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ABSTRACT

This paper estimates how much additional work capacity there might be among men and women aged between 55 and 74 in the United Kingdom, given their health, and how this has evolved over the last decade. The objective is not to suggest how much older people should work but rather to shed light on how much ill-health (as opposed to other constraints and preferences) constrains older individuals' ability to work. We present two alternative methods, both of which rely on constructing a 'counterfactual' employment rate for older people based on the behaviour of other similarly healthy individuals. Both methods suggest that there is significant additional capacity to work among older men and women, but that this has been declining over recent years for women (and possibly also for men). This latter finding suggests that the increase in employment rates among older people seen over the last decade are more rapid than would have been expected based on the improvements seen in health alone.

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1. Introduction

Over recent years there has been growing enthusiasm among policymakers to increase employment rates of older people in the UK. This has been driven by concerns about the financial sustainability of publicly funded support for older people and the adequacy of private pension saving.[1] A number of policies have been implemented with the explicit intention of enabling or encouraging people to work for longer – such as increasing the state pension age, increasing normal pension ages in public sector occupational pension schemes, and abolishing mandatory retirement ages. The government has also now committed to holding regular reviews of the state pension age, with future increases in the state pension age being 'based on the principle that people should spend a given proportion of their lives receiving a State Pension' (DWP 2015). However, one concern that is often raised about such policies is that there are some people who are unable to work because of their health.[2]

In this paper we present two approaches to try to understand whether and how many older people in England have sufficiently good health to be able to work and thus whether there appears to be potential (on the grounds of health alone) to increase employment rates among this group. Each approach endeavours to estimate a counterfactual employment rate for current older people based on employment rates seen among a similarly healthy group of people – either in earlier years or at a younger age. We are interested in understanding how health affects the ability to work, and thus how we might expect employment rates to change over time as the health of successive cohorts changes, under the maintained assumption that health is the only factor determining employment.

Clearly health is not the only factor that determines whether or not people actually do work. Some people may not work for other reasons. For example, some may be unable to work because of other calls on their time, such as caring responsibilities. Some may want to work but be unable to find suitable employment, either because of a general lack of labour demand or because of specific discrimination against older workers. By focussing here on health, our objective is not to diminish the importance of these other factors, nor to draw firm conclusions about how much people *should* work, but rather to suggest how much they *could* work *given their health*. In other words, the aim is to help policymakers understand how much health constrains the ability of (different groups of) older people to work. If it does, policymakers interested in increasing employment rates may need to devote time and energy to understanding and (possibly) addressing this constraint. If it does not, then it suggests that other factors should perhaps instead be focussed on.

We present results from two alternative approaches. Both approaches aim to estimate how much current older people could work, given their health, by finding another group of people, who have very similar health, and looking at how many of them work. In other words, we attempt to construct a counterfactual employment rate. The first approach uses data from earlier years to compare employment rates of current older people to the employment rates of people with the same level of health in an earlier year – if the former is lower than the latter, we conclude that there is 'additional work capacity' among the current older population. The second approach uses data on younger individuals at the same point in time. In this case, spare work capacity is measured as the difference between the employment rate of older people and the employment rate of similarly healthy younger people. The other chapters in this volume present similar analysis for other countries.

[1] See, for example, Pensions Commission (2005).
[2] See, for example, Department for Work and Pensions (2010).

Results from the different countries can, therefore, be compared to construct a third type of counterfactual – using similarly healthy individuals in different countries to estimate how much older people in the UK could work if they had the same health-specific employment rate as people in another country.

Health is a complex concept with many different facets. It is difficult to measure health comprehensively and it is hard to find consistent measures of health over time and/or across countries. A further difficulty arises in understanding how health (and different aspects of it) affects ability to work. These issues make the current endeavour challenging and explains why we take two alternative approaches to addressing the question, each of which has its own strengths and weaknesses.

Our first approach takes a simple measure of health but one which is – without any doubt – defined in the same way over time and across countries. This is the one-year death rate of people of a specific age. We examine how the employment rates of men and women with a given probability of death have changed over long periods of time. This is an approach presented by Banks et al. (2012) and also by Milligan and Wise (2012). The strength of this method is that we can be confident that this measure of health – which is readily available for long time periods – is defined in the same way in each year. The weakness is that this measure of 'health' may not be a particularly relevant one for determining whether or not someone is able to work: there are many conditions which may not affect one's immediate survival probability very much but which heavily impact one's ability to work, and vice versa.

The second approach – based on a method proposed by Cutler et al (2012) – uses a much more comprehensive set of measures of individuals' health from the English Longitudinal Study of Ageing (ELSA) and examines how these are related to employment rates. The strength of this approach is that we are able to include a much richer set of indicators of health that may impact on work capacity. The weakness of this approach is that it relies on the assumption that the impact of health on work capacity does not vary by age. We are also limited in the application of this approach because the data required are only available for England from 2002 onwards, meaning that we cannot look at a very long time period.

Both the methods we use rely on finding a comparison group for whom health is the only reason for them not working. This assumption is more problematic for women, especially when using the Milligan-Wise method since the tendency for women to be out of the labour market for reasons not related to their health was particularly large in the past. Therefore, for women we present two alternative sets of results for each method. First, we present results by comparing women to other women with the same observed health (i.e. analogous to the approach we use for men). Second, we compare women to men with the same observed health.

We present results separately for men and women and for those with different skill levels in order to highlight heterogeneity in currently under-utilised work capacity. We focus on those aged between 55 and 74. We use a measure of 'skills' that is not defined on the basis of the job that an individual is currently doing because we want to be able to compare similar individuals who are and are not in work. Therefore, we split people into skill groups based on the age that they left full-time education. However, this poses a challenge when looking over long periods of time because average levels of education have risen significantly over time – suggesting that those leaving education at very young ages become an increasingly selected group of (very low skilled) people in later cohorts. This point was noted for the United States by Bound et al (2014) and is also apparent for the United Kingdom in Figure 1, which shows the age of leaving full-time education for people reaching age 50 in each year from 1975 to 2015. Figure 1 shows clearly two significant reforms to the compulsory school leaving age that affected people who have reached age 50 over the last 40 years. The school leaving age was first raised from age 14 to age 15 (in April 1947, affecting those reaching age 50 from 1983 onwards), and then raised from age 15 to age 16 (in September 1972, affecting those reaching age 50 from 2008 onwards). Therefore, in order to compare similar groups of people across time, we define 'education quartiles' within year of birth – that is, grouping together the 'highest skilled' quarter of the population born in a given year, and so on.[3] We define these quartiles separately for men and women to allow for time-varying differences in the education opportunities afforded to men and women, although this actually has relatively little effect on the grouping of individuals for the cohorts we examine here.

Throughout this paper we will abstract from the possibility that work and/or retirement may have a direct causal effect on individuals' health. This is a potentially important concern and our results should be interpreted with this caveat in mind. A multitude of theoretical reasons have been postulated for why work, and hence exits from work, might directly affect physical and/or mental health and well-being. These theoretical reasons, which are reviewed in more detail by Banks, Chandola and Matthews (2015), suggest that there may be substantial heterogeneity in how work (and exits from work) affect health, with work potentially having positive effects in some instances and negative in other. Empirical evidence on the effect of retirement on health is mixed. A number of studies have shown strong correlations between exits from work and health but there is heterogeneity in whether retiring from work is found to be associated with better or worse health. More robust causal analyses are rarer in the literature and find weaker effects (particularly for physical health) and mixed results.

Both the methods we use suggest that there is currently significant additional health capacity to work at older ages among both men and women in the United Kingdom. Looking at individuals in the past who had similar levels of health, and also looking at currently younger individuals with similar health, it seems that – for the majority of people – health is not a significant factor limiting capacity to extend working lives. However, our estimates also suggest that capacity to work is not 100 per cent among those aged 55–74 and so there are a significant minority of this group for whom our results suggest health does limit their capacity to work.

Exactly how much additional capacity to work there is found to be depends on the counterfactual used. In particular, using the Milligan-Wise method, additional work capacity is found to be larger the further back in time one looks to construct the counterfactual. In this paper we have gone back as far as 1977. Comparing to 1977, we find that men had 9.2 years of additional work capacity between the ages of 55 and 74 in 2013, compared to 2.0 years when we instead compare 2013 to 1995. Were we to go back further than 1977, we would be very likely to conclude that there was even more capacity to work among current older people. What is clear, however, is that there is additional work capacity. The method proposed by Cutler et al (2012) also confirms this. Using this

[3] From Figure 1 it is clear that some of the quartile splits fall in the middle of a group. In these cases we randomly assign people within that group to one or other of the quartiles in question in order to achieve four equally sized groups.

method, we find that there is little heterogeneity in additional work capacity by skill level among men but that there appears to be significantly more spare work capacity among high skilled women than among low skilled women.

The Milligan-Wise method also suggests that the increases in employment rates seen among older women since the mid-1990s are entirely in line with the estimated growth in work capacity over the same period. In other words growth in employment has not led to a change in the estimated amount of additional work capacity.

The remainder of this paper is structured as follows. Section 2 describes briefly how employment rates and health have evolved in the United Kingdom over the last few decades. Section 3 describes the method and presents the results for the first empirical approach we have used. Section 4 describes the second empirical approach. Section 5 concludes.

2. Changes in health and employment rates over time

Advances in medicine, improvements in living conditions and greater understanding of the adverse effects of behaviours such as smoking have led to rapid improvements in life expectancy and many objective measures of health across virtually all developed economies, including the United Kingdom, over the last half a century. For example, as Figures 2 and 3 show, the chance of dying at any given age has fallen steadily over time, with the reductions in mortality being particularly large at older ages. Figure 2 shows, for example, that men aged 60 in 1970 had a 2.1 per cent chance of dying in the next year, while in 2015 this mortality chance was not reached until about age 71. The improvements in mortality have been slightly smaller for women (shown in Figure 3): women aged 60 in 1970 had a 1.1 per cent chance of dying in the next year, which is a mortality probability not reached until age 69 in 2015.

However, other measures of 'health' that have been collected over long time periods and which may be more closely related than mortality to capacity to work tend not to show this same sort of improvement. Figure 4 shows that the fraction of people at any age reporting that they were in 'poor' health changed little between the period 1991–1999 and 2004–2012, even though there were significant reductions in mortality over this period. Figure 5 confirms that this lack of time variation is also present among individual education groups (where the education quartiles are defined in the way described above). Banks et al. (2012) document that this is also the case in the United Kingdom over longer time periods and using various other measures of health, such as reporting having a limiting long-standing illness.

This lack of time trend is in spite of the fact that all of these measures show systematic variation by age and education level in cross-section. For example, Figure 6 shows that – pooling years of data together – there is a systematic relationship between age and ill-health, and between education and ill-health. Within each education group, older individuals are more likely to report being in poor health. Furthermore, at a given age, those with higher levels of education report being in better health than those with lower levels of education. The latter fact is consistent with the extensive literature that has documented – but not universally agreed on the causes of – the relationship between socioeconomic status and health.[4]

[4] For a review of the literature, see Cutler and Lleras-Muney (2006).

