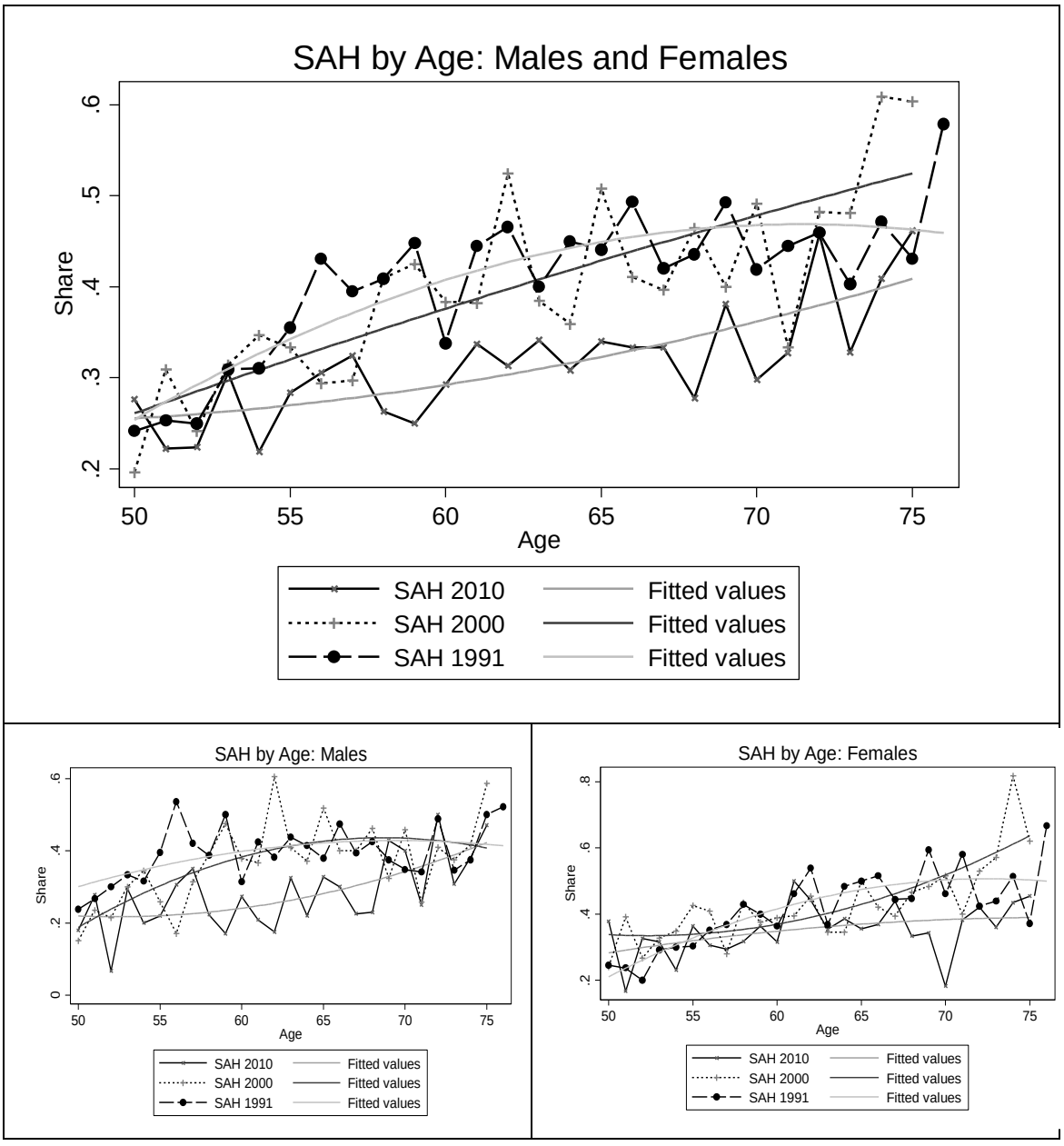

Figure 19 Share reporting fair or poor health by age in 1991, 2000 and 2010. Overall and by gender groups, respectively

Source: *Swedish level of living survey*.

In Figure 20 we break up the data by quartile of number of years of schooling. Since the sample sizes are smaller in each education quartile than for the overall sample, we only present the smoothed graphs. The graphs show that the development is very similar

within each education group: the 1991 and 2000 graphs are very similar, but there is a marked improvement reflected in the 2010 graphs. That is, the improvements in SAH seem to be equally shared between the four education groups and we find no evidence of increased health inequality in that dimension.

