Health Capacity to Work at Older Ages: Evidence from Spain

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Abstract: In a world with limited PAYGO financing possibilities this paper explores whether older Spanish individuals have the health capacity to work longer. For that purpose we use Milligan-Wise and Cutler-Meara Cutler-Meara- Richards-Shubik simulation methods. Our results suggest that Spanish workers have significant additional capacities to extend their working careers.

JEL-CLASS: J11, J26, I12, I18
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I. Introduction

There are large concerns about the sustainability of social security systems due to population aging among developed countries, and Spain is not an exception. Spain has one of the lowest fertility rates in Europe (below 1.4 according to Eurostat, 2013) while life expectancy at birth was the highest in 2012 at 82.5 years compared to an average EU-28 of 79.2 (OECD, 2014). In a similar vein, life expectancy at age 65 has been improving over time; in 1960 men aged 65 expected to live 13.1 more years, while the expectations were 18.7 in 2012 (Garcia-Gomez et al 2012 and OECD, 2014). And this trend is expected to continue in the coming decades (European Commission, 2012).

In parallel, there was a tendency in the 1980s and early 1990s towards reducing employment participation of older workers (Gruber and Wise, 1999 and 2004; Boldrin et al, 1999 and 2004). The decreasing trends were reverted in the mid-1990s but employment participation rates have remained considerably lower than the ones observed in the late 1970s (see, for example, Garcia-Gomez et al 2012a). There is a large body of literature that shows that financial incentives have an effect on employment decisions (Gruber and Wise, 2004) but bad health has also been found to hamper labor force participation of (older) workers (García-Gómez, 2011; Cervini-Pla and Vall Castello, 2015). Therefore, it remains an extremely relevant policy question whether future Social Security reforms have room to increase the labor market involvement of older individuals, and whether there is latent work capacity among Spanish older workers.

In this paper, we aim to provide a first set of estimates to whether there is health related unused work capacity among Spanish older workers. We do so following two alternative methods and focusing on employment as our measure of work capacity. First, we use the method proposed by Milligan and Wise (2015) and estimate that in 2010 individuals aged fifty-five to sixty-nine would have worked an additional 7.08 years if they would have worked as much as individuals with the same mortality rates in 1976. Second, we use individual level data from the Survey of Health and Retirement in Europe and the method suggested by Cutler et al (2012) to estimate that work capacity increases over 60% once the normal retirement age of sixty-five kicks in. We are nonetheless cautious with our conclusions as these results hinge upon somewhat strong assumptions.

The rest of the paper is organized as follows. Section 2 illustrates trends in labor force participation and their relation with trends in subjective and objective health measures. Section 3 simulates gains of work capacity of older workers using the Milligan-Wise method, while estimates using the Cutler-Meara- Richards-Shubik are presented in section 4. In section 5 we analyze the evolution over time of poor health by education quartiles. Finally section 6 concludes.

I. Trends in Labor Force Participation and Health

As in many industrialized countries, labor force participation in Spain has changed substantially in the last decades. We use data from the Spanish Labor Force Survey (*Encuesta de Población Activa*, EPA) to illustrate trends in labor force participation since 1977. The EPA is a rotating quarterly survey carried out by the Spanish National Institute that contains detailed information on labor market behavior, education and household characteristics of approximately 180,000 individuals every quarter. In particular, it asks every individual about her labor market status the week prior to the interview. We use this information to estimate average annual participation rates combining data from all quarters in a given year. Figures 1 plots the evolution of labor force participation for men and women aged at least fifty-five in Spain since 1977 and Figure 2 shows the evolution of labor force participation for men and women aged at least sixteen in the same period. We can see in Figure 1 that there was a steep decline in the labor force participation of men aged at least fifty-five between 1977 and the mid-1990s; while forty-eight percent of men aged at least fifty-five were in the labor force in 1977, only twenty-five percent stayed in the labor force during the 1990s. This declining trend was slightly reversed at the turn of the century. However, the participation rate was only twenty-eight percent in 2014, which still represents a much lower value than in 1977. This decrease in labor market participation since the late 1970's is substantially explained by the incentives provided by Social Security institutions (Boldrin et al. 1999). In Spain, legislation promoting early retirement has had a large effect on the number of early retirees, particularly during the 1970s and 1980s (Boldrin et al. 2001). In addition, the importance of other exit routes for individuals approaching retirement, such as unemployment or disability insurance, have also been documented in the literature, particularly for the group of individuals with 55 years or more (Jimenez-Martin and Vall Castello 2009; García-Gómez et al 2012).

Several competing phenomena can be behind the reversal of this downward trend in male participation (and especially employment) since the late-1990s. Part of the reversal of this trend can be attributable to the effects of business cycle conditions, changes in the legislation, increasing levels of education and the increase in the inflow of immigrants, which have, typically, higher participation rates than native Spanish people (Congregado et. Al 2011; Aragon et. Al. 2009; Cuadrado et. Al. 2007).[1]

The evolution of labor market behavior of women is markedly different from that of men (see Figures 1 and 2). First, labor market participation for women aged at least fifty-five remained fairly constant between 1977 and 2001 at around 10%. Second, there is a remarkable increase in the participation rates in the last 15 years, so participation is currently higher than it was during the late 1970s (Figure 1). The steady increase in the last fifteen years in labor force participation of older females relate to the overall trend in labor force participation of women (see Figure 2). Similar to other developed countries, labor market participation of women has experienced a steady and continuous increase, from 28% in 1977 to 53% in 2014. We find that trends in labor market participation of men and women have been converging, although there is still a substantial gap in 2014: fifty-three percent of women participate in the labor market compared to sixty-six percent of men. This increase is concentrated among young women, mainly driven by a substitution of low educated older women by more educated younger generations (Boldrin et al. 2001). As the increase in female participation rates are mainly driven by cultural changes regarding the role of women in society, and not by changes in the incentives provided by the social security schemes, we focus on males in the rest of the paper.

Labor force participation and health of males

[1] Immigrants are typically younger than age 55 when they first arrive in the country. In any case, as the highest immigration inflow in Spain occurred in the late 1990's some of those immigrants have already crossed the 55 age threshold.

We now turn to revise the evolution of two health measures, mortality and self-assessed health for Spanish males aged fifty to seventy-five. Several factors have been identified as determinants of the evolution of population health such as the health care system, individual behavior and social environment, among others. We use data from the Human Mortality Database (HMD) and the Spanish National Health Survey (ENS) to analyze the evolution of both mortality and self-reported health in the last thirty years. ENS is a set of nationwide cross-sectional surveys that collect information on health, health care use, lifestyles and socioeconomic characteristics of the Spanish population. Figure 4 plots the age-profile of self-assessed health and mortality for males in 1987, 1993 and 2006. Self-assessed health is obtained from ENS and shows the percentage that rate their general health as fair or poor, while mortality rates by age are obtained from HMD. Figure 4 shows that, as expected, health (measured both by self-assed health and mortality) deteriorates with age. We also see that the large gains in mortality obtained during the last decades have been concentrated among the elderly. A reduction in mortality would translate in an increase in the population able to work if these changes go hand in hand with an improvement of the health of the population in the working age. The international evidence is inconclusive regarding whether changes in mortality are translated into a compression or expansion of morbidity (Klijs et al. 2009). The evidence shown in Figure 4 points out that also the self-reported health of the older Spanish has improved over time: in 1987, fifty-one percent of men aged 65 reported having fair to poor health, while this proportion falls to forty-six percent in 1993 and to forty-one percent in 2006. This improvement in self-reported health over time is observed specially among men aged fifty-eight to seventy.

Summing up, the last decades have witnessed a decrease in older men labor force participation and, at the same time, an improvement in the general health of men in their 60s. Thus, in what follows, we examine how much older Spanish men could work today if they experienced the relationship between health and employment of earlier years, i.e., what is the unused health capacity to work.

II. Health Capacity to Work using the Milligan-Wise method

We begin our analysis following the methodology first developed by Milligan and Wise (2015). The aim of this method is to get an estimate of the ability to work at older ages by comparing the relationship between mortality and employment in some previous period to the relationship between employment and mortality now. Thus, the idea is to get the potential employment possibilities of current cohorts if they worked as much as individuals that exhibited the same mortality rate almost thirty years ago. Once we get this potential employment (for a given mortality rate) estimate, its difference with respect to current employment rate constitutes an estimate of the additional work capacity for current cohorts.

This method implicitly assumes that mortality is a good proxy for health and that the relationship between health and mortality has remained moderately stable during this thirty year period. Despite the potential limitations behind these assumptions, we have chosen to use mortality has our proxy of health (rather than a measure more directly related to ability to work such as self-assessed health or prevalence of limiting health problems) for several reasons. First, the use of mortality data allows cross-country comparison of the estimates, while self-reported measures are subject to reporting bias across countries (Jürges 2007; Milligan and Wise, 2012b). Second, mortality data is yearly available for a long period of time, while self-assessed health is only available for the years 1987, 1993, 1995, 1997, 2001, 2003 and 2006 (in the National Health Survey, which, in turn, has a smaller number of observations if we want to have self-assessed health at each age). Last, although mortality represents a more extreme event in life than a change self-assessed health, Milligan and Wise (2012b) show that, within countries, improvements in self-assessed health show a very similar evolution than improvements in mortality.

We use data for mortality from the Human Mortality Database for years 1976 to 2010 and data for employment from the Labour Force Survey from the National Institute of Statistics in Spain also for the years 1976 to 2010. We consider only men in our analysis due to the late incorporation of Spanish women in the labor market, which would make our analysis much more difficult to interpret.

We plot the relationship between employment and mortality for Spanish men in two different periods; 1976-1980 and 1991-1995 in Figure 5 and 1976-1980 and 2006-2010 in Figure 6.[2] We can see that for a given mortality rate employment is lower in the two latter periods compared to the earlier one. For example, the employment rate at 0.7% mortality rate (first vertical line plotted in the two figures) is 89% in 1976-1980, 77% in 1991-1995 and 71% in 2006-2010, or the large differences observed at higher mortality rates like 2% (second vertical line plotted in the two figures). Thus, at a 2% mortality rate, the employment rate in 1976-1980 was around 60%, in 1991-1995 around 10% and in 2006-2010 around 3%. One of the reasons behind these large differences is that each of these mortality rates are also reached at later ages. For instance, the 2% mortality rate is reached

[2] We pool data for those 5 years for employment and also for mortality and calculate average employment and average mortality rate at each age.

at 63 years old in 1976-1980 but the same mortality rate is achieved at age 65.5 in 1991-1995 and at age 69 in 2006-2010. As mentioned before, this goes in line with observed increases in life expectancy.

Therefore, following the Milligan-Wise method, we estimate that, at a 2% mortality rate, if men in 2006-2010 would have worked as much as men in 1976-1980, the employment rate in 2006-2010 would have been 57 percentage points higher (observed employment rate is 3%, while employment rate in 1976-1980 was 60%, i.e., a difference of 57 percentage points). In other words, men in 2006-2010 aged sixty-nine (with a mortality rate of 2%) would have worked 57 percentage points more than men in 1976-1980 with the same mortality rate, which they achieved at age sixty-three.