The discrepancy between lack of improvement over time in self-assessed measures of health but improvements in mortality could be for at least two reasons. First, there are many facets of ill-health that might not increase mortality but nonetheless would impact on self-assessed health – in other words, it may be true that some measures of health (including, perhaps, those that are relevant for capacity to work) have not been improving over time in the same way as mortality. Second, self-assessed health could be affected by reporting biases – that is, people's true health has been improving but this is not reflected in the way they answer questions about their health. To help to disentangle this we would ideally like to examine a wider range of more objective measures of people's health over the same time periods. However, such data has only been collected on a systematic and consistent basis in the England in recent years – for example, in ELSA. Therefore, such data cannot be used to look at developments in the 20th century. There is some evidence though that reporting bias is important to some extent. Disney and Webb (1991) found that self-reported disability was related to labour market conditions. Banks et al. (2009) find that differences in reporting styles can account for large differences across countries in reported problems with pain (a leading cause of work disability) despite limited differences in the prevalence of conditions that cause pain and limited differences in the use of medication and technologies to reduce pain. Kapteyn, Smith and van Soest (2007) also find that differences in reporting styles can explain a significant part of differences in reported prevalence of work disability between the United States and the Netherlands.

Changes in employment rates among older people have diverged from trends in health (when measured using either mortality rates or self-reported health). As Figure 7 shows, employment rates of older men fell sharply between the 1970s and mid-1990s, before rising steadily over the last 20 years. Employment rates of older women also declined somewhat between the 1970s and mid-1980s before rising steadily thereafter (Figure 8). In other words, while health appears to have steadily increased over time (at least when measured using mortality data, and still not have to have fallen when measured using self-reported health), employment rates initially fell (suggesting that health capacity to work of those out of work probably grew) and then started to rise again (suggesting that more recently employment rates may have kept pace with, or possibly out-stripped, growing health capacity to work).

Earlier research highlighted the importance of financial incentives from public and employer-sponsored pension schemes in incentivising early retirement in the United Kingdom and elsewhere (Gruber and Wise, 1999, 2004). Others have also demonstrated the importance of disability benefits in facilitating exit from the labour market, particularly during periods of weak economic activity (Benitez-Silva, Disney and Jimenez-Martin, 2010). The increases in employment rates in the United Kingdom since the mid-1990s likely reflect a reversal of some of these factors. For example, early retirement options in employer-provided pension schemes have become less easily available, the state pension has been reformed (including removing the earnings test on pension receipt) to reduce incentives to leave work, and there have been substantial reforms aimed at reducing on-flow to, and increasing off-flow from, disability benefits. However, empirical evidence on some of these factors is limited – for example, Chandler and Tetlow (2014) provide a description of these changes in employment rates, while Banks, Blundell and Emmerson (2015) provides an initial descriptive evaluation of the effect of disability benefit reforms on employment rates.

This section has shown that – on some measures at least – health improved significantly between the 1970s and 2010s and yet employment rates of older people have perhaps not kept pace. This appears to be particularly true among men, for whom employment rates are now around the same level as they were at in the late 1970s despite large improvements in many dimensions of health. It is also clear that employment rates drop sharply between those in their late 50s and those in their late 60s, even though there does not appear to be a similar steep decline in health. Both these facts suggest that there may be unused potential for older people to work. In the next two sections we present two approaches to quantifying this extra potential. Both approaches attempt to identify how health affects the capacity to work by finding a group whose actual employment is assumed to be *only* affected by their health and then using this information to predict work capacity for other groups. The first method (which was proposed by Milligan and Wise (2012)) does this by looking back in time. The second method (which adapts the approach taken by Cutler, Meara and Richards-Shubik (2012)) looks to a younger age group at the same point in time.

3. Using mortality as an indicator of health (the Milligan-Wise approach)

The probability that someone of a given age and sex dies within the next year is an indicator of the average health of that particular group, which can be measured accurately and consistently across time and across countries. Milligan and Wise (2012) therefore suggest using this measure of health to examine how the relationship between 'health' and the probability of being in paid work has changed over time.

To do this for the United Kingdom we use two data sources. Mortality probabilities are taken from official life tables from the Office for National Statistics (ONS). These are calculated based on official death records and are available by sex and single year of age for every calendar year since 1951. Employment rates are taken from the Labour Force Survey (LFS), which was collected in 1975, 1977, 1981, annually from 1983 to 1991, and quarterly since 1992. These data allow us to calculate employment rates by sex and single year of age in each year for which there are data. On average, among individuals aged 55 to 74 we have around 2,000 individuals of each age/sex combination in each year; the sample size increases over time (in particular, it is smaller before 1992 and larger after). We define as being 'in employment' those who are in paid employment either as an employee or through self-employment.

The basic idea of the Milligan-Wise approach is to compare employment rates of groups of individuals in different years who had the same mortality rate as one another. So, for example, in order to estimate 'work capacity' for men in 2013 (our most recent year of data) on the basis of the behaviour of men in 1995, we do the following. First, we take men of a given age (a) in 2013 and find their one-year mortality probability from the ONS data (which we will denote $m(a,2013)$). We then estimate what age group (a') in 1995 had that same one-year mortality probability. As an example, Figure 9 shows that men aged 64 in 2013 had a 1.1 per cent chance of dying in the next year, which was very similar to the mortality probability of men aged 59 in 1995. We then compare the employment rates of these two groups, and estimate additional work capacity as the gap between them – as shown in Equation 1. In the case of the example just set out, men aged 64 in 2013 had an employment rate of 44 per cent, compared to 58 per cent among men aged 59 in 1995: suggesting (perhaps) additional work capacity of 15 percentage points in 2013.[5] Figure 13 shows the share of men employed in 2013, the predicted share employed (shown by the full height of the stacked bars) based on men with a similar mortality probability in 1977, and the difference between these, which we term the estimated additional work capacity. The figure splits the results by age group. This suggests that there are particularly large amounts of additional work capacity among men aged just over the state pension age, which is consistent with the large drop in employment observed at the state pension age being due to factors other than deteriorating health.

$$SC_{a,t} = \Pr\left(w_{a',t} = 1\right) - \Pr\left(w_{a,2013} = 1\right) \quad where\; m(a',t) = m(a, 2013) \qquad (1)$$

We conduct the equivalent exercise for women. However, since employment rates of earlier cohorts of women were lower for reasons that are not related to their health, we also conduct a second simulation for women. That is, we simulate work capacity of women using the observed historical employment rates of men with similar mortality probabilities. So, for example, we compare 69 year old women in 2013 to women aged 62 in 1977 (as shown in Figure 10). Among this group the employment rate was 22.7 per cent. The actual employment rate among 69 year old women in 2010 was 11.5 per cent, implying additional work capacity of 11.2 percentage points. However, comparing to men with similar mortality probabilities in 1977 suggests much higher spare work capacity among 69 year old women, at 79.1 percentage points. The estimated variation in additional work capacity among women in different age groups is shown in Figure 14 (from comparing the employment rates of women in 2013 to those of women in 1977 who are similar in terms of their mortality probability) and in Figure 15 (from comparing the employment rates of women in 2013 to those of similar men in 1977).The procedure outlined in Equation 1 provides an estimate of the percentage of individuals of a given age (*a*) in 2013 who could have worked (but did not), under the assumption that they could work as much as those with the same mortality probability in year *t* ($S_{a,t}$). We then estimate the average years of spare work capacity between ages 55 and 75 by summing these percentages over$a \in [55,74]$, as shown in Equation 2. The results are summarised in Figre 11 (with the results of an equivalent exercise, but instead looking at ages 55 to 69, are shown in Figure 12).[6] For men these results are particularly sensitive to the choice of base year: comparing current employment rates by mortality to those in the recent past suggests some (but relatively little) spare work capacity. In other words, recent increases in employment rates among older men by age are almost sufficient to match the improvements in one-year mortality rates at those ages over the same period. But, if we go further back, this is no longer the case: employment rates by a given level of one-year mortality probability have fallen significantly since the late 1970s. For example in 2013, compared to 1977, there is an average of 8.6 years of spare work capacity between the ages of 55 and 74.

$$SC_t = \sum_{a=55}^{74} SC_{a,t} \qquad (2)$$

For women the results are sensitive to whether women are compared to the employment rates of women with similar mortality probabilities in the past or to the employment rates of men with similar mortality probabilities in the past. Women's employment rates are now rather similar to those for men. However, this was not the case in the past, as Figures 7 and 8 show. These

[5] In the majority of cases where there is not a group with exactly the same mortality probability in the two years, we use a linear interpolation between two adjacent age groups.
[6] We also present alternative results summing over ages 55 to 69, for comparison with results from other countries presented in this volume.

differences in employment rates between men and women in the past are unlikely to be due differences in health between men and women. Rather it seems more likely that there were other factors that led to fewer women than men working in the past, some of which have changed over recent decades leading to a rapid increase in women's employment rates. Therefore, it is interesting to compare currently older women's employment rates not only to the employment rate of similarly health women in the past but also to that is similarly healthy men in the last. Comparing to women with similar mortality probabilities in the past, we find that there is relatively little spare work capacity among current older women (a little over 2 years when comparing 2013 to 1977). However, when we compare to similarly healthy men in the past, the estimates suggest considerable spare work capacity – for example as much as 11.8 years when older women in 2013 are compared to men in 1977. In both cases, however, the results suggest that spare capacity among women has not been changing over the last 15 years – suggesting that increases in female employment rates over this period have been sufficient to keep pace with declines in mortality.

4. Using a comprehensive set of health indicators (the Cutler-Meara-Richards-Shubik approach)

A drawback of the approach adopted in Section 3 is that mortality is a crude indicator of the health conditions that are likely to be important for determining someone's ability to work. An alternative approach, therefore, is to make use of more detailed information on the health of older workers and non-workers. This is possible in more recent years using data from ELSA. Since 2002–03, ELSA has (biennially) collected data on the health, economic behaviour and a range of other circumstances of a representative sample of the household population aged 50 and over in England. This allows us to look more closely at how a wide variety of health conditions and limitations have been related to employment of older people over the last decade and produce an alternative estimate of spare work capacity.

A second advantage of using these data to explore this question, rather than the approach used in section 3, is that we can examine whether there is heterogeneity within age/sex groups – in particular, across education groups. This was not possible using the approach adopted in section 3 because detailed data are not available in the UK on how mortality varies across education groups over time.

Following an approach originally suggested by Cutler, Meara and Richards-Shubik (2012), in this section we estimate the potential work capacity of those aged 55–74 on the basis of the relationship between health and employment observed among those aged 50–54. Under the (potentially strong) assumptions that: (i) health is the only factor that prevents anyone aged 50–54 from working, and (ii) a given health condition constrains older people's capacity to work in the same way as it does younger people's capacity, we can use the relationship between health and employment among those aged 50–54 to estimate capacity to work among those aged 55–74, based on their observed health.

