Health Capacity to Work at Older Ages: Evidence from Japan

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Abstract:
This paper explores the extent to which older Japanese can potentially expand the labor supply, based on two analytic approaches: the Milligan-Wise and Cutler et al. methods. First, we examine how much older individuals could work if they worked as much as those with the same mortality rate in the past (the Milligan-Wise method). Second, we estimate how much older individuals could work if they worked as much as younger ones in similar health (the Cutler et al. method). Results from both of these methods underscore a large work capacity in old age in Japan. We further investigate differences in health capacity across education groups and find that highly educated individuals tend to have more capacity to work after they are 65 years of age.

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The combination of a shrinking labor force and large fiscal deficits is an urgent and common challenge among developed countries. The main driving force for both of these serious concerns is the rapid speed of population aging: it dampens labor force participation with continuing lower fertility and expands fiscal deficits under a pay-as-you-go public pension program. A natural and simultaneous solution for these two policy challenges is to encourage older adults to continue to work for as long as possible in terms of age. Thus, the main visible target of recent pension reforms has been to raise pension eligibility ages, although pension reforms are often accompanied by revisions in a variety of other aspects such as coverage, adequacy, and sustainability, as well as work incentives (OECD, 2013). Indeed, many developed countries have implemented or are planning to execute public pension reforms to extend the normal retirement (i.e., pensionable) age.

Japan is also confronted with a declining labor force and enormous fiscal deficits, both of which are the most pronounced of the OECD countries. Although the labor force participation rate of those aged 65 and over in Japan is higher than in most other developed countries, there have been many policy debates on raising the normal pensionable age. In recent years, Japan has begun extending the eligible age for pensions. For male pensioners, since 2001, the eligible age for the flat-rate component increased from 60 by one year for every three years to reach 65 years in 2013. Furthermore, the eligible age for the wage-proportional component has been scheduled to rise from 2013 by one year for every three years to reach 65 years in 2025. For female pensioners, while maintaining a five-year lag relative to that for men, the eligible age for the flat-rate benefit was raised in 2006, and that for the wage-proportional benefit will be raised in 2018 in the same manner (Oshio, Oishi, and Shimizutani, 2011).

However, there is a possibility that a simple extension of the eligible pensionable age may not be successful, because not all older adults are necessarily able to work even if they are willing to. In particular, one major possible constraint on working is health, either physical or mental, which may also be associated with declining cognitive function. If this is the case, a simple extension of eligible pension age, which considers fiscal consolidation and ignores heterogeneity among older adults, may result in increasing inequality between healthy and unhealthy individuals and impair the overall living standard of older adults.

Keeping heterogeneity in health among older adults in mind, this paper examines the work capacity of older Japanese—that is, the extent to which they can potentially extend their work lives—based on two analytic methods. Specifically, we first employ the Milligan-Wise method, which examines how much people with a given mortality rate today could work if they were to work as much as those with the same mortality rate worked in the past (Milligan and Wise, 2012). For this analysis, we use the aggregated data from Population Census and Life Tables from 1975 to 2010, and focus on men, because the diversity of women's occupational statuses makes it difficult to interpret their association with health.

Second, we apply the Cutler et al. method, which examines how much people with a given level of health could work if they were to work as much as their younger counterparts in similar health (Cutler et al., 2012). For this analysis, we use microdata from the Japanese Study on Aging and Retirement (JSTAR) to estimate the relationship between health and employment for people aged 51 to 54, and use this association, along with the actual characteristics of older people aged 55 to 74, to simulate the latter's capacity to work based on health. Further, we examine whether health capacity to work varies by education group.

Results from both of these methods underscore a large work capacity among older people in Japan. The Milligan-Wise method shows that the amount of projected additional work capacity would be 3.7 years if we use the employment-mortality relationship that existed in 1975 as a basis for comparison. This amount would be 2.2 years if we use 1995 as the base year instead. The results obtained by the Cutler et al. method suggest that roughly an additional one in five men and women aged 60 to 64 and one in three men and women aged 65 to 69 could be employed, relative to the share working today, based on their own health profile and the estimated relationship between health and employment for younger workers. Finally, our analysis by education group finds somewhat higher work capacity for more educated individuals than less educated ones when they are at age 65 and above.