We follow this same logic (but for single years and single ages) to estimate the additional employment capacity in 2010 using the relationship between employment and mortality from 1976. The results are shown in Table 1 for men in each age from fifty-five to sixty-nine in 2010. In order to calculate the additional employment capacity we proceed as follows. First, we take the mortality rate for men aged fifty-five in 2010 and go back to the employment rate of men in 1976 that had the same mortality rate than the fifty-five years old in 2010. Once we have this (equal-mortality) employment rate we subtract it from the current employment rate for fifty-five years old in 2010 to estimate the additional work capacity for men aged fifty-five in 2010. Third column of Table 1 reports the employment rate in 2010, while the employment rate in 1976 at same mortality rate can be found in the fourth column. Thus, as can be seen in the last column (first row) of Table 1, men aged fifty-five in 2010 could have worked an additional 18.8%, which is translated into 0.18 additional years of work on average. If we perform the same estimation for the older individuals included in our sample, we can see that men aged sixty-nine in 2010 could have worked an additional 0.69 years of work.

If we repeat this calculation for each age from fifty-five to sixty-nine and we sum up all the additional work capacity, we get a total additional employment capacity of 7.08 years of work (last column of Table 1). We can compare this number with the average amount of employment of 5.7 years observed among Spanish male aged fifty-five to sixty-nine in 2010 (see third column of Table 1, last row). Thus, we can observe that, in Spain, the estimated additional capacity to work is much larger than the current average amount of employment for men aged fifty-five to sixty-nine. However, notice that the legal normal retirement age in Spain is 65 years old and most Spanish men do actually retire at this age (or earlier). This is different in other countries like the USA where it is quite common to work after the normal retirement age. This fact implies that the estimated additional capacity to work increases by 20 percentage points from 54.9% at age sixty-four to 73.6% at sixty-five, as employment drops from almost 30% (at sixty-four) to 9.2% (at sixty-five) and the mortality rate in 2010 of individuals aged 65 years old (1.32%) is reached at a much lower age in 1976 with an employment rate as high as 82.8%.

Labor market conditions have gone through important changes during the time period of analysis (from 1976 to 2010). Therefore, the estimated additional employment capacity depend to a great extent on the year that we choose as the baseline year. In the analysis shown in Table 1, 1976 was the baseline year used to calculate the additional work capacity for individuals in 2010 but, one could perform the same exercise choosing a different base year. We therefore repeat the exercise using all years from 1976 until 2009 as base year in order to provide a sensitivity measure of the robustness of our results to the specification chosen. Figure 6 plots the cumulate additional employment capacity for men aged 55 to 69 in 2010 compared to a baseline year that ranges from 1976 to 2009. We see that the largest estimated value corresponds to the value for the baseline year 1976 (7.08, as shown in Table 1).

Using mortality as our health measure allows us to make use of very detailed information over a long time period as well as to compare the results across several countries. However, it also assumes that the additional years of life can be used to work, which may not be the case if individuals are not healthy enough to continue working. However, as Figure 4 shows, self-assessed health has also improved during this period, especially among individuals aged sixty or older. This result is similar to the evolution of self-assessed health reported for other countries in this volume.

The advantages of using mortality data are larger in countries like Spain in which longitudinal or large cross-sectional health surveys are not available. The sample size of the Spanish National Health Survey limits the analysis based on single-ages, and changes in the questions asked prevent comparison based on other measures of health like limitations in daily activities. Despite these limitations, we perform similar analysis using two measures of subjective health to assess the robustness of the previous conclusions to measures that can better capture work limitations.

Figure 7 plots the relationship between self-assessed health and employment in 1987 and 2006 for individuals aged forty-five to seventy years old while Figure 8 plots the relationship between work limitations[3] and employment for the same group of individuals and years. As before, employment is taken from the Spanish Labour Force Survey. As we need to calculate both employment rates as well as self-assessed health (and work limitations) at each age for the two survey years (1987 and 2006) the number of observations for the health variables at each age can be relatively small and, thus, the estimates are quite unstable[4]. For this reason, we apply a smooth transformation of the two health variables averaging the level of the current age with the level of the previous and next age.

We see that the percentage of men that reports their health to be at best fair and the percentage that reports being limited for work does not change between 1987 and 2006 for those aged forty-five to fifty-five (Figures 7 and 8) However, both health measures improve in 2006 compared to 1987 for men aged at least fifty-five. Figures 7 and 8 also illustrate that employment falls sharply at the normal retirement age of sixty-five.

To summarize, using the Milligan-Wise method we estimate an additional capacity to work of 7.08 years from fifty-five to sixty-nine in 2010 with respect to equal-mortality values in 1976. This value is larger than the observed employment capacity of 5.7 years for men aged fifty-five to sixty-nine in 2010. The finding of a bigger estimated additional capacity to work than the current observed capacity to work is somewhat counterintuitive and unexpected. However, in the Spanish labor market context, this is mainly explained by

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[3] More specifically, work limitations corresponds to answering yes to at least one of the following two survey questions: 1) during the last twelve months did you suffer a disease or illness that limited your principal activity (work, study, house work, etc..)? 2) During the last two weeks did you have to reduce your principal activity for at least half a day for any of the symptoms or pains described before?

[4] For example, the number of observations varies from 120 (minimum value) for age 70 to 289 (maximum value) for age 45 in the survey of 1987 and from 113 (minimum value) for age 68 to 235 (maximum value) at age 45 for the survey of 2006.

the strong decrease in employment at the normal retirement age of 65 years old for Spanish men. For example, in 2010 employment is observed to decrease by 20 percentage points (from 29.4% to 9.2%) from age 64 to age 65 for men in Spain.

III. Health Capacity to Work using the Cutler, Meara and Richards-Shubik method

We also estimate the capacity to work using information from younger workers in the same year to estimate the relationship between health and employment as suggested by Cutler et al. (2012). We first estimate a regression on employment decisions controlling for a large number of individual and health characteristics of individuals aged 50-54. Then, we use the estimated coefficients to predict the employment probabilities of older workers using their current explanatory variables (current health and individual characteristics). The novelty of this method is to use the estimates from individuals (baseline group) that are presumably not affected by Social Security benefits as they are years away from the normal and early retirement age.

We use individual data from the Survey on Health, Ageing and Retirement in Europe (SHARE) for waves 1 (2004-2005), wave 2 (2006-2007), wave 4 (2010-2011) and wave 5 (2013). SHARE is a multidisciplinary cross-national panel that contains detailed information on sociodemographic characteristics, health and labor status, among others, for a representative sample of the population aged 50 and over in Europe. We pool information from the four waves mentioned above, and have a sample of 4684 men and 5466 women aged fifty to seventy-four.

We estimate regressions of the following form:

$$Employment_i = \beta_0 + \beta_1 health_i + \beta_2 X_i + \varepsilon_i \qquad (1)$$

where *employment* is a dummy equal to 1 if the individual is employed and *health* is a comprehensive set of health measures: i) dummy variables for different categories of self-assessed health (excellent, very good, good, fair, and poor); ii) mobility limitations (dummy variable if the individual has at least one arm function and fine motor limitations); iii) dummy variable if limited in any activity of daily living (ADLs); iv) dummy variable if limited in any instrumental activity of daily living (IADLs); v) EUROD mental health index; vi) dummy variables for different health problems (AMI, stroke, cholesterol, lung disease, cancer, high blood pressure, arthritis, diabetes, osteoporosis, Alzheimer, back pain and asthma); vii) dummy variables that capture if the individual is underweight, overweight or obese; and viii) smoking behavior (former or current smoker). Last, we control for educational attainment and marital status and estimate this equation using linear probability model. Tables 2a and 2b for men and women respectively provide descriptive statistics for all the relevant variables for the different age groups, as long with sample sizes. Table 2c includes a description of the variables displayed in tables 2a and 2b.

Sample size for individuals aged 50-54 (see tables 2a and 2b) may not be large enough to precisely estimate all the coefficients for the large set of health conditions. Therefore, we also perform an alternative version of this regression model in which we create a single health index that combines the information provided by a set of health variables. We follow Poterba et al. (2013) and construct a health index based on 24 health questions, including self-reported health diagnoses, functional limitations and other health indicators. To do so, we first obtain the first principal component of these 24 indicators which is subsequently used to predict percentile scores for each individual.[5] Thus, the index has to be interpreted as higher values implying better health. Poterba et al. (2013) show that, the health index is strongly related to mortality and future health events such as stroke and diabetes onset, though not to new cancer diagnoses.

Tables 3a and 3b show the results of estimating equation (1) for individuals aged 50-54 including either a large number of health variables (3a) or the health index (3b). The results are shown separately for men and women due to the potentially differential effect of the explanatory variables on employment for men and women. Overall, we find the expected sign of the association between health and education and the probability of working for both men and women: more educated individuals and those in better health are more likely to be employed. However, there are some differences in the magnitude of the estimates between men and women. For example, the decrease in the employment probability is larger for men with mobility problems or depression compared to women, while having a college degree increases the employment probability of women twice that of men. . On the other hand, we find an opposite sign for marital status: being married is associated with a higher employment probability for men but lower for women. The estimates using the health index are similar to the ones using the large set of health variables. In table 3b we can see that higher health is associated with better employment probabilities. Similarly, the education gradient and the differential association between marital status and employment are also in line with the findings presented in table 3b.

We use the estimates presented in Tables 3a and 3b to predict employment probabilities for four age groups (55-59, 60-64, 65-69 and 70-74). Table 4 shows these predictions and

[5] Table 3c shows the factor loadings of the first principal component. All loadings are positive so that larger values of the first principal component represent worse health.

actual employment rates. The difference between the predicted and the observed percentage of individuals working in each group represents the estimated work capacity, also shown in Table 4. We find that predicted employment decreases with age, but the decrease is very modest compared to the actual decrease, and this is independent of how health is included in the model. In fact, even the magnitude of the estimated work capacity is extremely similar in both cases. Therefore, the rest of the analysis is only shown using the estimates from the model that controls for health using the health index.

Figures 9 and 10 plot the percentage of men and women working in each age group as well as the estimated additional capacity to work for each age group and gender. We first note that both the actual and predicted probabilities of working are lower for women than for men for all age groups. This is not surprising as we are analyzing individuals over the age of 50 in the 2000's which correspond to the cohorts of 1960 and before for which women showed very low labor market participation rates. Furthermore, the actual percentage of individuals working in the age groups 55-59 and 60-64 remains relatively high (67.7% and 42.6% for men and 41.3% and 22.4% for women). However, when the normal retirement age kicks in at age 65 the actual percentage of individuals working drops substantially to 6.3% and 0.8% for ages 65-69 and 70-74 for men (3.6% and 0.5% for women). Obviously, there is no health related shock that affects individuals at age 65 so that the predicted percentage of individuals working is reduced smoothly over the ages of 60-64, 65-69 and 70-74. Therefore, when individuals reach the normal retirement age their actual employment decreases sharply while the predicted employment probabilities decrease relatively slower and, thus, the estimated capacity to work increases substantially from age 65. That is, the additional capacity to work is estimated to be 5.4% (6.6%) for men (women) aged 55-59, 26.3% (20.7%) for ages 60-64, 59.1% (36.1%) for the age group 65-69 and 61.5% (35.7%) for ages 70-74.