To do this we estimate regressions of the form shown in Equation 3 for the sub-sample of ELSA respondents who were aged between 50 and 54 in any of the first six waves of ELSA (from 2002–03 to 2012–13). We then use the coefficients from this regression, combined with the observed health of the older group, to predict work capacity for those aged 55–74.

$$W_i = \gamma H_i + X_i'\beta + \varepsilon_i \qquad (3)$$

W_i is an indicator equal to 1 if someone is engaged in paid employment or self-employment and 0 otherwise, H_i is a set of indicators of an individual's health, and X_i are other characteristics (including a time dummy). We estimate regressions separately for men and women as linear probability models. To estimate these regressions we pool data from the first six waves of ELSA; this provides approximately 3,000 male and 4,300 female person-year observations for use in the regression. As each individual may be included in the data more than once, we cluster the standard errors at the individual level.

The indicator of health that we use is based on the first principal component of 23 health indicators from the ELSA data. This is a summary measure of health that was first suggested by Poterba, Venti and Wise (2011, 2013; henceforth PVW); the 23 indicators we include are those that most closely approximate the measures used by PVW. We have also estimated Equation 3 including each health indicator separately, rather than using the index. We find that estimated work capacity is virtually identical following both approaches and so do not report results from the latter approach here.[7]

Deciding which variables to include in X_i is complicated and ultimately a matter of judgment on the basis of untestable assumptions. Since the ultimate objective is to use the coefficients from these regressions to predict work capacity out of sample, we would ideally like to ensure that all relevant measures of health (and how health constrains employment) are included but that we are not including any other factors that determine employment but are not health related. For example, we definitely would not want to include in X_i whether or not an individual is eligible for pension income, since this is not health-related but is likely to be strongly predictive of work. However, while there are some indicators that clearly do not capture health and some that clearly do, there is also a grey area of characteristics that may reflect additional information on health (i.e. information that is not already controlled for in the PVW index) but may equally well capture other non-health-related factors. On the one hand, omitting such factors risks biasing the coefficient on the health measure. On the other hand, including such measures if they are not in fact related to health runs the risk that the predictions of work capacity will pick up not only health capacity but also other factors.

Bearing in mind this trade-off, we include in our regressions indicators for being non-white, and for having a partner. Both of these have been shown to be related to differences in health outcomes, even after controlling for quite detailed measures of observed health status. We also control for education level. This is because the way that health constrains work capacity may depend on the type of work that someone has the skills to do, which we proxy by their education level.[8]

Tables 1a and 1b present summary statistics on the health and employment of men and women (respectively) aged 50–74 in the first six waves of ELSA. These show that – in many dimensions – health deteriorates with age. The second row of the table summarises the PVW health index. This measure of health is expressed as a percentile ranking of individuals – with 100 being the healthiest

[7] Results are available from the authors on request.

[8] We also estimated separate regressions for each education group to allow for the fact that the effect of the health measure on employment may be different for each education group. However, since the results were quantitatively and qualitatively similar to those obtained from simply including a dummy indicator for education level, we only present the latter results here. Results of the fully interacted model are available from the authors on request.

person and 0 being the least healthy person – where individuals are ranked among all those aged 50–74. Table 1a suggests that, among men, those aged 50–54 are on average at the 66th percentile of the health distribution, while men aged 70–74 are on average at the 49th percentile; this suggests that health does decline quite significantly on average between ages 50–54 and 70–74. Women's health is slightly worse on average than men's at all ages: women aged 50–54 are on average at the 61st percentile, while women aged 70–74 are on average at the 41st percentile.

The rest of Tables 1a and 1b show how specific measures of health differ across the age groups. For example, 23 per cent of men and 22 per cent of women aged 50–54 report that they are in excellent health, while this is true of only 12 per cent of men and women aged 70–74. The fraction of men (women) with at least one physical limitation rises from 32 per cent (45 per cent) among those aged 50–54 to 58 per cent (72 per cent) among those aged 70–74.

The fraction of men who have never smoked is highest among the youngest age group (38 per cent of men aged 50–54, compared to 26 per cent of men aged 70–74), while for women the peak in smoking prevalence seems to have happened somewhat later – with 47 per cent of those aged 50–54 being non-smokers compared to 42 per cent of those aged 60–64 and 45 per cent of those aged 70–74.

Overall Tables 1a and 1b suggest that health does deteriorate on average with age. This suggests that there will be less capacity to work among older people than there is among younger people. Our simulation results – presented below – quantify the scale of this.

The results from our regressions are shown in Table 2. These show that there is a large and statistically significant association between health (as measured by the PVW index) and employment for both men and women. The coefficients shown in Table 2 suggest that a 10 percentage point increase in the index (for example, being at the 60th percentile of health, rather than at the median) would be associated with a 6 percentage point increase in employment rates among men and a 5 percentage point increase among women. The results also show that, conditional on other measures of health, more highly educated women are more likely to be in work, as are married men and white women.

Figures 16 and 17 show the results of our simulation exercise for men and women aged 55–74. These figures show the share employed, the predicted share employed (shown by the full height of the stacked bars) and the difference between these, which we term the estimated additional work capacity. Based on their health status, we estimate that 80 per cent of men aged 60–64 have the capacity to work, while 56 per cent of them are actually working – suggesting that there is additional work capacity of 25 per cent of men in this age group. This compares to spare work capacity of 37 per cent estimated for 60–64 year old men in 2013 using the Milligan-Wise approach and comparing to behaviour in 1977 (as shown in Figure 13), or 10 per cent when comparing to 1995 (not shown).

Predicted work capacity declines somewhat with age for both men and women. Predicted work capacity declines from 82 per cent among 55–59 year old men to 76 per cent among 70–74 year old men – a drop of 6 percentage points. Among women the decline is from 75 per cent to 69 per cent – also a drop of 6 percentage points. However, actual employment rates decline much more sharply across these age groups. For men, employment rates drop from 76 per cent at ages 55–59 to 11 per cent at ages 70–74 – a decline of 66 percentage points. For women, employment rates drop by 62 percentage points (from 67 per cent to 5 per cent). Consequently additional work capacity rises sharply with age – for example, from 6 per cent among men aged 55–59 to 65 per cent among men aged 70–74.

Figure 18 shows an alternative set of results for women – using the coefficients from the male regression, coupled with women's observed health, to predict additional work capacity among women. These results are very similar (particularly for the 65+ age group) to the results shown in Figure 17. This similarity suggests that, since 2002, the relationship between health and employment is similar among men and women in their early fifties. This is in contrast to the results from the Milligan-Wise method, which suggested that the relationship between mortality and employment had been very different for men and women in earlier decades.

Figures 19 and 20 show how additional work capacity differs across education groups. The first thing to note is that – as has been documented elsewhere (for example, Chandler and Tetlow (2014)) – more highly educated people are more likely to be in employment at ages 55–74 than less highly educated people. However, these figures also show that predicted work capacity is lower among less educated groups: this reflects the fact that they are in poorer health on average than more highly educated people.[9] As a result, predicted additional work capacity is actually similar across all education groups for men. For example, among men aged 65–69, additional work capacity is estimated to be 56 per cent for the most educated quartile and 55 per cent for the least educated quartile. Among women, the more highly educated are estimated to have greater additional work capacity than the less highly educated – suggesting that the difference in employment rates seen between the high and low educated are not as large as the better health of the more educated group would imply. For example, among women aged 65–69, additional work capacity is estimated to be 61 per cent for the most educated quartile, compared to 53 per cent for the least educated quartile.

5. Conclusions

This paper has presented two alternative methods for estimating how much current older people could work, given their health. The idea behind both methods is to find a comparison group, whose employment rate is constrained only by their health, and use this group to construct an estimate of 'work capacity' for current older people. The first method we have presented (the Milligan-Wise method) uses data on employment rates of men and women in earlier years to estimate what fraction of those with a particular one-year mortality probability could work. The second method (the Cutler-Meara-Richards-Shubik approach) instead uses data on employment rates of younger people at the same point in time.

Exactly how much additional work capacity there is thought to be among current older people depends on which group we compare them to, and which measure of health we use. However, all the various comparisons presented in this paper suggest that older people do, on average, have capacity to work more than they currently do, given their health. Estimated spare work capacity is particularly large if we compare the behaviour of current older men and women to that of similarly

[9] For example, among men aged 50–54, those in the highest education quartile are on average at the 73rd percentile of the health distribution, while those in the lowest education quartile are on average at the 58th percentile.

healthy older men in the late 1970s. Were we to extend our analysis even further back in time, we would likely conclude that there was even more spare capacity.

Among men, the amount of spare work capacity is found to be similar across those with different skill levels. However, among women, we find that there is significant heterogeneity in spare capacity across the skill distribution. High skilled women have greater spare work capacity than low skilled women.

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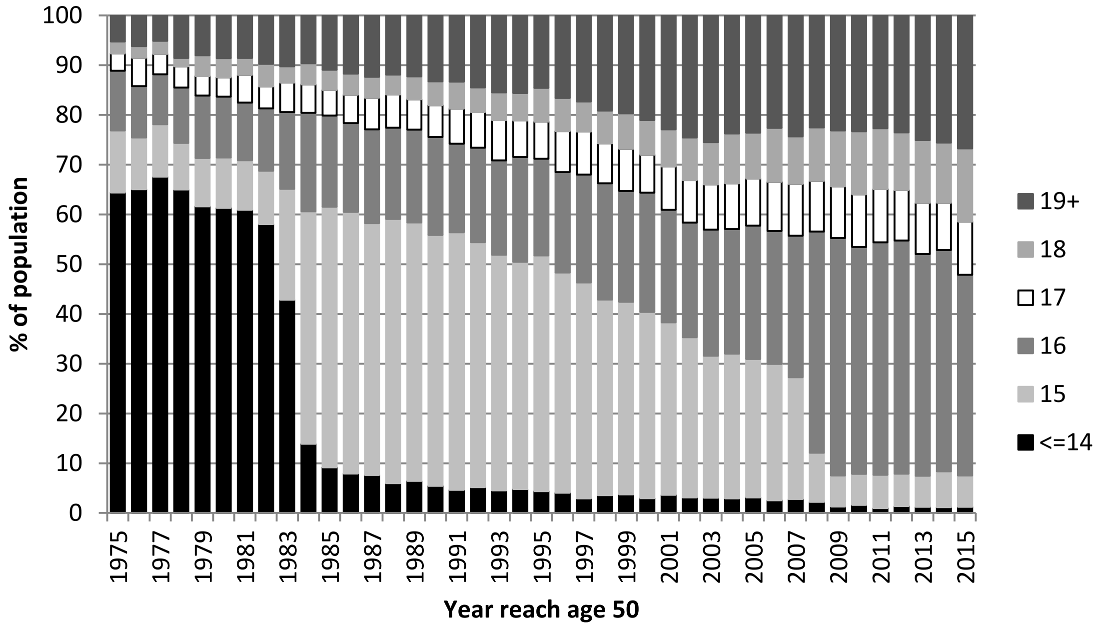
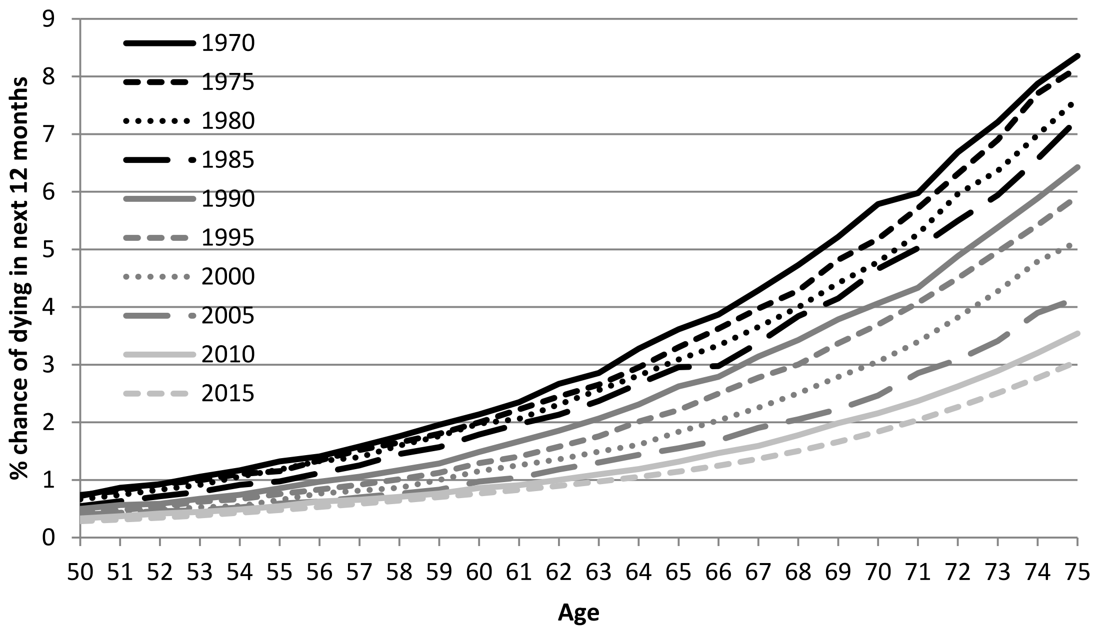
Figures and Tables