The remainder of this paper is organized in the following manner. Section I provides a brief overview of trends in labor force participation and health in Japan. Sections II and III estimate health capacity to work, based on the Milligan-Wise and Cutler et al. methods, respectively. Finally, Section IV concludes.

I. Trends in Labor Force Participation and Health

Figures 1 and 2 depict the trends of labor force participation rates for Japanese men and women, respectively, between 1970 and 2014. For men aged 55 to 64, the participation rate has stayed between 80 and 90 percent with minor cyclical fluctuations. In contrast, participation for men aged 65 and above has been on a long-term downtrend; however, it stopped declining in the early 2000s, presumably reflecting a gradual increase in the eligible age for pension benefits since 2001. Oshio, Oishi, and Shimizutani (2011) showed that a series of pension reforms since the mid-1980s has reduced disincentives to work by making pension benefits less generous. During the past 44 years, however, men's participation has still dropped remarkably: from 49 percent in 1970 to 30 percent in 2014.

Labor force participation trends for women show a different evolution. Participation among women aged 55 to 64 has been steadily rising from 44 percent in 1977 to 57 percent in 2014, while for women aged 65 and above, participation has remained almost flat during the same period, stabilizing at 13 to 14 percent in recent years.

Figure 3 depicts the trends in mortality and self-assessed health (SAH) for men aged 50 to 75 over the past decades. The data on mortality and SAH are based on the Life Tables and the Comprehensive Surveys of Living Conditions, respectively, both released by the Ministry of Health, Labour and Welfare (MHLW). The figure first confirms downward shifts in age-mortality curves over time. The mortality rate was 0.8 percent for men aged 55 in 1975-79, whereas that mortality rate is not reached until age 60 in 2010-13. Similarly, men aged 65 in 1975-79 had a mortality rate of 2.2 percent, a rate that applied to men aged 72 in 2010-13.

SAH, which is depicted in the upper part of the figure, also improved between 1986 and 2010. We compare the averages of the fractions reporting fair/poor SAH for 1986-95 and 1998-2010, respectively, because the original SAH data are very noisy due to small sample sizes. The curve for 1998-2010 is generally located below that for 1986-95, with the fraction reporting fair/poor SAH in 1986-95 corresponding to that for an age two or three years younger in 1998-2010.

Taken as a whole, Figure 3 confirms that health in terms of both mortality and SAH at any given age has improved over recent decades, while Figure 1 shows that older men's labor force participation has been stabilizing since the mid-2000s after declining gradually. We address how much individuals today could work based on the employment-mortality relationship of the past in the following section.

II. Estimating Health Capacity to Work Using the Milligan-Wise Method

Using the Milligan-Wise method, we estimate an individuals' ability to work at older ages based on the relationship between mortality and employment that existed at an earlier point in time along with current mortality data in Japan. The mortality and employment data used for this analysis come from the Life Tables released by the MHLW and Population Censuses released by the Statistics Bureau. The Population Census is conducted every five years, and we use the data for 1975, 1995, and 2010. We draw an employment-mortality curve, which displays the employment rate at each level of mortality for a given year, and repeat this for other years, making some calculations based on comparisons of the different curves. We focus on men only for this analysis.

Figure 4 compares the employment-mortality curves for men in 2010 and in 1975. In 2010, the one-year mortality rate for 55-year-old men was about 0.5 percent and the employment rate at this age was 86 percent. In 1975, 49-year-old men had a mortality rate of 0.5 percent, while the mortality rate for 55-year-olds was 0.9 percent. In 1975, the labor force participation rate for 49-year-olds was 93 percent. Thus, if men in 2010 had the same employment rate as did men in 1975 with the same mortality rate, the employment rate of 55 year-olds would have been 7 percentage points higher.

We extend this exercise through age 69. Table 1 shows how much more men in 2010 could have worked over the age range 55 to 69 if they had worked as much as men with the same mortality rate worked in 1975. At age 55, an additional 11 percent of men could have worked, which generates an average 0.11 additional work years (one additional year for 11 percent of 55-year-olds). At age 56, an additional 11 percent of men could have worked for an additional 0.11 work years. We repeat this calculation at each subsequent age through age 69 and cumulated the amounts to obtain an estimated total amount of additional employment capacity of 3.7 years, which is equivalent to integrating between the two curves from one vertical line to the next on Figure 4. As the average length of employment between ages 55 and 69 in 2010 is 10.0 years, an additional 3.7 years would represent a 37 percent increase over the baseline year of work.