The work capacity is expected to be different for individuals with different educational attainment as labor opportunities may differ and a negative association between education and health has been found across the board. In addition, different health conditions may hinder employment opportunities differently depending on the educational attainment. Therefore, we provide estimates of the work capacity by education in two ways: i) use estimates shown in Tables 3a and 3b to estimate work capacity for men and women (Table 6a for men and 6b for women); ii) estimate separate regressions by education group to estimate work capacity for men and women (Table 5a for men and 5b for women). We divide the sample in two groups based on educational attainment depending on whether they have completed or not secondary education. . In general, we see that higher educated individuals show higher employment rates at each age group and gender but, at the same time, they also have higher estimated additional employment capacity as their health is better compared to low educated individuals. However, there is an exception to this rule; lower educated women aged 55-59 have a larger estimated additional capacity to work than low educated women. This result is probably due to the fact that low educated women at these ages show very low employment rates although having a relatively good health status. Figures 11 and 12 plot the results of tables 5a and 5b for men and women, respectively, for the regressions using all health variables and a single regression for each educational group.

The Cutler, Meara and Richards-Shubik method (Cutler et. al 2012) allows to estimate the health capacity to work using a group of contemporaneous individuals, so restricting the assumption that labor market conditions are similar in different points in time as needed in the Milligan-Wise method (Milligan and Wise, 2015). However, we still need to , assume that individuals aged fifty to fifty-four do not face any disincentive effects from the Social Security system to stop working. This seems a reasonable assumption for Spain as beneficial access to disability benefits kicks in at age fifty-five (in which benefits are increased from 55 to 75% of the regulatory base for partial disability) and early retirement schemes, which have been reformed over time, do not begin before age sixty. The only program that could pose a threat to this assumption is the unemployment benefit scheme which includes an access to (permanent) unemployment subsidies for individuals aged fifty-two or more until retirement (fifty-five after the last reform in 2013). However, this program gains in importance as the individual get closer to the early retirement age especially after age fifty-five. Additionally, the Cutler et al. method also includes the implicit assumption that health affects employment decisions of individuals aged fifty to fifty-four in a similar way than those older than fifty-five. If older individuals are systematically concentrated in certain type of jobs for which negative health shocks represent a stronger limitation to work than younger individuals, then our results would be biased.

IV. Changes in Self-Assessed Health by Education Level Over Time

It is well-established that education is correlated with health and mortality across-the-board (Cutler and Lleras-Muney, 2010). Therefore, trends in self-assessed health and mortality can be (partly) driven by changes in educational attainment. In addition, jobs opportunities for a given level of education may change over time. In this section, we first illustrate how the educational attainment of the Spanish population aged fifty has changed over time, and later illustrate the evolution of self-assessed health using comparable groups of education.

Figures 13 and 14 show the distribution of education completed by cohort and gender.[6] They clearly show that education accumulation has changed dramatically in the Spanish cohorts that get 50 between the late 60s and the current years. While the older cohorts have very little education (a large majority, 60 and 70 percent for men and women, had only low education), the younger ones have much more education (60 per cent of men and 70 percent of women that are 50 in 2011 have high education).

Figures 15 and 16 present the evolution of the fraction having bad health by education quartile and gender in three periods of time (1987, 2003, and 2006). The fraction having bad health is defined as the fraction that declares having fair or poor self assessed health. We find a clear decreasing gradient of the fraction having bad health by education quartile for both gender. Alternatively, the decreasing gradient over time is much less clear. Therefore, we find that the improvement in the health status of the population shown before seems to be driven by changes in the educational attainment of the Spanish population rather than by changes in the health status of individuals within a given education quartile.

V. Conclusion

[6] Low education refers to individuals who did not complete primary education. Medium education refers to individuals who have primary education completed while high education refers to individuals who have completed secondary education and above.

One of the caveats behind any pension reform that extents the normal retirement age is whether workers are capable of working longer. In this paper we have explored whether Spanish workers have the health capacity to work longer using two alternative methods First, we have estimated what would be the current level of employment if individuals with a given mortality rate today worked as much as individual with the same mortality rate in the past. Second, we have used a contemporaneous younger cohort to evaluate the work capacity assuming that the same health problem hampers employment in the same way for the two groups of individuals. The conclusions from both analyses are similar: there is a large employment potential among the population aged fifty-five to sixty-nine. In particular, using the Milligan-Wise method (Milligan and Wise, 2014), we estimate an additional capacity to work of 7.08 years from fifty-five to sixty-nine in 2010 with respect to equal-mortality values in 1976. Similarly, using the Cutler-Meara- Richards-Shubik method (Cutler et al, 2012), we detect substantial gains that increase both with age (between 20 and 26 percent for individuals aged sixty to sixty-four and between 36 and 61 percent for individuals aged seventy to seventy-four) and the level of education.

There are several strong assumptions behind the analysis done in this exercise. Therefore, the results should be taken as an indication that there is potential employment capacity among the population older than fifty-five in Spain rather than as a conclusive result for policy purposes. Further research using more detailed employment and health information is needed before one could drive large policy reforms to increase participation rates at older ages.

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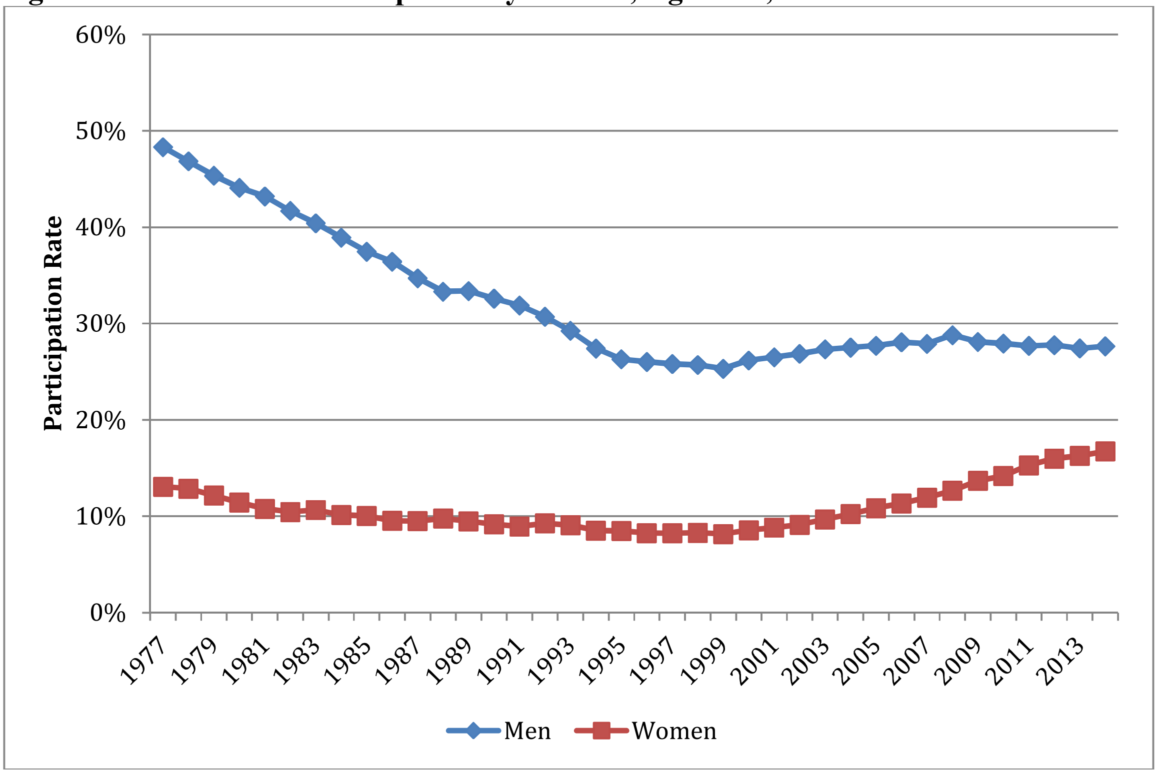
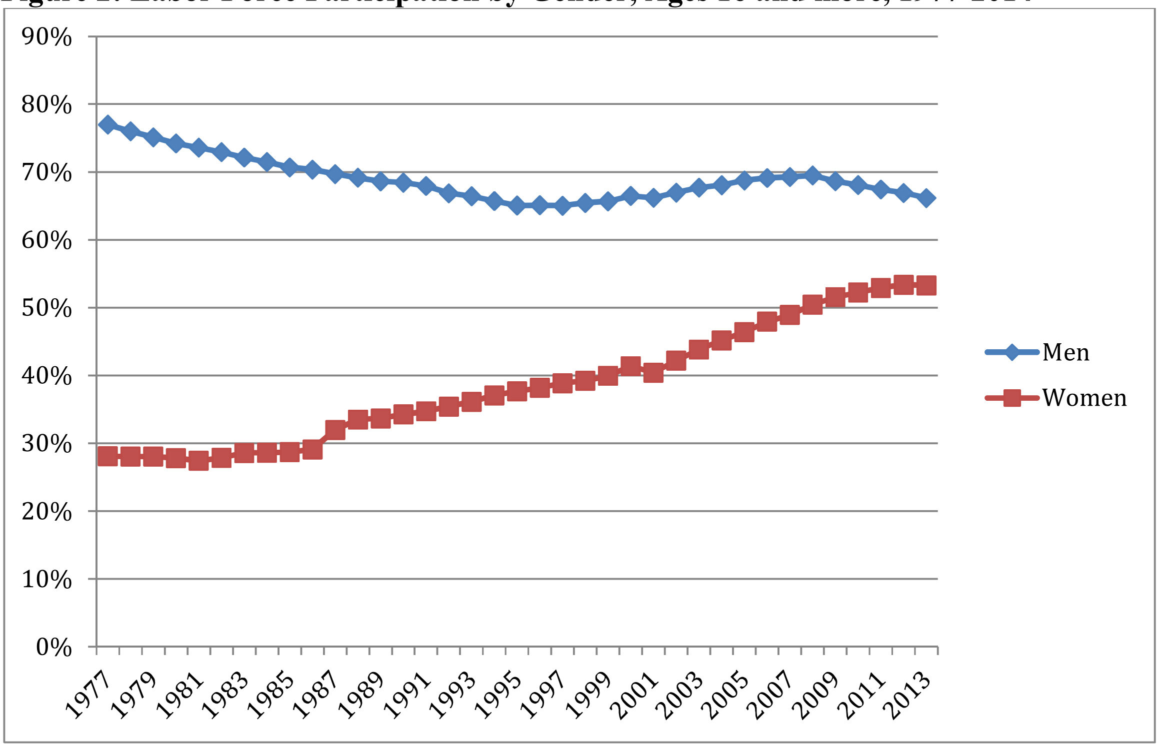
Figure 1: Labor Force Participation by Gender, Ages 55+, 1977-2014