Figure 1. Distribution of age of leaving full-time education, by cohort



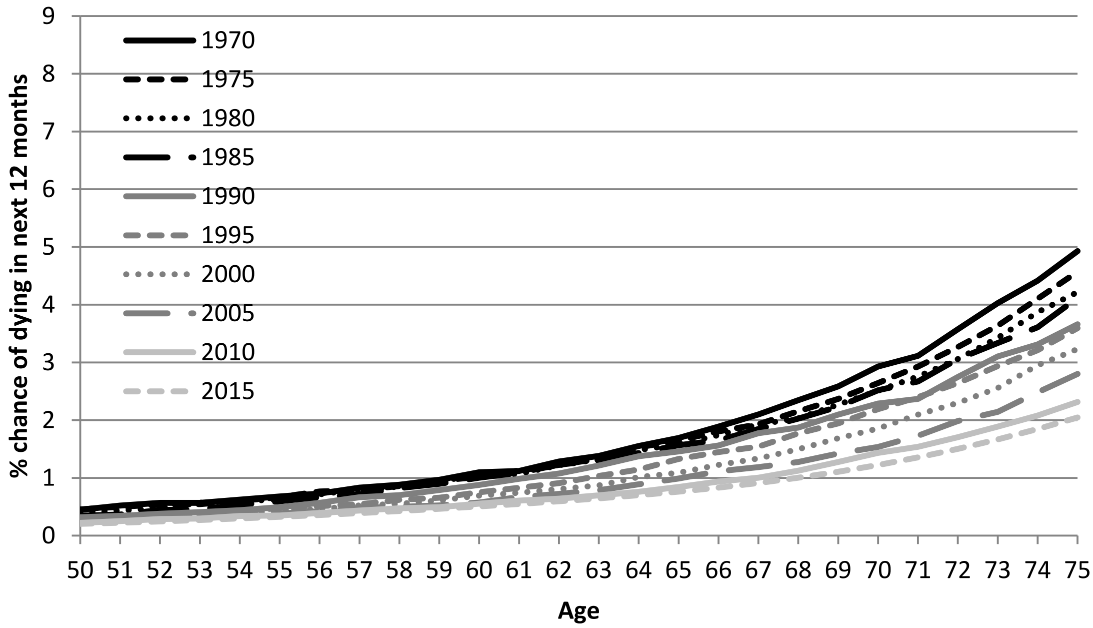
Source: Based on sample of all individuals born between 1925 and 1960 observed in the Health Survey for England (1991–2012).

Figure 2. Probability of dying in the next 12 months, by age and year (men)



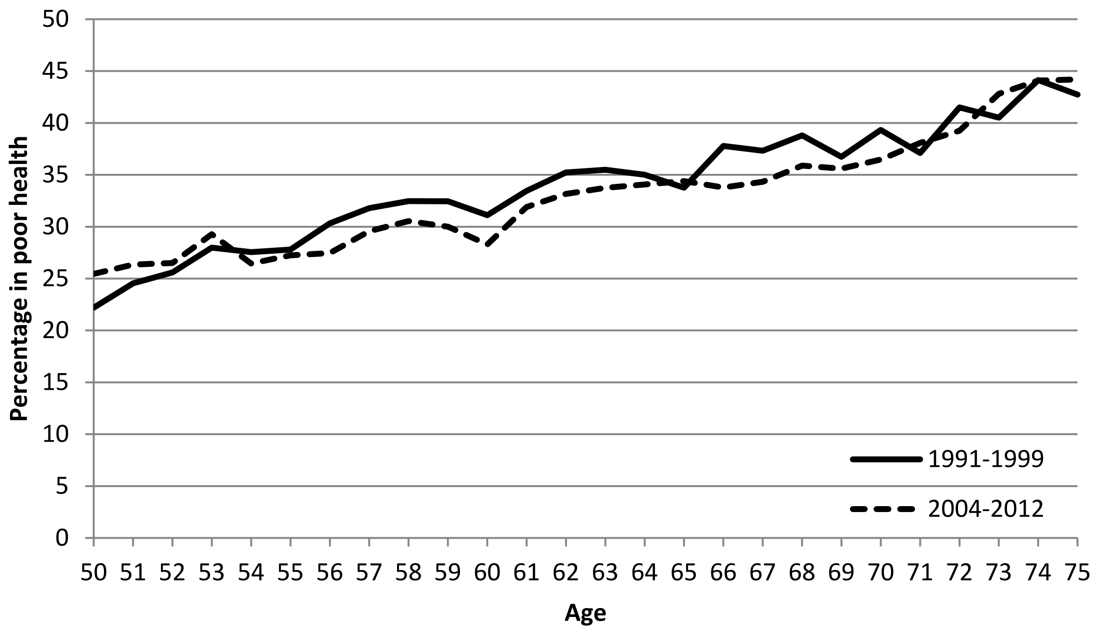
Source: Office for National Statistics.

Figure 3. Probability of dying in the next 12 months, by age and year (women)



Source: Office for National Statistics.

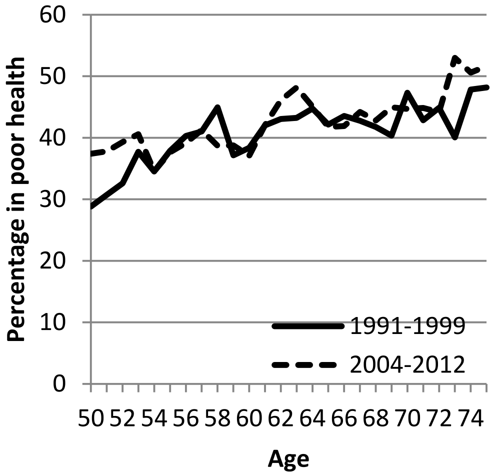
Figure 4. Changes in self-assessed health over time



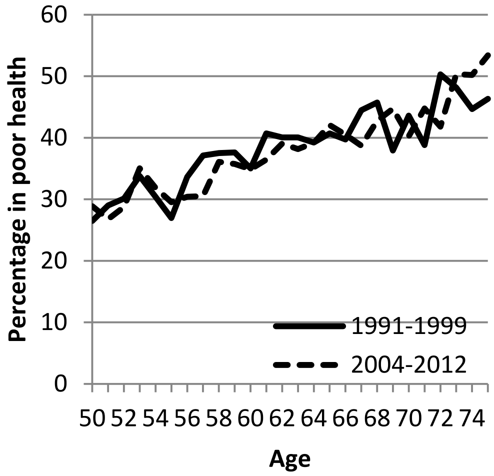
Notes: “Poor” health includes anyone reporting fair, bad or very bad self-assessed general health.
Source: Health Survey for England, 1991–2012.