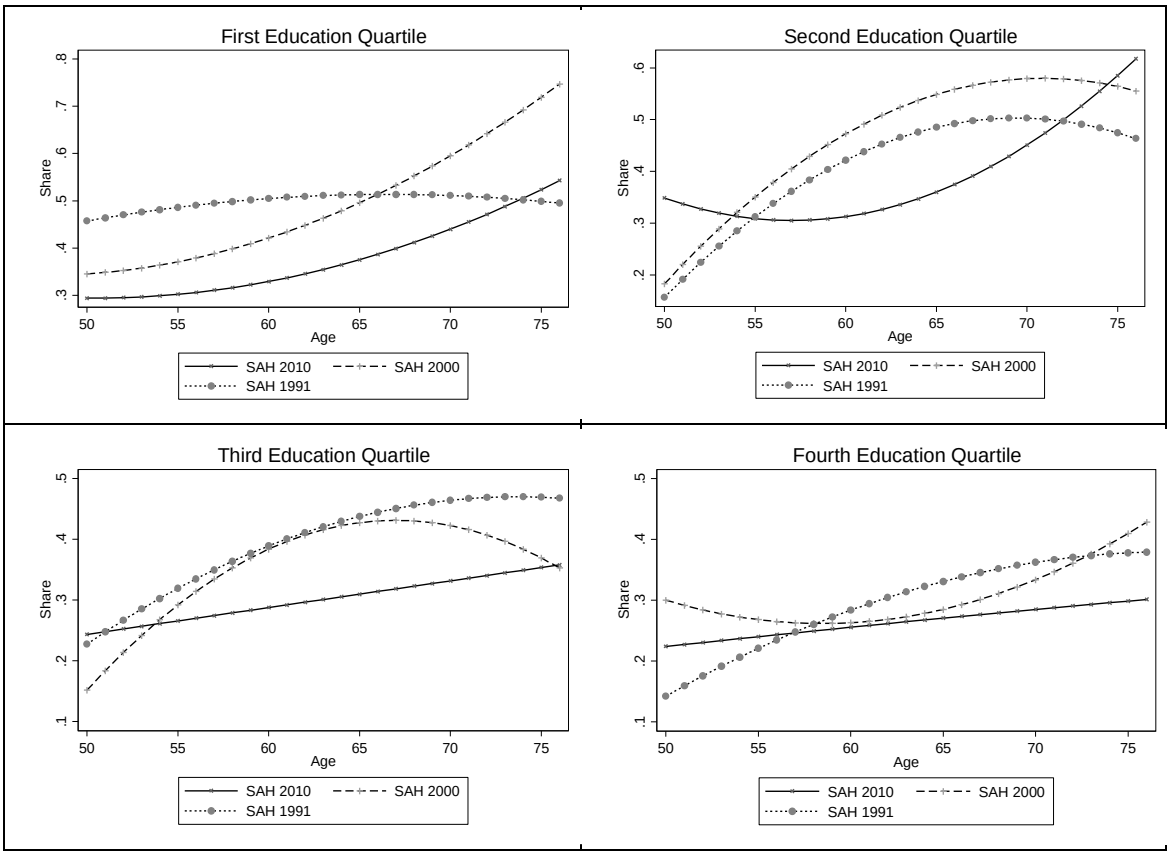

Figure 20 Share reporting fair or poor health by age in 1991, 2000 and 2010. Each panel reports separate results for quartiles by years of schooling

Source: *Swedish level of living survey.*

6 Discussion and conclusion

The Swedish history of labor force participation since the early 1960s shows big changes and great differences between the gender groups. For men there was a large decline in labor force participation rates until the late 1990s and since then a sharp increase in labor force participation rates. The development in the age group between age 60 and 64 has been most pronounced. In this group the LFP rates decreased from about 85 percent to 55 percent in the mid-1990s and have since then increased to almost 75 percent. For females the development has been dominated by the great increase in female labor force participation that took place between the mid-1960s and 1980.

However, the labor force participation in the age group 60 to 64 has continued to increase since then and is now on a level of above 65 percent.

The research question for this paper is to investigate whether or not there are potentials, with respect to health and work capacity of the population, for extending this trend toward delayed retirement further. We use two different methods. First, a method originally suggested by Milligan and Wise (2012), which calculates how much people would participate in the labor force today compared to a particular point back in time at a constant mortality rate, considering the fact of a continuously decreasing mortality rate. Second, the Cutler et al. (2012) method, which asks how much people would participate in the labor force if they would work as much as the age group 50-54 at a particular level of health.

Given the methodological differences the results obtained from using the two methods, respectively, are not really comparable. They should be viewed as complements rather than substitutes. The Cutler et al. method suggest a potential increase of labor force for men (women) in the age group 60-64 of 19.6 (23.2) percent, using the specification when all health indicators are included, and on 13.6 (18.1), using the PVW index specification. The Milligan-Wise method suggest that the labor force participation rate for men could increase in the age group 60-64 by on average 16.2 percent if the labor force participation rate in 2014 would have been the same as in 1985 at a constant mortality rate. For females, given the great increase in female labor force participation across cohorts, the increased labor force participation rate has kept pace, and even increased slightly more, than the corresponding decrease in the mortality rate over this era in the age group 60-64.

Finally, Section IV shows that the trend towards improved population health reflected in lower mortality rates also applies to *self-assessed health* between the years 2000 and 2014. We did not find any evidence suggesting that there is an increase in health inequality measured as differences in *self-assessed health* between different quartiles in the distribution of educational attainments.

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