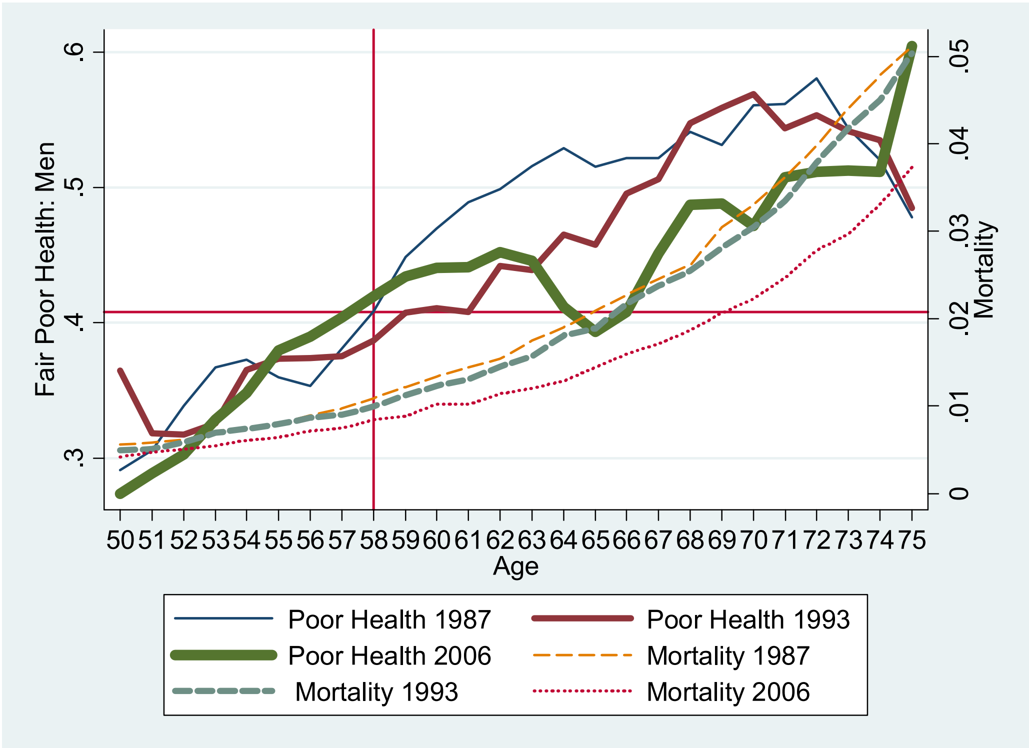
Source: Spanish Labor Force Survey.

Figure 2: Labor Force Participation by Gender, Ages 16 and more, 1977-2014



Source: Spanish Labor Force Survey.

Figure 4: SAH and Mortality for Men Age 50 to 75, 1987 to 2006

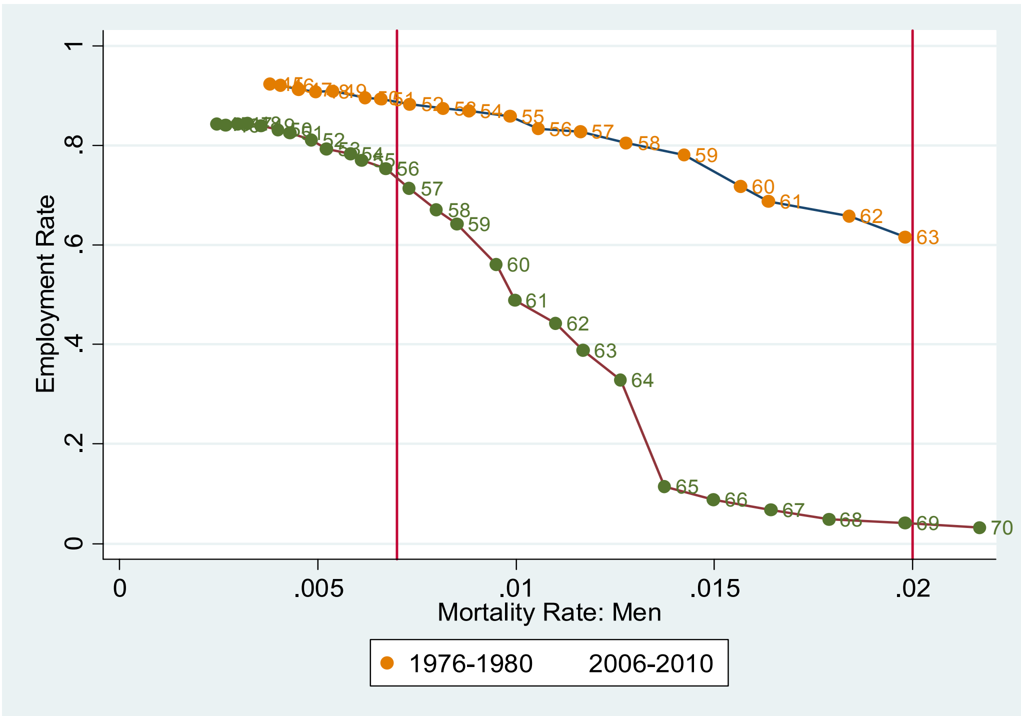


Source: Own elaboration from data from the Human Mortality Database and the Spanish National Health Survey.

Figure 5: Employment vs. Mortality, 1976-1980 versus 1991-1995

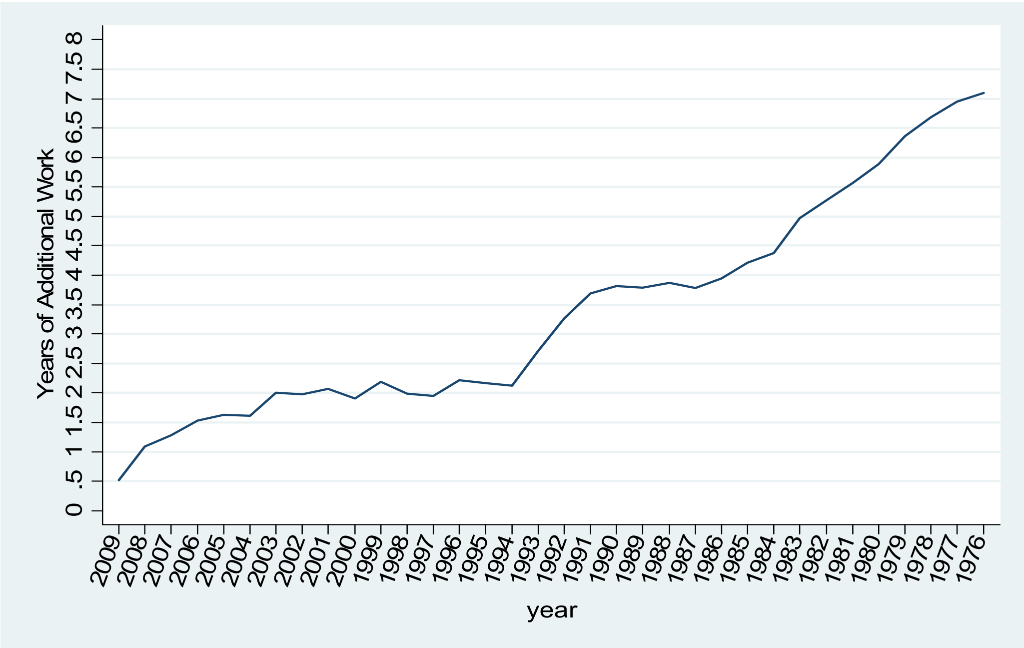
Source: Own elaboration from data from the Human Mortality Database and the Spanish Labor Force Survey.

Figure 6: Employment vs. Mortality, 1976-1980 versus 2006-2010



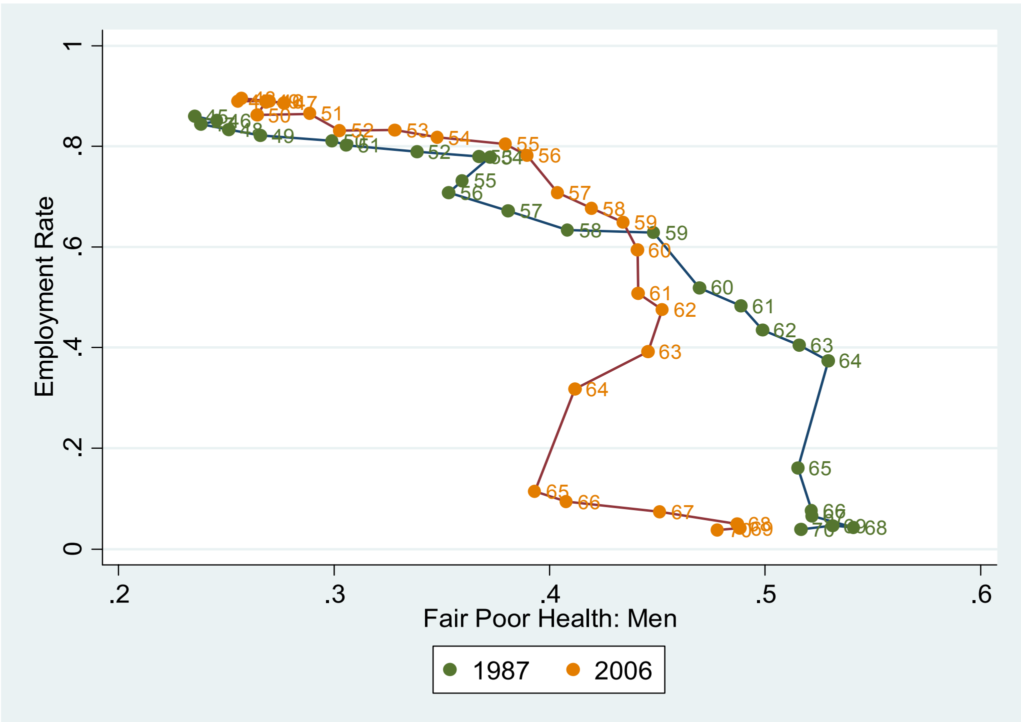
Source: Own elaboration from data from the Human Mortality Database and the Spanish Labor Force Survey

Figure 6: Estimated Additional Employment Capacity by Year of Comparison



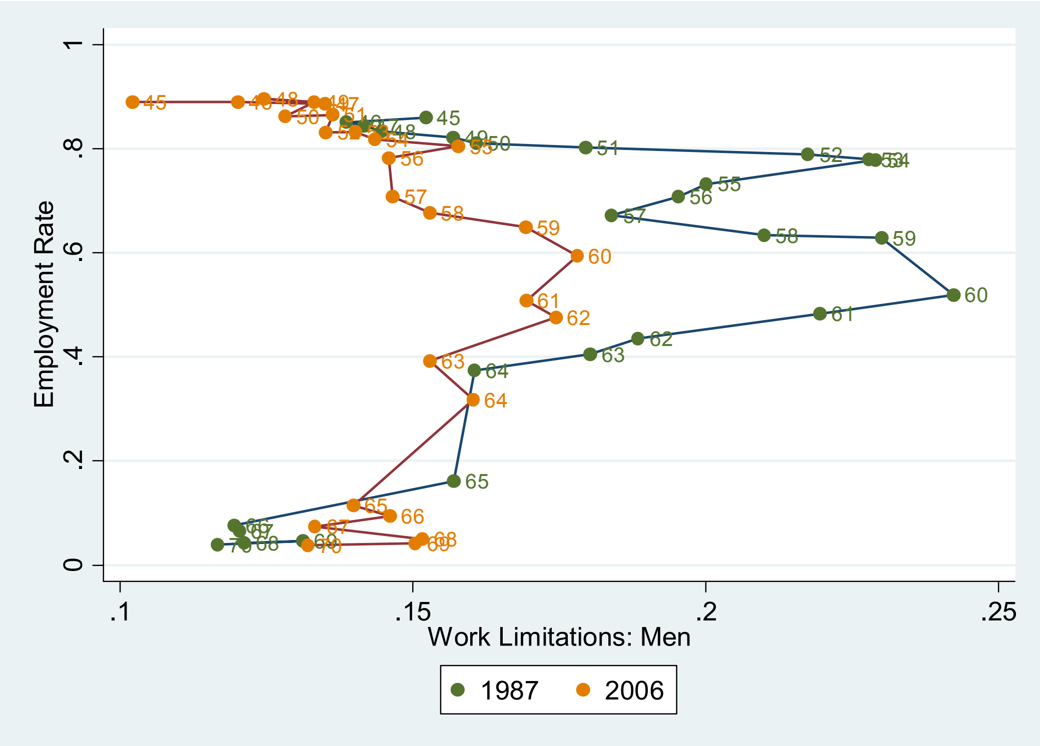
Source: Own elaboration from data from the Human Mortality Database and the Spanish Labor Force Survey.