Figure 5. Self-assessed health, by age, year and education quartile

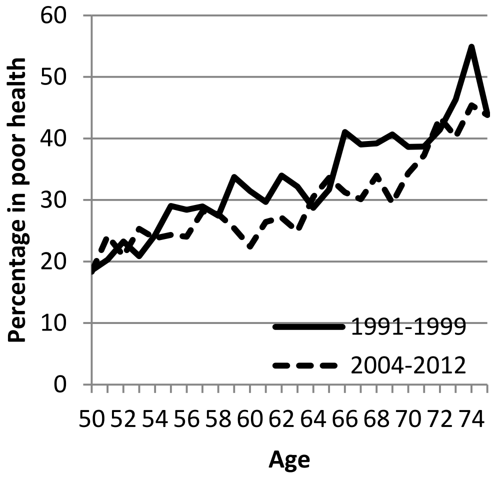
a. Lowest education quartile



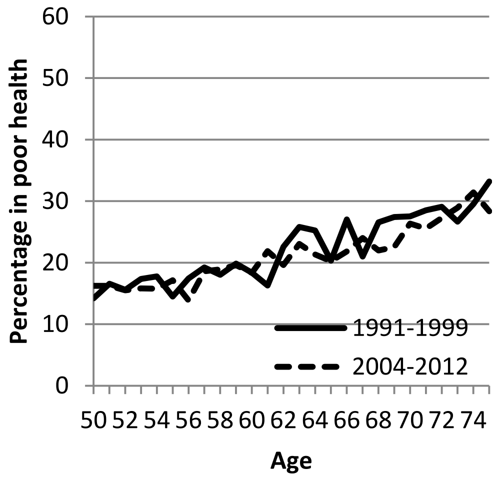
b. Quartile 2



c. Quartile 3

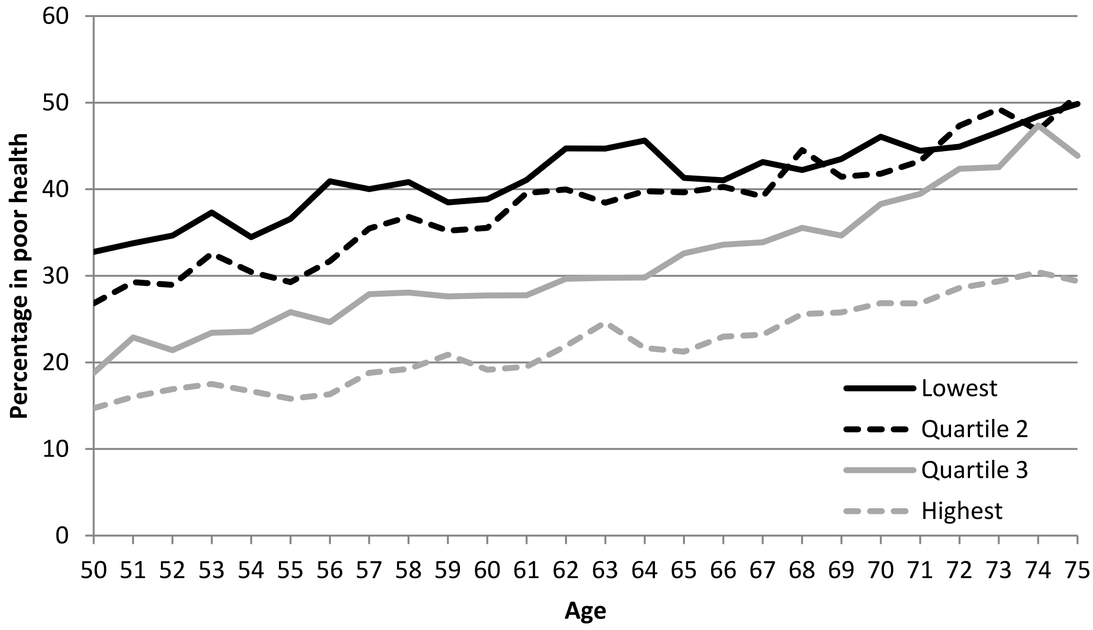


d. Highest education quartile



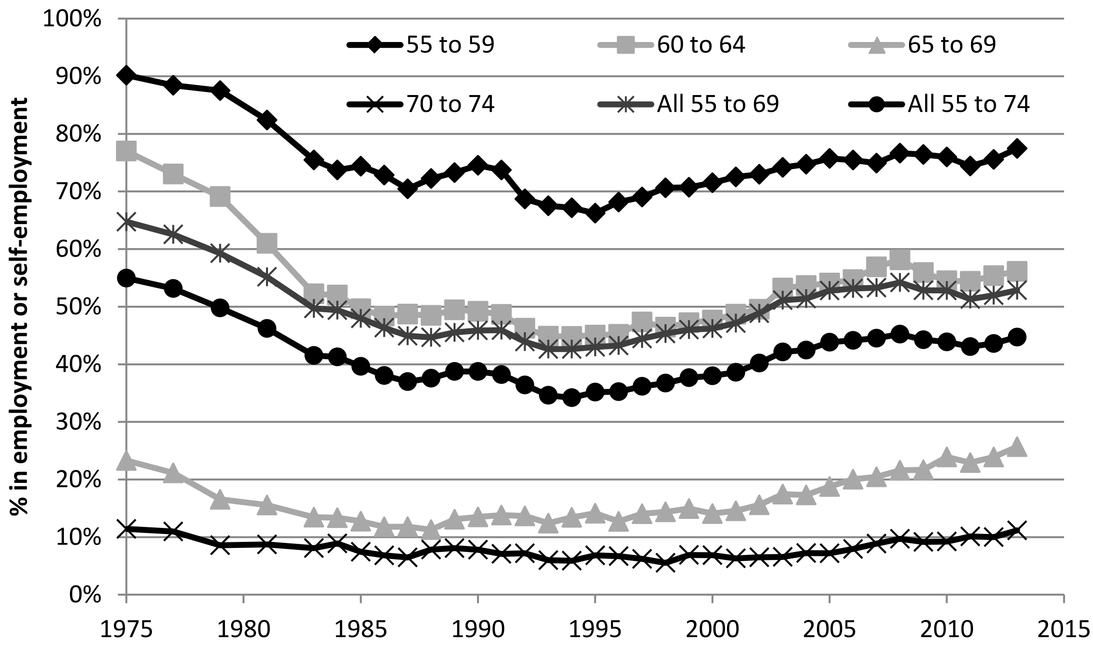
Notes: "Poor" health includes anyone reporting fair, bad or very bad self-assessed general health.
Source: Health Survey for England, 1991–2012.

Figure 6. Self-assessed health, by age and education level



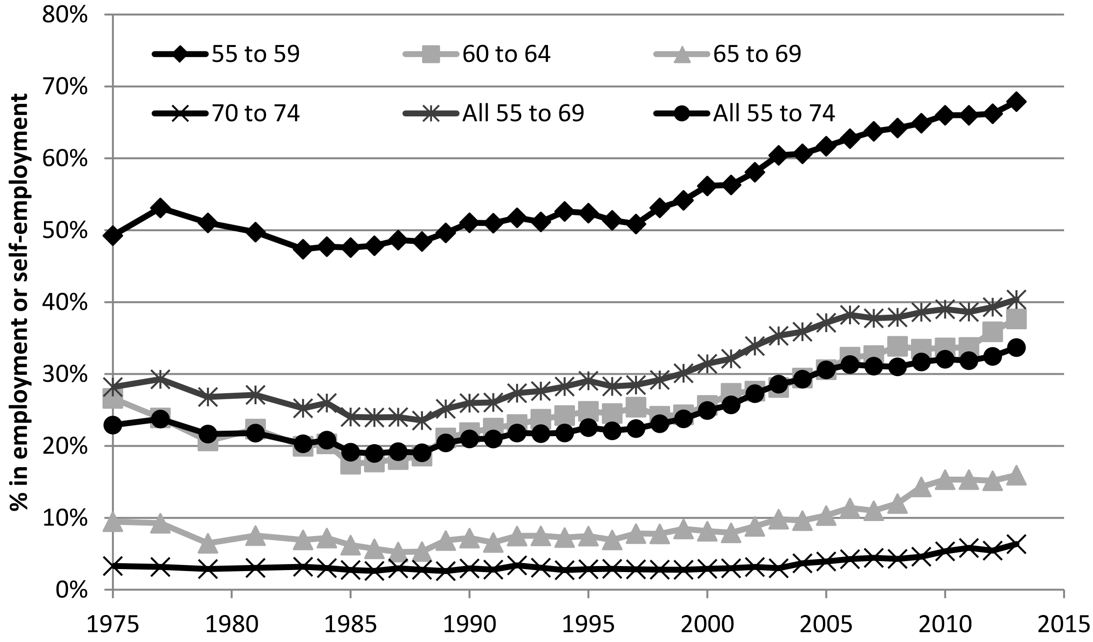
Notes: “Poor” health includes anyone reporting fair, bad or very bad self-assessed general health.
Source: Health Survey for England, 1991–2012.

Figure 7. Men’s employment rates, 1975–2014



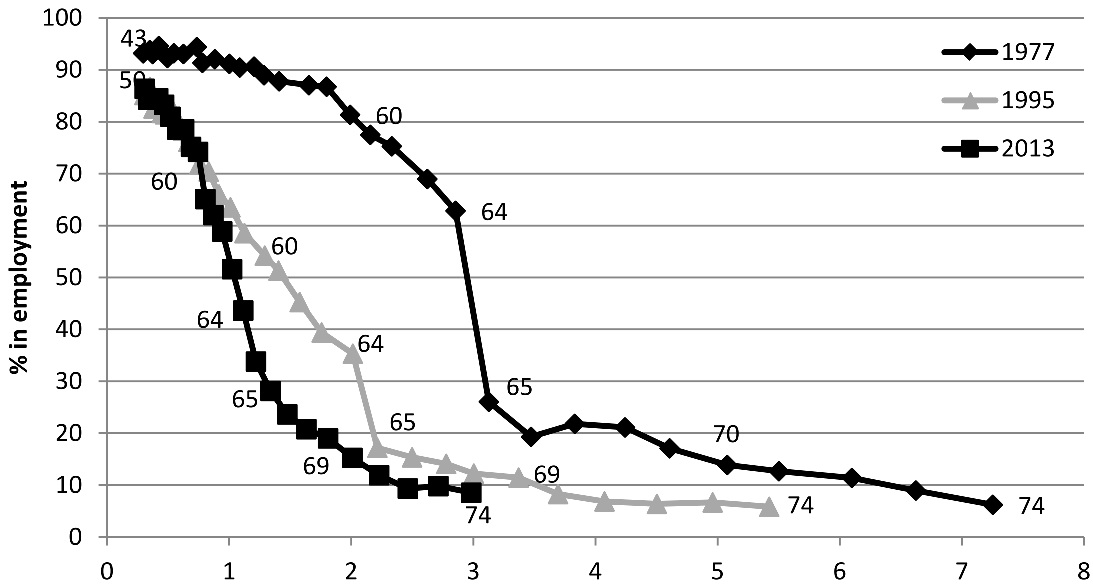
Source: Labour Force Survey.

Figure 8. Women's employment rates, 1975–2014



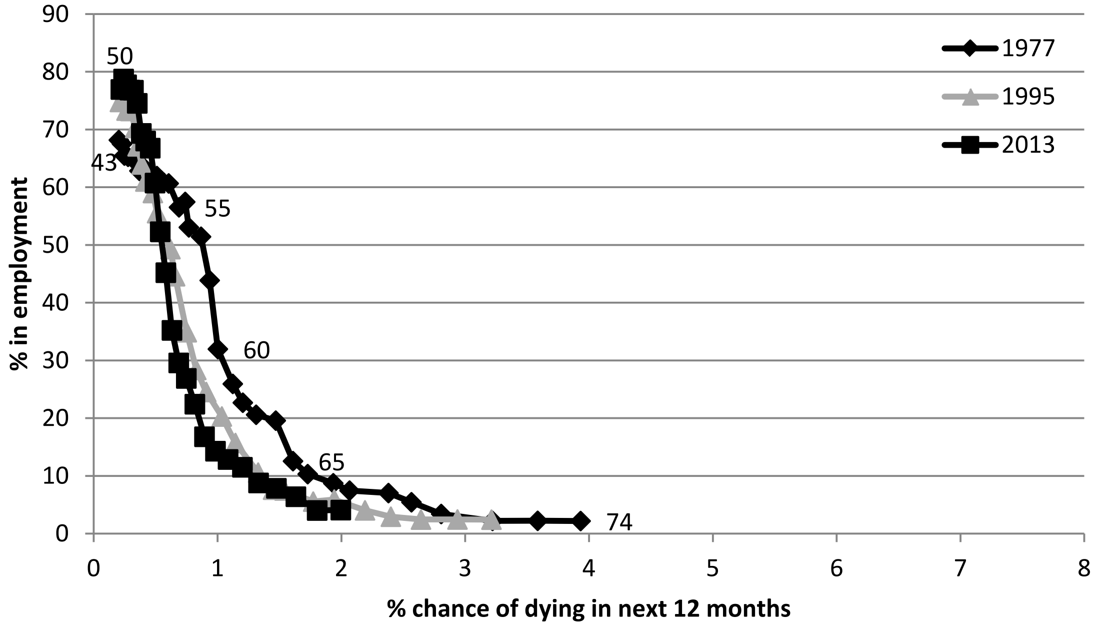
Source: Labour Force Survey.

Figure 9. Male employment vs. mortality, 2013 vs 1995 vs. 1977



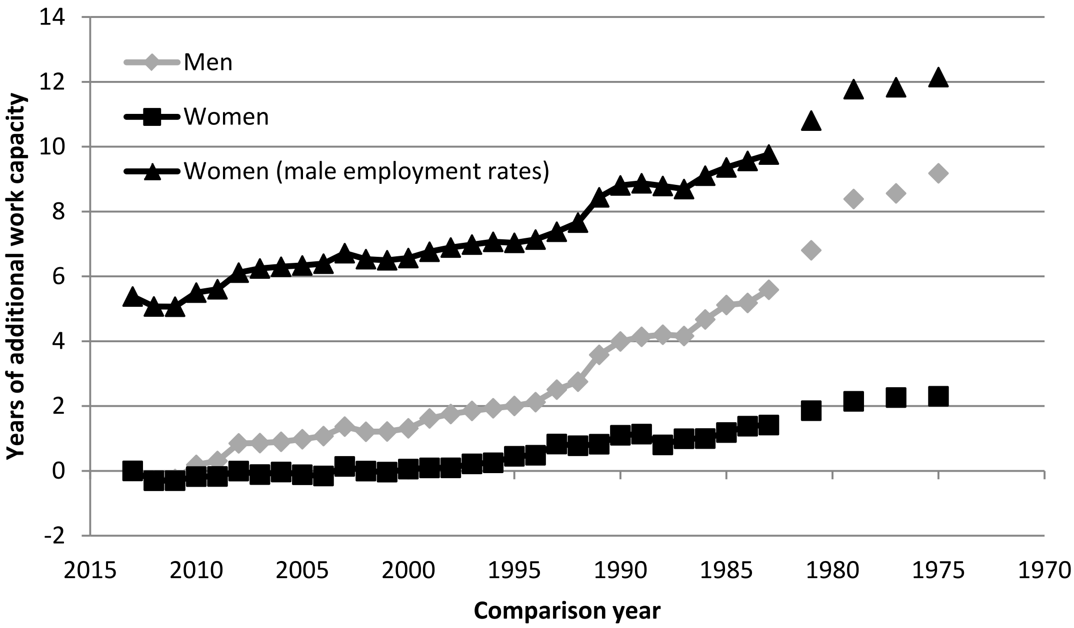
Sources: Labour Force Survey and Office for National Statistics.

Figure 10. Female employment vs. mortality, 2013 vs 1995 vs. 1977



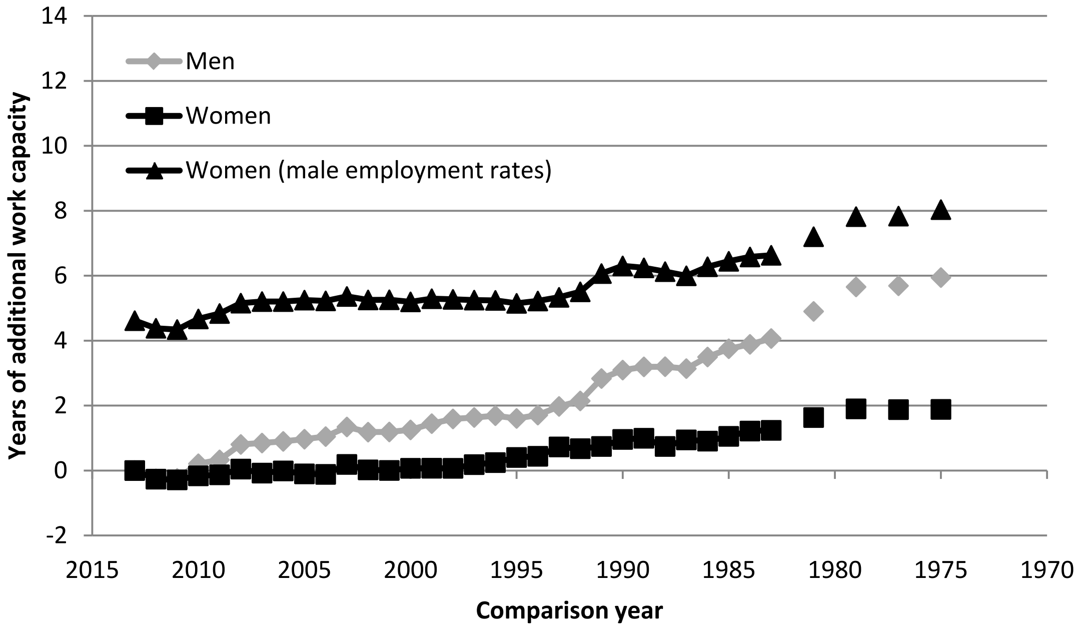
Sources: Labour Force Survey and Office for National Statistics.

Figure 11. Estimated additional employment capacity by year of comparison, by sex, 55 to 74 year olds (Milligan-Wise approach)



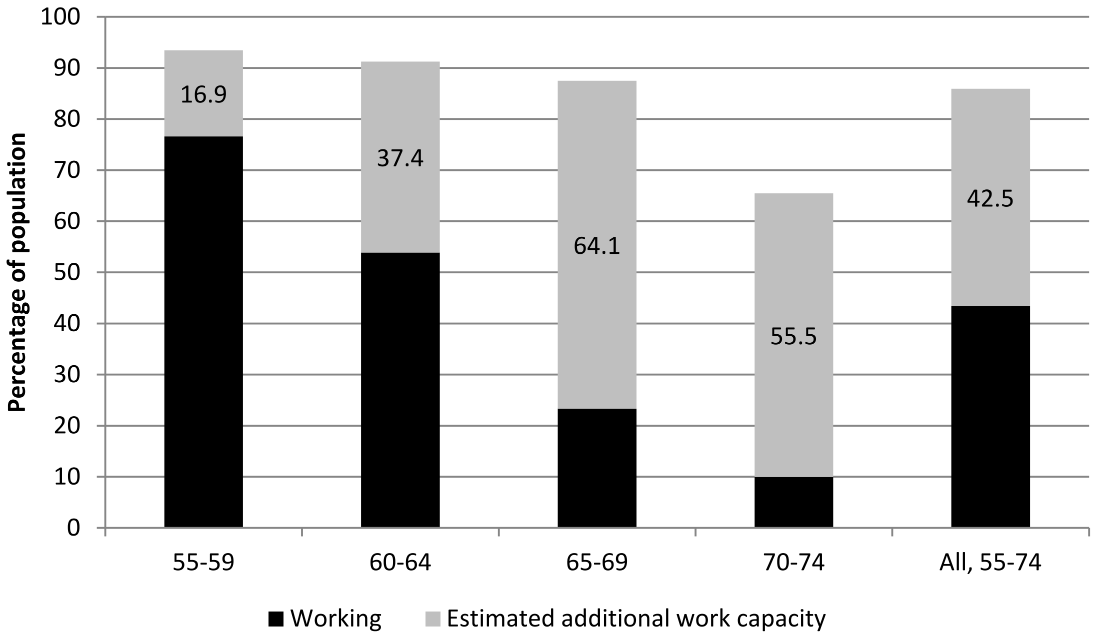
Source: Authors' calculations using the Labour Force Survey and mortality data from the Office for National Statistics.

Figure 12. Estimated additional employment capacity by year of comparison, by sex, 55 to 69 year olds (Milligan-Wise approach)



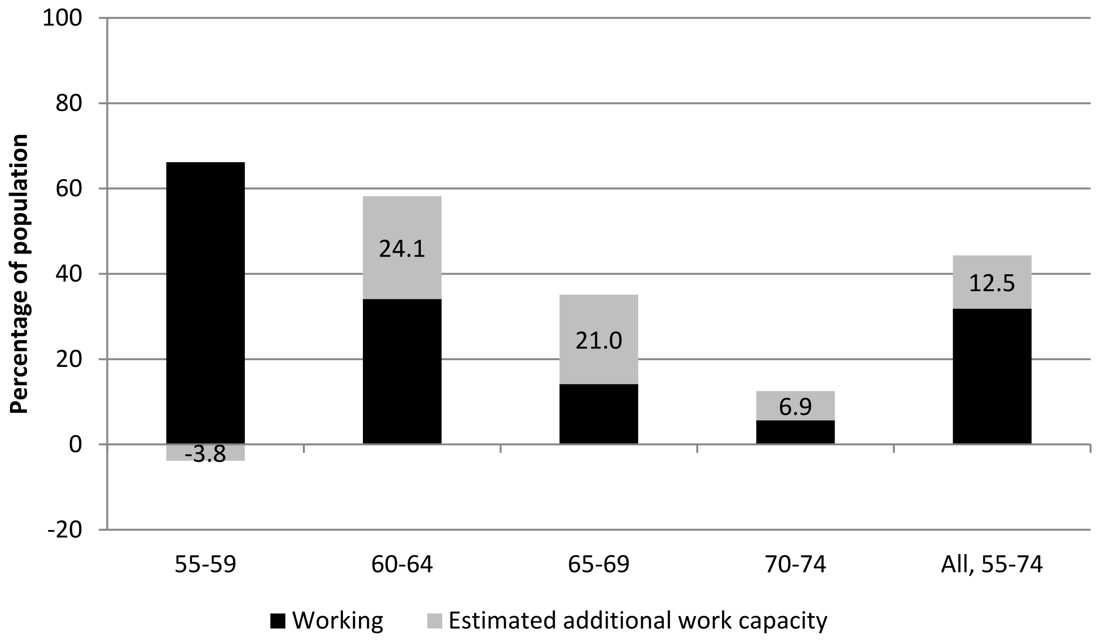
Source: Authors' calculations using the Labour Force Survey and mortality data from the Office for National Statistics.