Figure 7: Employment vs. SAH, 2006 vs. 1987



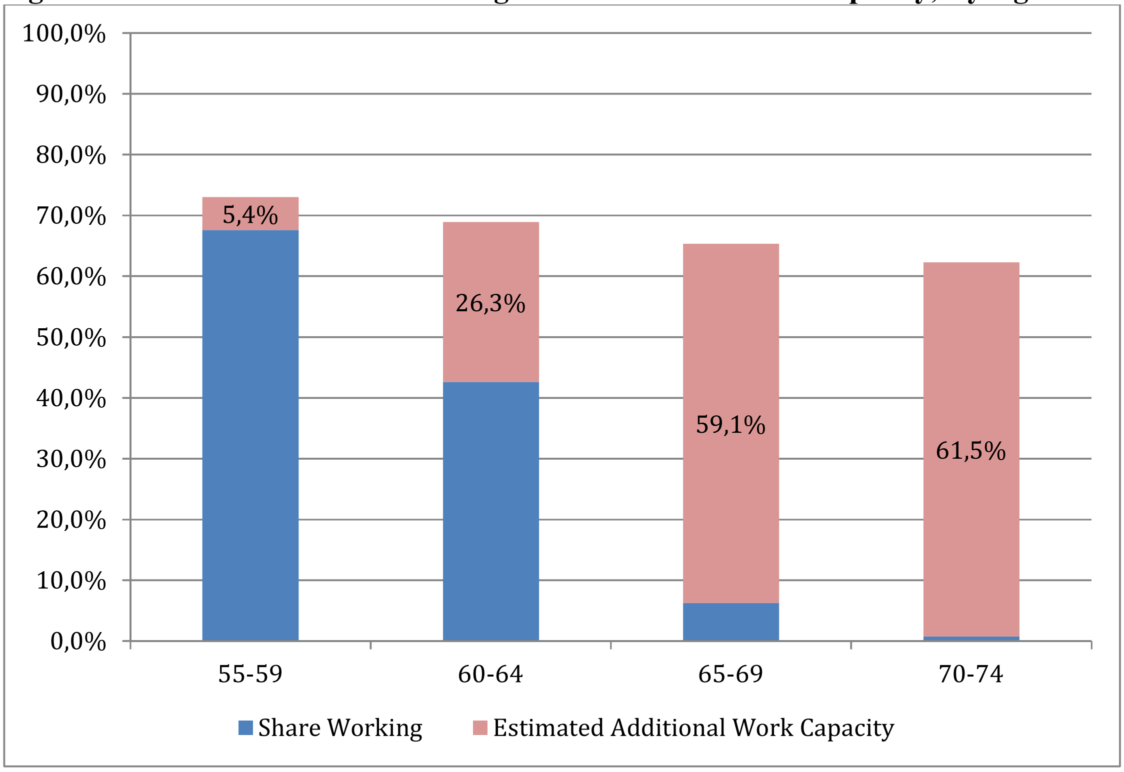
Source: Own elaboration from data from the Spanish National Health Survey and the Spanish Labor Force Survey.

Figure 8: Employment vs. Activity Limitations, 2006 vs. 1987



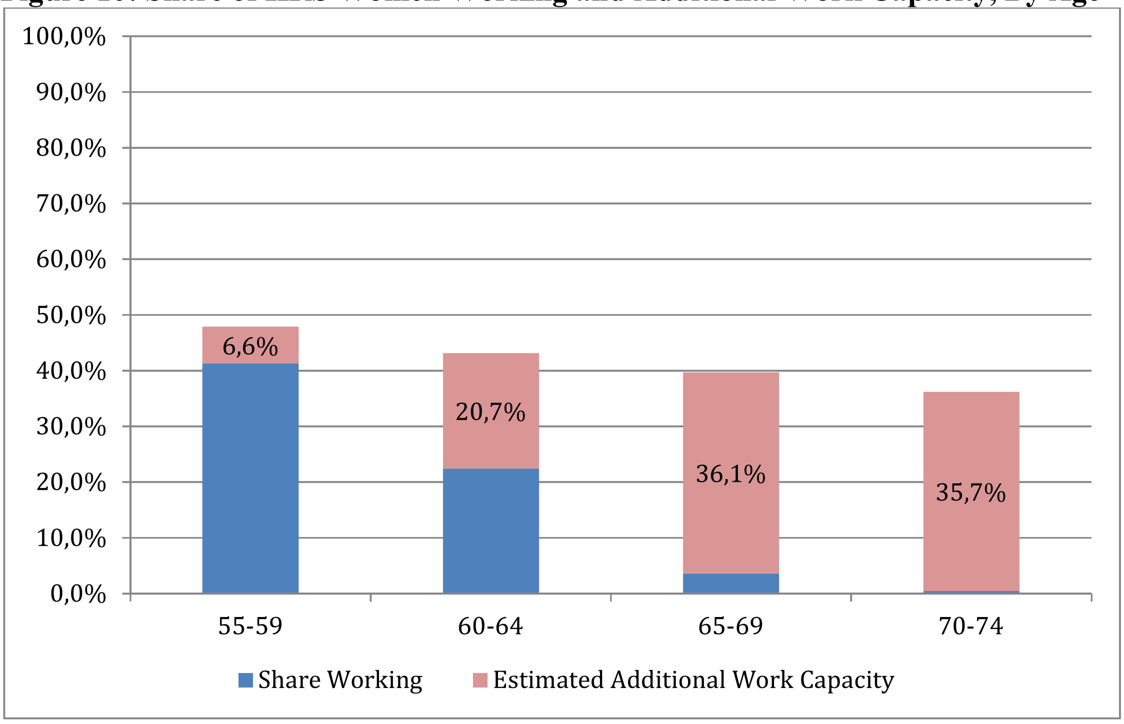
Note: : Own elaboration from data from the Spanish National Health Survey and the Spanish Labor Force Survey.

Figure 9: Share of HRS Men Working and Additional Work Capacity, By Age



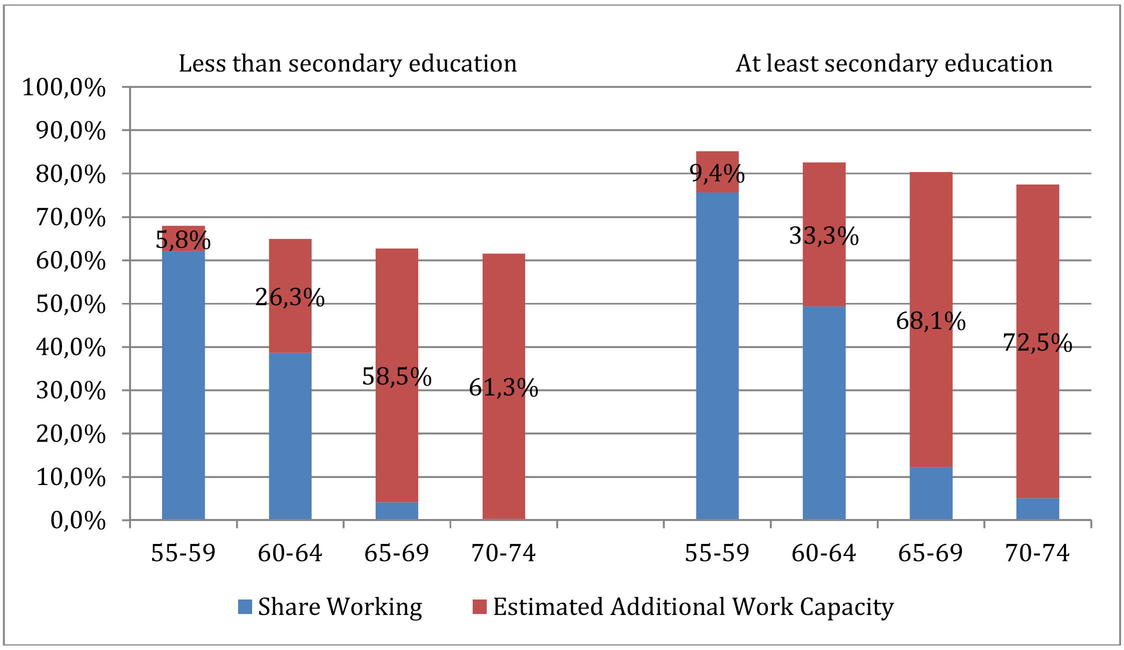
Source: Own elaboration from data from the Spanish National Health Survey and the Spanish Labor Force Survey.

Figure 10: Share of HRS Women Working and Additional Work Capacity, By Age



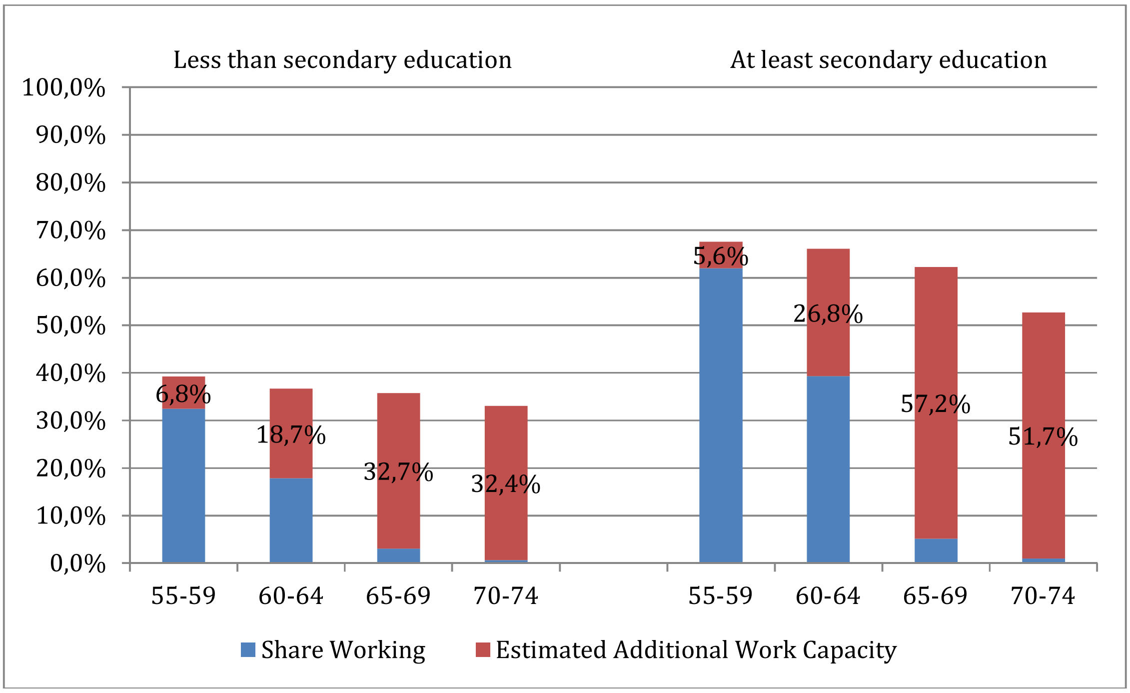
Source: Own elaboration from data from the Spanish National Health Survey and the Spanish Labor Force Survey.

Figure 11: Share of HRS Men Working and Additional Work Capacity, by Age and Education



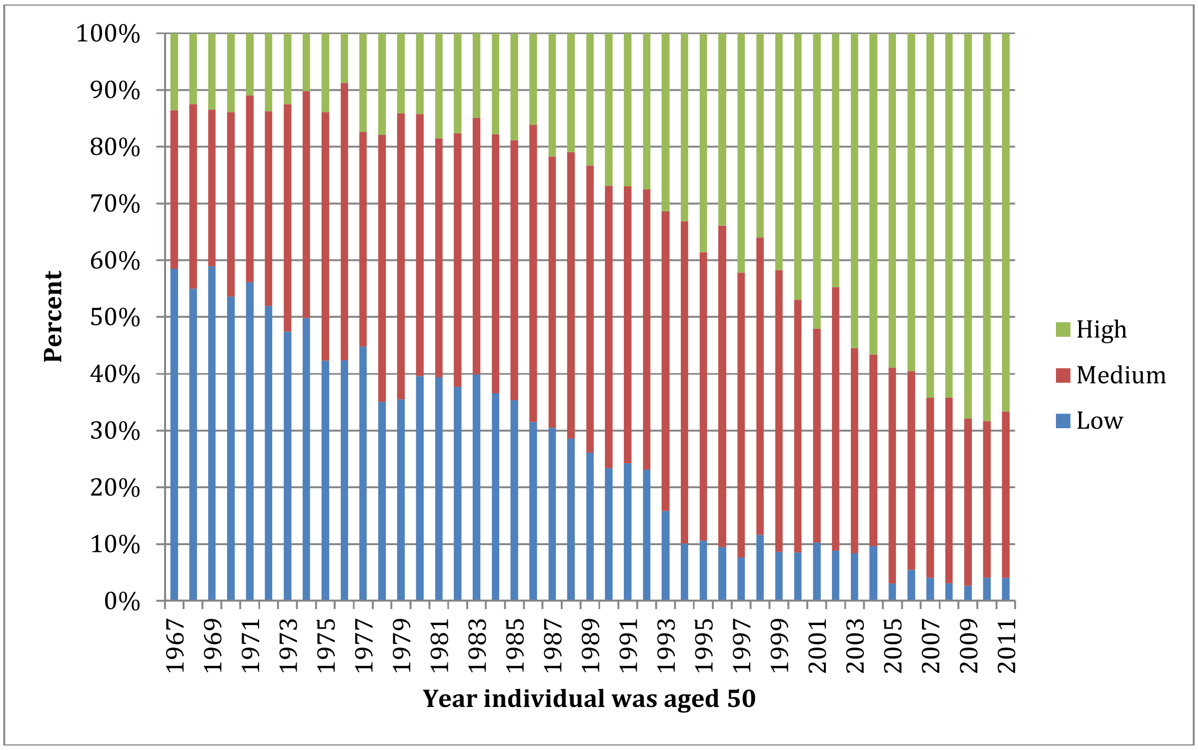
Source: Own elaboration from data from the Spanish National Health Survey and the Spanish Labor Force Survey.

Figure 12: Share of HRS Women Working and Additional Work Capacity, by Age and Education



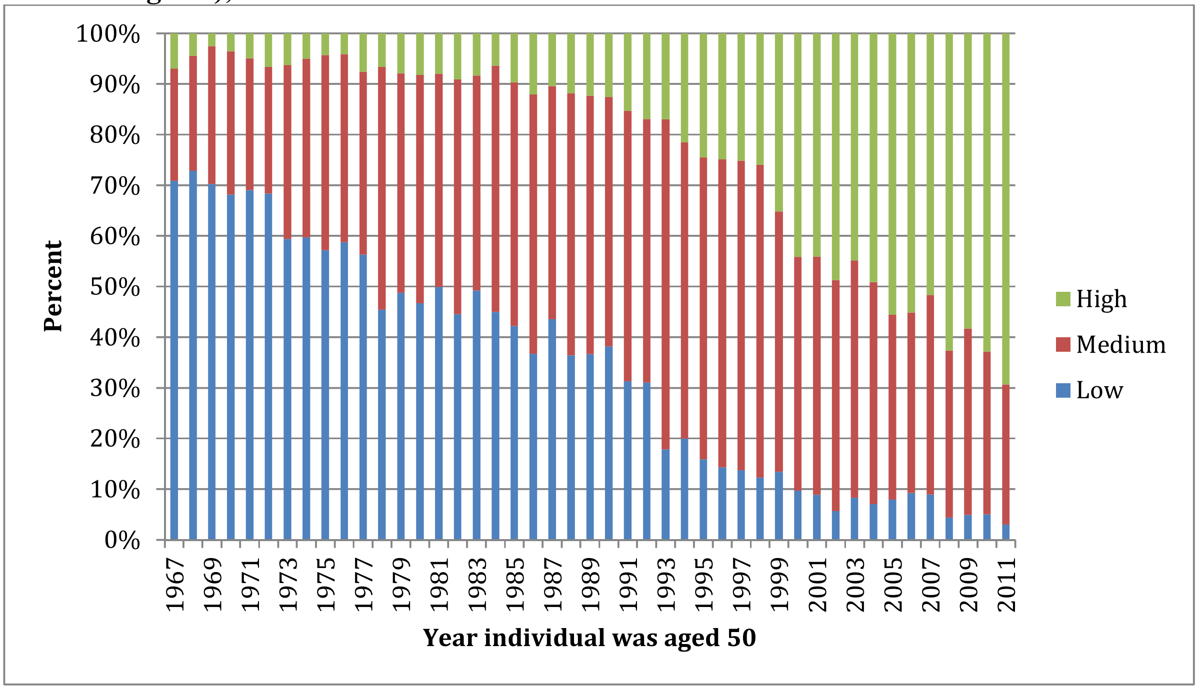
Source: Own elaboration from data from the Spanish National Health Survey and the Spanish Labor Force Survey.

Figure 13: Distribution of Years of Education Completed by Cohort (by Year Cohort Attained Age 50), Men



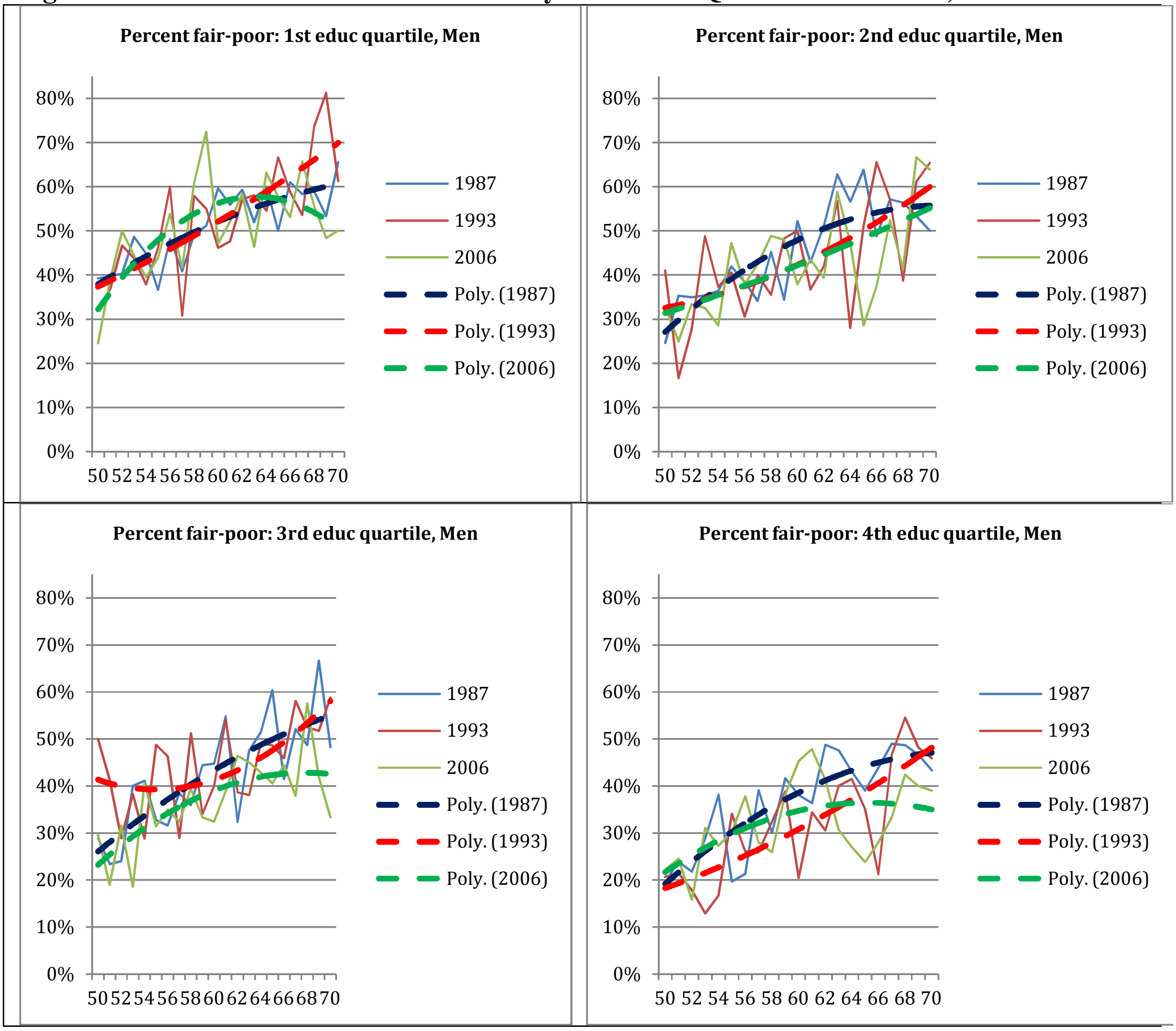
Source: Own elaboration from the Spanish National Health Survey.
Note: Low education refers to individuals who did not complete primary education. Medium education refers to individuals who have primary education completed while high education refers to individuals who have completed secondary education and above.