Figure 13. Share of men working and additional work capacity comparing men in 2013 to men in 1977, by age (Milligan-Wise approach)



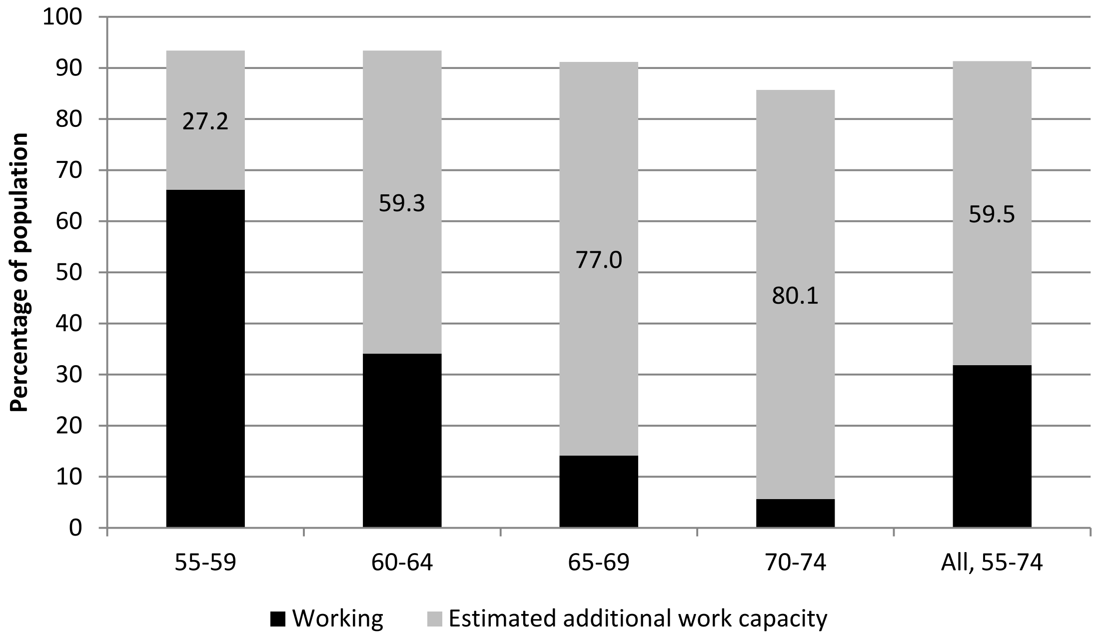
Source: Authors' calculations using the Labour Force Survey and mortality data from the Office for National Statistics.

Figure 14. Share of women working and additional work capacity comparing women in 2013 to women in 1977, by age (Milligan-Wise approach)



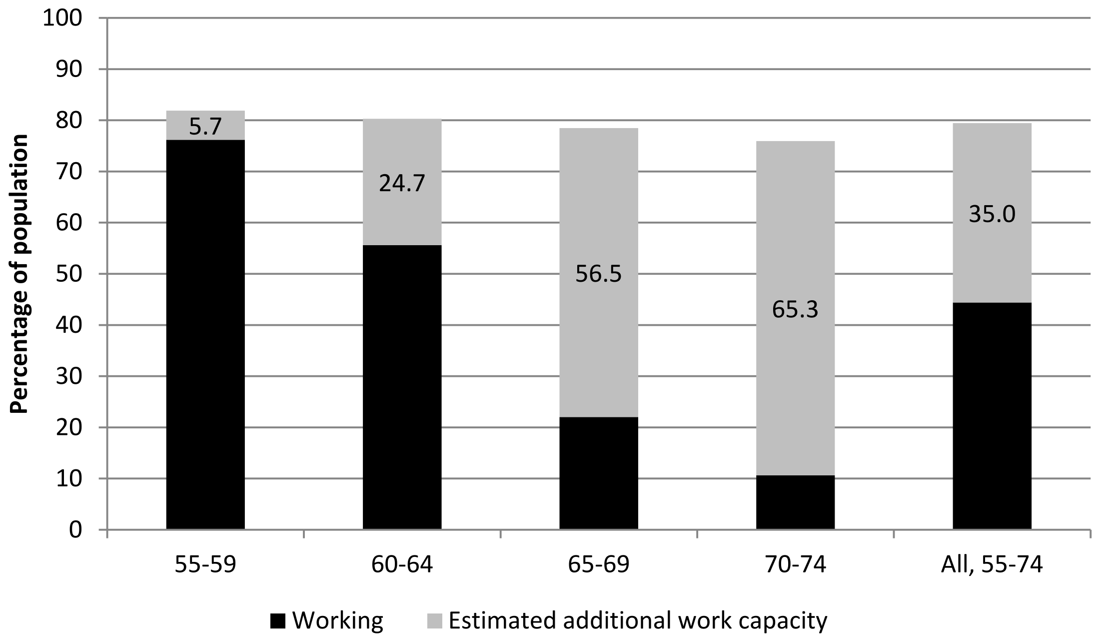
Source: Authors' calculations using the Labour Force Survey and mortality data from the Office for National Statistics.

Figure 15. Share of women working and additional work capacity comparing women in 2013 to men in 1977, by age (Milligan-Wise approach)



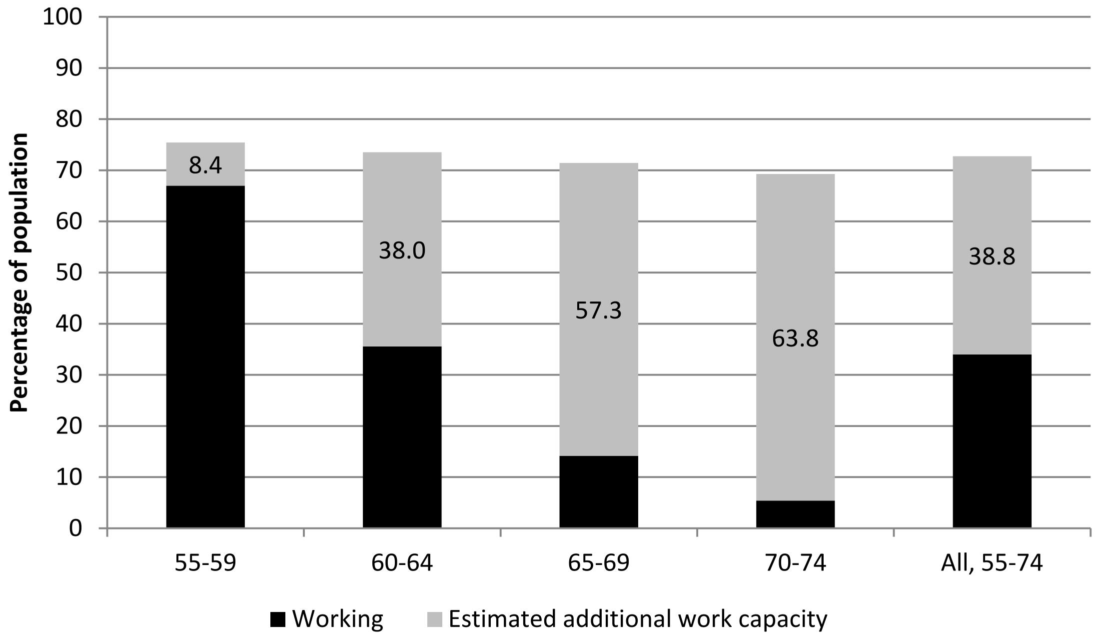
Source: Authors' calculations using the Labour Force Survey and mortality data from the Office for National Statistics.

Figure 16. Share of men working and additional work capacity, by age (Cutler-Meara-Richards-Shubik approach)



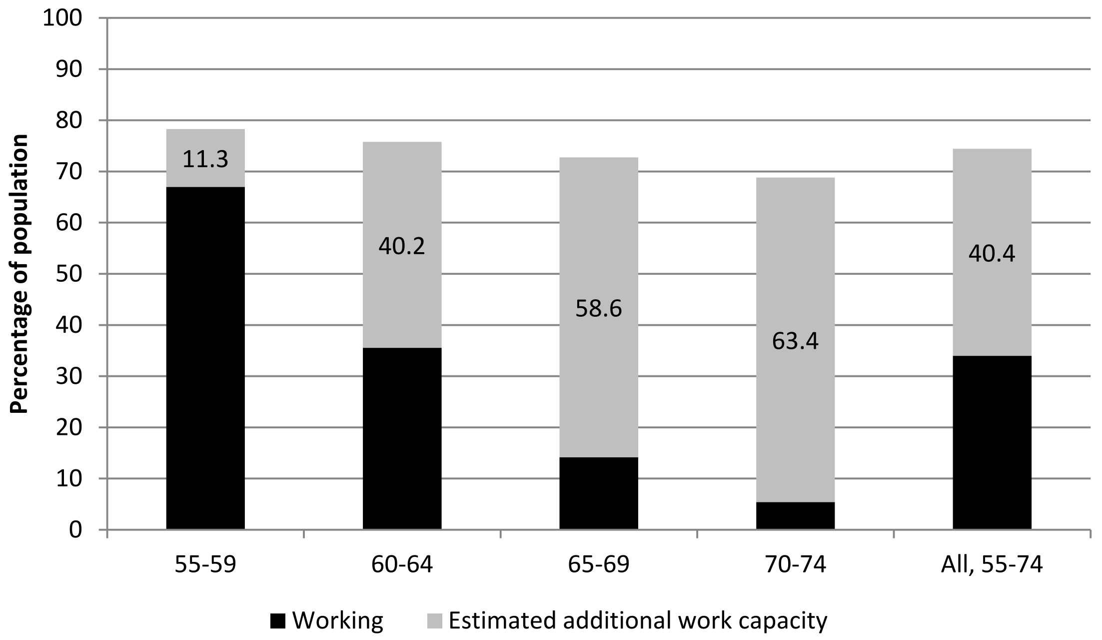
Source: Authors' calculations using the English Longitudinal Study of Ageing (2002–03 to 2012–13).

Figure 17. Share of women working and additional work capacity, by age – using female regression coefficients (Cutler-Meara-Richards-Shubik approach)



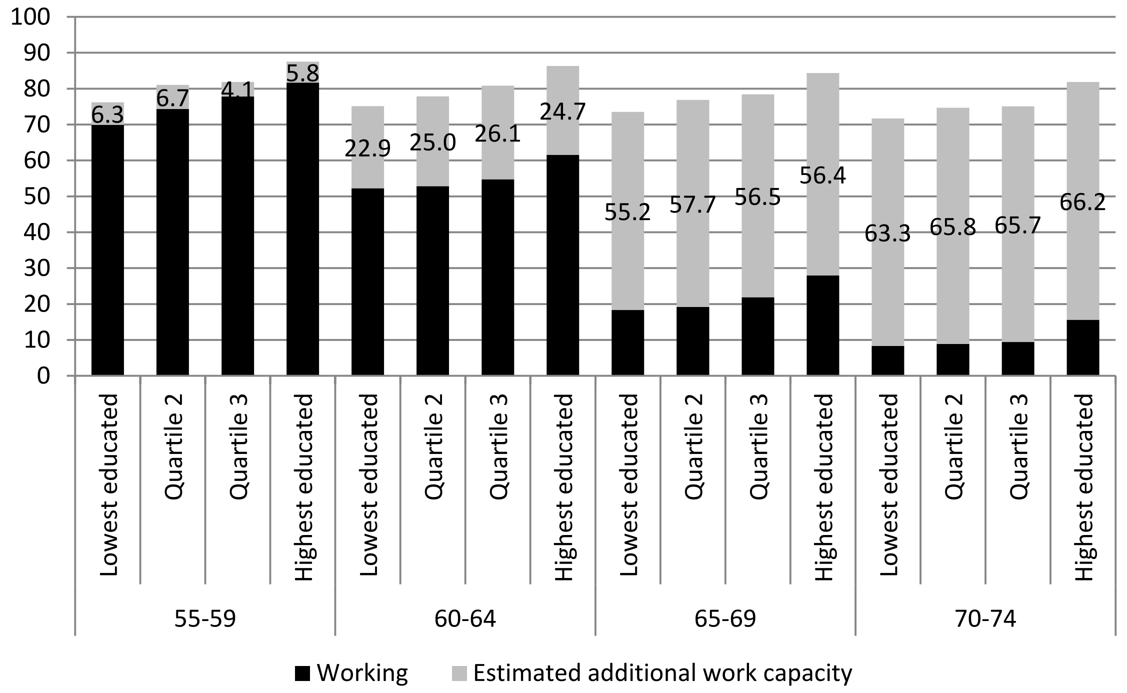
Source: Authors' calculations using the English Longitudinal Study of Ageing (2002–03 to 2012–13).