Figure 14: Distribution of Years of Education Completed by Cohort (by Year Cohort Attained Age 50), Women



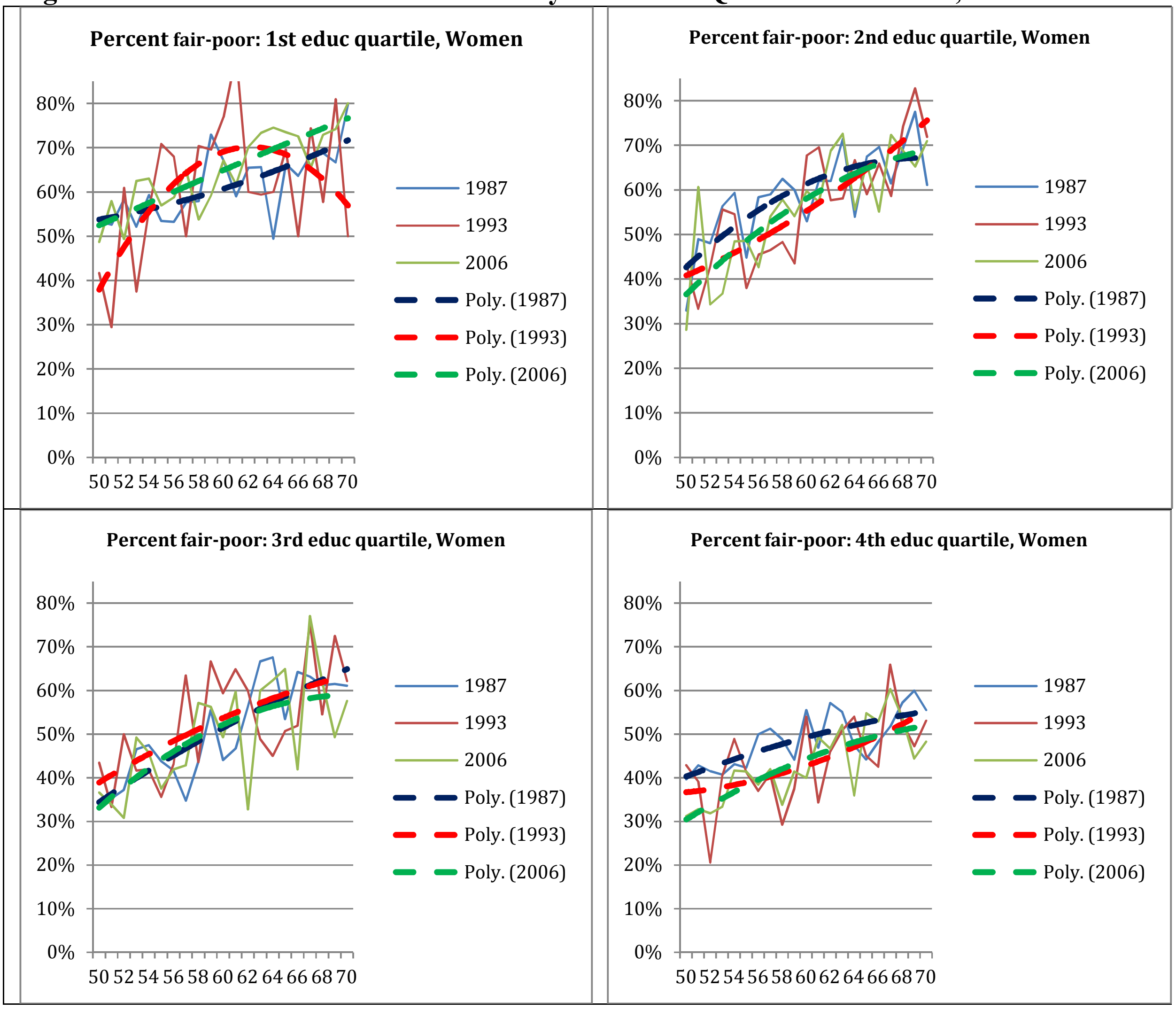
Source: Own elaboration from the Spanish National Health Survey.
Note: Low education refers to individuals who did not complete primary education. Medium education refers to individuals who have primary education completed while high education refers to individuals who have completed secondary education and above.

Figure 15. Evolution of Fair/Poor Health by Education Quartile Over Time, Men



Source: Own elaboration from data from the Spanish National Health Survey.

Figure 16. Evolution of Fair/Poor Health by Education Quartile Over Time, Women



Source: Own elaboration from data from the Spanish National Health Survey.

Table 1: Additional Employment Capacity in 2010
Using 1976 Employment-Mortality Relationship

Age	Death Rate in 2010	Employment Rate in 2010	Employment Rate in 1976 at Same Death Rate	Additional Employment Capacity
55	0.58%	73.6%	92.4%	18.8%
56	0.65%	71.7%	91.1%	19.4%
57	0.71%	67.7%	90.3%	22.6%
58	0.75%	62.9%	89.9%	27.0%
59	0.84%	61.8%	89.4%	27.6%
60	0.87%	52.2%	89.4%	37.2%
61	0.93%	44.7%	89.1%	44.4%
62	1.07%	40.6%	86.3%	45.7%
63	1.11%	34.7%	84.5%	49.8%
64	1.22%	29.4%	84.3%	54.9%
65	1.32%	9.2%	82.8%	73.6%
66	1.44%	7.9%	81.6%	73.7%
67	1.57%	5.1%	79.0%	74.0%
68	1.63%	4.6%	74.6%	70.0%
69	1.79%	3.7%	72.8%	69.2%
Total years		5.7		7.08

Table 2a: Summary Statistics, Men					
	Age Group				
	50-54	55-59	60-64	65-69	70-74
employed	0.74701	0.66869	0.41682	0.06256	0.00961
health_exc	0.07910	0.06984	0.03676	0.04356	0.03088
health_vgood	0.28060	0.22773	0.19133	0.14950	0.12247
health_good	0.44627	0.45749	0.44581	0.44554	0.42812
health_fair	0.12985	0.17915	0.23186	0.25941	0.31842
health_poor	0.06418	0.06478	0.09425	0.10099	0.10011
mobilit2	0.16269	0.22470	0.29689	0.37624	0.43497
ADLany	0.03731	0.04352	0.04995	0.07921	0.09808
IADLany	0.05821	0.04656	0.08577	0.11782	0.13220
eurod	1.57187	1.73077	1.77843	1.81205	1.93069
heartat	0.05357	0.06539	0.08937	0.13708	0.14665
stroke	0.00446	0.01006	0.03010	0.03550	0.02763
cohlester	0.22917	0.24849	0.29069	0.29882	0.27418
lungdis	0.03720	0.03924	0.06115	0.09172	0.09458
cancer	0.00149	0.00604	0.00188	0.00690	0.01275
highblpr	0.19048	0.24044	0.30386	0.38856	0.41233
arthritis	0.19048	0.24044	0.30386	0.38856	0.41233
diabetes	0.03869	0.06439	0.08278	0.12525	0.12327
osteopor	0.00595	0.00905	0.00376	0.00394	0.00638
alzheimer	0.00149	0.00604	0.00188	0.00690	0.01275
back	0.19494	0.21429	0.21919	0.24063	0.24973
asthma	0.00744	0.00704	0.01223	0.00986	0.01169
underweight	0.00448	0.00000	0.00192	0.00101	0.00323
overweight	0.47982	0.50154	0.51631	0.51558	0.51832
obese	0.18087	0.21392	0.18138	0.19900	0.19289
smokerform	0.26339	0.30584	0.38852	0.41716	0.47078
smokecurr	0.37463	0.32490	0.23113	0.19524	0.15672
educ_lessthHS	0.64030	0.65231	0.72683	0.79715	0.85297
educ_hs	0.17910	0.17026	0.11902	0.08359	0.05946
educ_collegemore	0.17164	0.17231	0.15220	0.11417	0.08324
married	0.79762	0.83702	0.85419	0.87870	0.86291
# Obs	672	994	1063	1014	941

Table 2b: Summary Statistics, Women

	Age Group				
	50-54	**55-59**	**60-64**	**65-69**	**70-74**
employed	0.50921	0.40575	0.21891	0.03330	0.00720
health_exc	0.07067	0.04710	0.02710	0.02511	0.01738
health_vgood	0.25363	0.18671	0.15297	0.11839	0.07055
health_good	0.41433	0.44155	0.41346	0.38475	0.34867
health_fair	0.19458	0.25736	0.29983	0.33722	0.36810
health_poor	0.06680	0.06728	0.10664	0.13453	0.19530
mobilit2	0.31462	0.38015	0.50175	0.56822	0.70829
ADLany	0.03872	0.05299	0.07605	0.07361	0.14944
IADLany	0.06389	0.09588	0.14773	0.16338	0.30911
eurod	2.71724	2.75576	3.01157	3.03137	3.65263
heartat	0.01838	0.02860	0.06376	0.07239	0.11236
stroke	0.00387	0.00336	0.01223	0.01519	0.03371
cohlester	0.15184	0.24222	0.28734	0.32082	0.32482
lungdis	0.02805	0.02523	0.03319	0.03664	0.05312
cancer	0.00193	0.00168	0.00437	0.00983	0.01328
highblpr	0.16731	0.23970	0.32052	0.44504	0.52809
arthritis	0.16731	0.23970	0.32052	0.44504	0.52809
diabetes	0.11896	0.14718	0.22620	0.23056	0.30950
osteopor	0.01741	0.03448	0.05328	0.05094	0.06742
alzheimer	0.00193	0.00168	0.00437	0.00983	0.01328
back	0.31915	0.32044	0.34847	0.36282	0.41267
asthma	0.01354	0.00925	0.01135	0.01340	0.01634
underweight	0.01265	0.00853	0.00527	0.00091	0.00103
overweight	0.29572	0.37255	0.38016	0.40018	0.39917
obese	0.17607	0.19693	0.22300	0.23519	0.24716
smokerform	0.15184	0.14718	0.11790	0.07596	0.05312
smokecurr	0.25194	0.16835	0.08392	0.05211	0.01738
educ_lessthHS	0.63770	0.71931	0.81311	0.88370	0.90729
educ_hs	0.18945	0.14335	0.08415	0.05220	0.04375
educ_collegemore	0.16797	0.13219	0.09920	0.06136	0.04271
married	0.84623	0.83011	0.80961	0.79267	0.69969
# Obs	1034	1189	1145	1119	979

Table 2c: Definition of variables in Tables 2a and 2b

Variable	Definition
employed	Dummy equal to 1 if the individual is employed
health_exc	Dummy equal to 1 if the individual states to be in excellent health
health_vgood	Dummy equal to 1 if the individual states to be in very good health
health_good	Dummy equal to 1 if the individual states to be in good health
health_fair	Dummy equal to 1 if the individual states to be in fair health
health_poor	Dummy equal to 1 if the individual states to be in poor health
mobilit2	Dummy equal to 1 if the individual has at least one arm function and fine motor limitations
ADLany	Dummy equal to 1 if the individual has difficulty with an activity of daily living (ADL)
IADLany	Dummy equal to 1 if the individual has difficulty with an instrumental activity of daily living (IADL)
eurod	EUROD mental health index
heartat	Dummy equal to 1 if the individual ever experienced AMI
stroke	Dummy equal to 1 if the individual ever experienced stroke
cohlester	Dummy equal to 1 if the individual ever experienced cholesterol
lungdis	Dummy equal to 1 if the individual ever experienced lung disease
cancer	Dummy equal to 1 if the individual ever experienced cancer
highblpr	Dummy equal to 1 if the individual ever experienced high blood pressure
arthritis	Dummy equal to 1 if the individual ever experienced arthritis
diabetes	Dummy equal to 1 if the individual ever experienced diabetes
osteopor	Dummy equal to 1 if the individual ever experienced osteoporosis
alzheimer	Dummy equal to 1 if the individual ever experienced Alzheimer
back	Dummy equal to 1 if the individual ever experienced back pain
asthma	Dummy equal to 1 if the individual ever experienced asthma
underweight	Dummy equal to 1 if the individual is underweight
overweight	Dummy equal to 1 if the individual is overweight
obese	Dummy equal to 1 if the individual is obese
smokerform	Dummy equal to 1 if the individual is a former smoker
smokecurr	Dummy equal to 1 if the individual is a current smoker
educ_lessthHS	Dummy equal to 1 if the individual has less than high school education
educ_hs	Dummy equal to 1 if the individual has high school education
educ_collegemore	Dummy equal to 1 if the individual has college education or more
married	Dummy equal to 1 if the individual is married

Table 3a: Employment Regressions, All Health Variables				
	Men 50-54		Women 50-54	
Variable	Coefficient	Std Error	Coefficient	Std Error
health_exc	0.240**	0.101	0.215**	0.0921
health_vgood	0.153*	0.0892	0.243***	0.0788
health_good	0.213**	0.0838	0.227***	0.0738
health_fair	0.0646	0.0817	0.167**	0.0713
1+ mobility, arm function and fine motor limitations	-0.194***	0.0504	-0.0388	0.0382
ADLany	0.104	0.0972	0.0474	0.0967
IADLany	-0.203**	0.0799	-0.142*	0.0777
Depression scale EURO-D - high is depressed	-0.0369***	0.00923	-0.0182***	0.00670
heartat	-0.0289	0.0699	0.0176	0.112
stroke	0.0711	0.216	0.405*	0.232
cohlester	0.0525	0.0364	0.0464	0.0424
lungdis	-0.113	0.0815	0.192**	0.0930
cancer	-0.0687	0.386	-0.639*	0.335
highblpr	-0.0534	0.0401	-0.0109	0.0417
diabetes	-0.131	0.0864	-0.0548	0.0527
osteopor	0.0645	0.189	-0.117	0.114
back	0.0590	0.0418	0.00664	0.0369
asthma	0.296*	0.173	-0.0473	0.127
underweight	-0.386*	0.219	-0.150	0.130
overweight	-0.00716	0.0335	-0.0267	0.0341
obese	0.0672	0.0449	-0.0756*	0.0426
smokerform	0.0876**	0.0389	0.0207	0.0426
smokecurr	-0.0583*	0.0351	0.0604*	0.0355
educ_hs	0.0798**	0.0404	0.126***	0.0395
educ_collegemore	0.148***	0.0416	0.362***	0.0408
married	0.0806**	0.0376	-0.149***	0.0408
Constant	0.569***	0.100	0.417***	0.0885
# Obs	645		1,005	
R-squared	0.294		0.189	

*** p<0.01, ** p<0.05, * p<0.1

Table 3b: Employment Regressions, PVW Health Index				
	Men 50-54		Women 50-54	
Variable	**Coefficient**	**Std Error**	**Coefficient**	**Std Error**
Health Index	0.00570***	0.000653	0.00373***	0.000535
educ_hs	0.106**	0.0425	0.158***	0.0390
educ_collegemore	0.187***	0.0430	0.390***	0.0404
Married	0.133***	0.0395	-0.136***	0.0410
Constant	0.193***	0.0561	0.308***	0.0504
# Obs	630		970	
R-squared	0.169		0.157	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3c: First principal component index of health				
Health measure	Wave 1	Wave 2	Wave 4	Wave 5
Difficulty walking several blocks	0.2540	0.2601	0.2847	0.2832
Difficulty lift/carry	0.2962	0.2966	0.2961	0.3080
Difficulty push/pull	0.2750	0.3048	0.2904	0.2978
Difficulty with an ADL	0.2431	0.2596	0.2687	0.2747
Difficulty climbing stairs	0.3086	0.3012	0.2895	0.2950
Difficulty stoop/kneel/crouch	0.3072	0.3125	0.2977	0.3093
Difficulty getting up from chair	0.2895	0.2990	0.2868	0.3019
Self-reported health fair or poor	0.2827	0.2605	0.2423	0.2688
Difficulty reach/extend arms up	0.2390	0.2422	0.2597	0.2622
Ever experience arthritis	0.1404	0.0983	0.1261	0.1071
Difficulty sitting two hours	0.1987	0.2333	0.2353	0.2293
Difficulty pick up a coin	0.1478	0.1501	0.1931	0.1785
Back problems	0.2268	0.1982	0.1851	0.1641
Ever experience heart problems	0.1286	0.1331	0.1292	0.1290
Hospital stay	0.1093	0.1273	0.1164	0.1363
Doctor visit	0.1014	0.0931	0.0813	0.0930
Ever experience psychological problem	0.2313	0.1980	0.2152	0.2220
Ever experience stroke	0.0808	0.0866	0.0816	0.0798
Ever experience high blood pressure	0.0406	0.0363	0.0285	0.0398
Ever experience lung disease	0.1000	0.1075	0.0770	0.0772
Ever experience diabetes	0.2269	0.1990	0.1967	
BMI at beginning of observation period	0.0841	0.0864	0.1001	0.0697
Nursing home stay	0.0347	0.0104	0.0315	0.0394
Ever experience cancer		0.0670	0.0700	0.0982
N	2165	1967	3088	5787

Table 4: Simulations of Work Capacity

Age Group	Use All Health Variables				Use PVW Health Index			
	# Obs	Actual % Working	Predicted % Working	Estimated Work Capacity	# Obs	Actual % Working	Predicted % Working	Estimated Work Capacity
				MEN				
55-59	945	67.3%	74.4%	7.1%	919	67.6%	73.0%	5.4%
60-64	993	42.4%	71.2%	28.8%	970	42.6%	68.9%	26.3%
65-69	947	6.1%	67.5%	61.3%	912	6.3%	65.3%	59.1%
70-74	894	1.0%	64.8%	63.8%	861	0.8%	62.3%	61.5%
				WOMEN				
55-59	1147	40.9%	47.5%	6.6%	1109	41.3%	47.9%	6.6%
60-64	1109	22.1%	42.4%	20.3%	1049	22.4%	43.1%	20.7%
65-69	1056	3.4%	39.2%	35.8%	1006	3.6%	39.7%	36.1%
70-74	931	0.8%	34.8%	34.0%	862	0.5%	36.2%	35.7%

Table 5a: Work Capacity by Education (Regression by Education Group)

Education	Men, All Health Variables Model				Men, PVW Model		
	# Obs	Actual % Working	Predicted % Working	Estimated Work Capacity	Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
Low Education	600	62.1%	67.9%	5.8%	62.5%	65.9%	3.4%
Medium/high Edu.	329	75.7%	85.1%	9.4%	76.0%	85.9%	9.9%
				Age 60-64			
Low Education	715	38.6%	64.9%	26.3%	38.7%	62.8%	24.1%
Medium/high Edu.	285	49.3%	82.6%	33.3%	50.0%	83.7%	33.7%
				Age 65-69			
Low Education	737	4.2%	62.7%	58.5%	4.2%	60.8%	56.6%
Medium/high Edu.	209	12.3%	80.4%	68.1%	12.4%	81.6%	69.2%
				Age 70-74			
Low Education	736	0.3%	61.6%	61.3%	0.1%	58.6%	58.5%
Medium/high Edu.	135	5.1%	77.5%	72.5%	4.4%	81.0%	76.5%

Table 5b: Work Capacity by Education (Regression by Education Group)

Education	Women, All Health Variables Model				Women, PVW Model		
	# Obs	Actual % Working	Predicted % Working	Estimated Work Capacity	Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
Low Education	799	32.4%	39.2%	6.8%	32.8%	39.1%	6.4%
Medium/high Edu.	322	62.0%	67.6%	5.6%	62.1%	69.6%	7.4%
				Age 60-64			
Low Education	856	17.9%	36.6%	18.7%	18.2%	36.8%	18.6%
Medium/high Edu.	213	39.3%	66.1%	26.8%	39.0%	68.8%	29.9%
				Age 65-69			
Low Education	892	3.1%	35.8%	32.7%	3.3%	36.3%	33.0%
Medium/high Edu.	132	5.1%	62.3%	57.2%	5.3%	66.4%	61.1%
				Age 70-74			
Low Education	785	0.7%	33.1%	32.4%	0.4%	34.0%	33.6%
Medium/high Edu.	93	1.0%	52.7%	51.7%	1.1%	63.9%	62.9%

Table 6a: Work Capacity by Education (Single Regression)

Education	Men, All Health Variables Model				Men, PVW Model		
	# Obs	Actual % Working	Predicted % Working	Estimated Work Capacity	Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
Low Education	339	76.6%	79.3%	2.7%	76.6%	76.1%	-0.5%
Medium/high Edu.	636	62.2%	71.5%	9.3%	62.2%	70.9%	8.6%
				Age 60-64			
Low Education	280	51.6%	76.8%	25.1%	51.6%	73.2%	21.6%
Medium/high Edu.	745	38.5%	69.9%	31.4%	38.5%	67.8%	29.3%
				Age 65-69			
Low Education	199	14.1%	75.7%	61.5%	14.1%	70.2%	56.1%
Medium/high Edu.	782	4.3%	66.9%	62.7%	4.3%	65.6%	61.3%
				Age 70-74			
Low Education	136	5.1%	72.1%	67.0%	5.1%	68.8%	63.7%
Medium/high Edu.	789	0.3%	65.8%	65.6%	0.3%	63.5%	63.3%

Table 6b: Work Capacity by Education (Single Regression)

Education	Women, All Health Variables Model				Women, PVW Model		
	# Obs	Actual % Working	Predicted % Working	Estimated Work Capacity	Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
Low Education	327	62.3%	56.3%	-6.0%	62.3%	54.2%	-8.1%
Medium/high Edu.	838	32.4%	45.5%	13.1%	32.4%	47.9%	15.5%
				Age 60-64			
Low Education	211	39.8%	54.7%	14.9%	39.8%	53.6%	13.7%
Medium/high Edu.	918	17.9%	41.9%	24.0%	17.9%	44.9%	27.0%
				Age 65-69			
Low Education	127	5.5%	55.4%	49.9%	5.5%	50.5%	45.0%
Medium/high Edu.	965	3.1%	40.8%	37.7%	3.1%	44.0%	40.9%
				Age 70-74			
Low Education	89	1.1%	49.1%	48.0%	1.1%	49.2%	48.1%
Medium/high Edu.	871	0.7%	36.8%	36.1%	0.7%	40.8%	40.1%