Figure 18. Share of women working and additional work capacity, by age – using male regression coefficients (Cutler-Meara-Richards-Shubik approach)



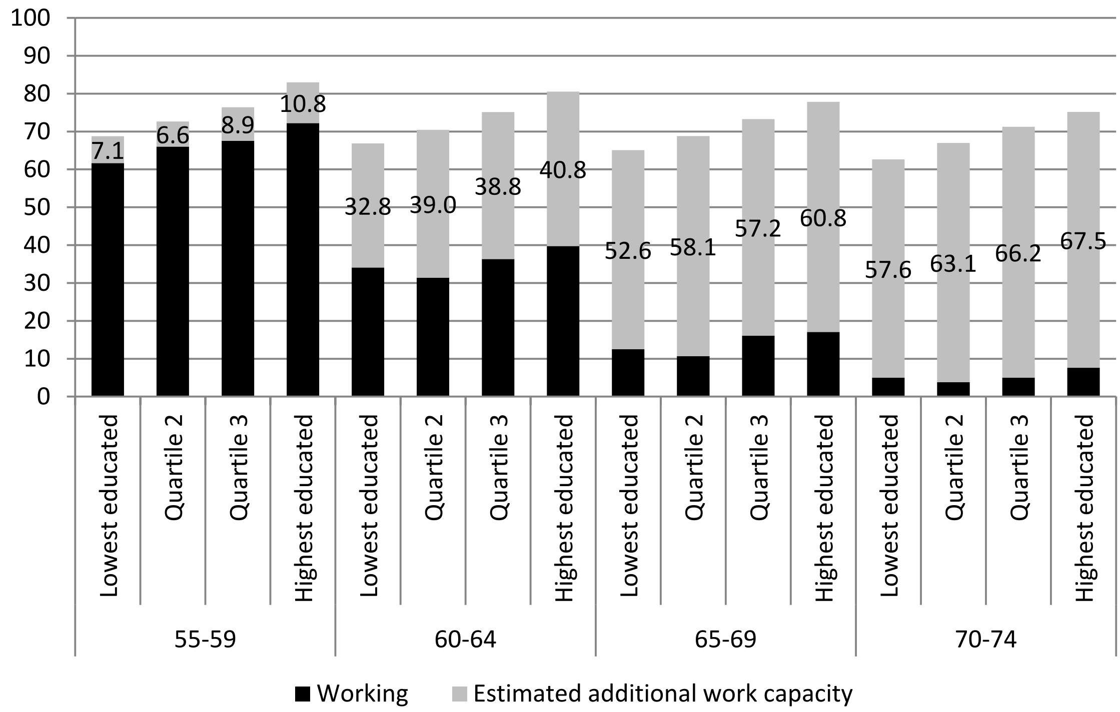
Source: Authors' calculations using the English Longitudinal Study of Ageing (2002–03 to 2012–13).

Figure 19. Share of men working and additional work capacity, by age and education (Cutler-Meara-Richards-Shubik approach)



Source: Authors' calculations using the English Longitudinal Study of Ageing (2002–03 to 2012–13).

Figure 20. Share of women working and additional work capacity, by age and education – using female regression coefficients (Cutler-Meara-Richards-Shubik approach)



Source: Authors' calculations using the English Longitudinal Study of Ageing (2002–03 to 2012–13).

Table 1a. Summary statistics, men

% (unless otherwise stated)	50-54	55-59	60-64	65-69	70-74	All, 50-74
In paid work	84.9	76.2	55.6	22.0	10.7	50.1
PVW index (mean percentile)	65.9	60.1	56.3	53.5	49.2	56.8
Self-reported health						
Excellent	22.8	17.6	16.3	13.6	11.5	16.1
Very good	35.3	34.3	32.7	30.5	30.0	32.6
Good	26.3	27.7	29.4	32.3	31.9	29.6
Fair	10.7	13.9	15.4	17.0	18.6	15.2
Poor	4.9	6.5	6.2	6.6	8.0	6.5
Limitations in activity and function						
1 physical limitation	13.6	14.7	14.9	16.3	18.0	15.5
>1 physical limitation	17.9	24.4	29.0	32.8	40.0	29.0
Any ADL limitation	11.7	14.7	17.4	18.6	24.4	17.4
Any IADL limitation	4.8	5.8	6.3	6.0	7.6	6.1
Depressed (CES-D>3)	10.1	9.8	8.1	7.7	8.4	8.8
Diagnoses						
Heart disease	9.9	14.6	18.0	24.7	30.5	19.6
Stroke	1.1	1.9	3.0	4.4	6.5	3.4
Psychiatric disorder	10.1	11.0	10.6	8.1	6.1	9.3
Lung disease	2.3	4.2	5.7	8.0	9.3	5.9
Cancer	2.4	3.0	5.2	8.4	11.2	6.0
Hypertension	29.0	36.6	41.8	45.9	49.8	40.9
Arthritis	16.0	23.0	29.3	32.2	36.1	27.6
Diabetes	6.5	8.5	10.2	12.6	15.7	10.7
Back pain	14.6	16.5	17.1	17.3	17.6	16.7
Risk factors						
BMI missing	4.6	3.6	3.0	3.2	2.8	3.4
Underweight	1.3	1.2	1.2	1.6	2.1	1.5
Normal weight	22.4	21.0	20.3	19.8	18.9	20.4
Overweight	43.9	45.7	46.7	48.8	51.0	47.2
Obese	27.8	28.4	28.8	26.6	25.1	27.5
Current smoker	22.4	19.2	16.3	14.0	11.8	16.6
Former regular smoker	28.6	36.3	43.7	46.8	51.5	41.7
Former occasional smoker	4.2	4.8	5.1	5.0	4.6	4.8
Former smoker, DK frequency	6.3	5.5	5.8	6.0	5.5	5.8
Non-smoker	38.4	34.1	28.9	28.2	26.3	30.9
Smoking status missing	0.1	0.1	0.1	0.0	0.2	0.1
Education						
Lowest quartile	23.6	23.5	23.5	23.8	24.1	23.7
Quartile 2	25.3	24.1	23.7	23.6	24.0	24.0
Quartile 3	25.6	25.3	25.6	26.1	25.7	25.6
Highest quartile	25.5	27.2	27.2	26.6	26.3	26.7
Ethnicity - white	95.6	95.8	97.1	97.0	97.3	96.6
Married	73.0	74.6	78.7	76.7	75.6	75.9
Sample size	2,948	5,118	4,889	4,235	3,632	20,822

Source: Authors' calculations using the English Longitudinal Study of Ageing (2002–03 to 2012–13).

Table 1b. Summary statistics, women

% (unless otherwise stated)	50-54	55-59	60-64	65-69	70-74	All, 50-74
In paid work	77.9	67.0	35.5	14.2	5.4	41.6
PVW index (mean percentile)	60.8	54.8	50.4	46.1	41.4	61.0
Self-reported health						
Excellent	21.5	17.2	16.5	14.0	11.5	16.2
Very good	34.6	34.6	33.6	31.5	29.6	33.0
Good	27.4	28.6	29.8	31.7	32.4	29.9
Fair	12.3	14.1	15.5	17.2	19.2	15.5
Poor	4.2	5.6	4.5	5.6	7.3	5.4
Limitations in activity and function						
1 physical limitation	15.3	15.7	17.7	17.0	15.2	16.3
>1 physical limitation	29.6	35.9	40.3	48.3	57.0	41.6
Any ADL limitation	12.4	16.6	17.1	21.4	27.6	18.8
Any IADL limitation	6.6	8.0	8.3	9.2	12.0	8.7
Depressed (CES-D>3)	14.5	14.1	11.7	12.6	13.6	13.3
Diagnoses						
Heart disease	8.8	11.3	14.7	18.4	23.7	15.1
Stroke	0.9	1.2	2.2	3.9	5.4	2.6
Psychiatric disorder	13.6	16.8	16.2	13.4	9.6	14.3
Lung disease	2.6	4.3	5.4	7.3	7.8	5.4
Cancer	4.2	7.2	8.9	11.1	10.2	8.3
Hypertension	24.3	30.6	38.9	43.8	51.6	37.4
Arthritis	22.8	33.0	41.4	48.2	52.2	39.2
Diabetes	3.8	4.9	7.1	8.3	10.3	6.7
Back pain	18.1	20.9	22.3	23.9	26.8	22.3
Risk factors						
BMI missing	5.5	3.1	2.1	1.9	2.6	3.0
Underweight	3.2	3.1	2.5	2.8	3.4	3.0
Normal weight	32.4	29.1	27.6	25.5	23.9	27.8
Overweight	30.8	33.3	35.4	37.8	37.5	34.9
Obese	28.0	31.3	32.3	32.0	32.5	31.3
Current smoker	22.1	19.9	16.3	12.6	11.7	16.7
Former regular smoker	21.1	28.2	31.9	32.9	31.3	29.2
Former occasional smoker	5.2	5.6	6.3	6.8	7.8	6.3
Former smoker, DK frequency	5.1	3.7	3.7	3.1	3.6	3.8
Non-smoker	46.5	42.6	41.7	44.4	45.4	43.9
Smoking status missing	0.1	0.0	0.1	0.2	0.2	0.1
Education						
Lowest quartile	24.7	24.3	23.7	23.8	23.8	24.0
Quartile 2	25.2	24.2	23.6	24.3	24.1	24.2
Quartile 3	25.6	25.6	25.7	25.3	25.0	25.5
Highest quartile	24.6	26.0	27.1	26.6	27.1	26.3
Ethnicity - white	94.9	96.5	97.5	97.8	97.8	96.9
Married	73.2	70.2	69.1	64.6	54.3	66.7
Sample size	4,316	6,205	5,596	4,751	4,182	25,050

Source: Authors' calculations using the English Longitudinal Study of Ageing (2002–03 to 2012–13).

Table 2. Employment regressions

	Men, 50-54	Women, 50-54
PVW index	0.006***	0.005***
	(0.000)	(0.000)
Education level (rel. to lowest quartile):		
Second quartile	0.016	0.028
	(0.021)	(0.022)
Third quartile	–0.015	0.046**
	(0.021)	(0.021)
Most educated	0.014	0.074***
	(0.020)	(0.021)
Married	0.131***	0.002
	(0.018)	(0.016)
Non-white	–0.043	–0.162***
	(0.037)	(0.041)
Constant	0.381***	0.458***
	(0.031)	(0.025)
Sample size	2,948	4,316

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Notes: Estimated using OLS. Standard errors are shown in parentheses and are clustered at the individual level. Using data from waves 1-6 of ELSA.