The results depend on the choice of year of comparison. In Figure 5, we replace 1975 with 1995 as the base year. The mortality-employment rate curve for 1995 still lies above that for 2010, but the gap between the two curves is less than that between the 2010 and 1975 curves in Figure 4. Using 1995 as the comparison year, the estimated additional employment capacity from ages 55 to 69 is 2.2 years, substantially smaller than the estimate of 3.7 years that we obtain when we use 1975 as the comparison year.

We repeat this calculation using 1980, 1985, 1990, 2000, and 2005 as the comparison years. Figure 6 depicts the estimated additional employment capacity for each comparison year. When we look back over a longer period of time, the estimated additional capacity is much larger: from 0.4 years for 2005 to 3.7 years for 1975. This evolution reflects both improving mortality and declining employment, as seen in Figures 1 and 3, respectively.

It is also of great interest to estimate work capacity using other measures of health. In Figures 7 and 8, we replicate the approach used in Figure 4 with SAH and activity limitations in place of mortality. Data on SAH and activity limitations are available from the Comprehensive Surveys of Living Conditions, which has been conducted by the MHLW every three years since

1986. In Figures 7 and 8, the horizontal axis reflects the share of individuals who report themselves to be in fair or poor health (Figure 7) or the share of those who report that they have any activity limitations (Figure 8). Due to limited sample sizes and data discontinuity, we average data over the late 1980s (1986 and 1989) and 2000s (2001, 2004, 2007, and 2010) for SAH; and around the 1990s (1989 and 1992) and over the 2000s (2001, 2004, 2007, and 2010) for activity limitations.

These two figures present the same patterns of health improvement over time as already shown for mortality in Figure 4. For example, in the 2000s, 13.2 percent of 55-year-olds were in fair or poor health. The employment rate would rise to 94% from 88% in the 2000s if they were to work in the late 1980s with the same SAH status. For activity limitations, there are no substantial differences among the younger individuals (aged 62 and below), but the older individuals worked less in the 2000s than around the 1990s even with the same degree of activity limitations.

We can estimate work capacity, basing our calculations on these employment-health curves in the same manner shown in Table 1. We find that the additional capacity between ages 55 and 69 is 2.0 years using SAH (comparing the late 1980s and the 2000s) and1.3 years using activity limitations (comparing around the 1990s and the 2000s). These values are roughly comparable to those obtained using mortality rates as a measure of health, which are illustrated in Figure 6.

In conclusion, estimates based on the Milligan-Wise method suggest a significant amount of additional work capacity. We estimate that the additional capacity from ages 55 to 69 is 3.7 years using the 1975 employment-mortality curve as a point of comparison, or 2.2 years using 1995 as the base year.

III. Estimating Health Capacity to Work Using the Cutler et al. Method

In this section, we apply the second method of estimating health capacity to work, that is, the Cutler et al. method, to the elderly Japanese population. For this method, we first run regression models to estimate the relationship between health and employment, for workers aged 51 to 54, who are sufficiently young that their employment decisions are not affected by the availability of social security benefits. In the second step, we simulate the health capacity to work of individuals aged 55 to 74, by combining the regression coefficients with their actual characteristics.

We use the data from the Japanese Study on Aging and Retirement (JSTAR). JSTAR is a family survey similar to those in other countries such as the Health and Retirement Study (HRS) in the United States, the English Longitudinal Survey on Ageing (ELSA) in the United Kingdom, and the Survey on Health, Aging, and Retirement in Europe (SHARE) in continental Europe.

In 2007, JSTAR conducted the first wave of data collection for the baseline from five municipalities (Takikawa city in Hokkaido Prefecture, Sendai city in Miyagi Prefecture, Adachi ward in Tokyo Metropolis, Shirakawa town in Gifu Prefecture, and Kanazawa city in Ishikawa Prefecture). Then, in 2009, JSTAR conducted the second wave of data collection; this involved re-interviewing respondents in the first wave in the five municipalities and beginning to collect baseline data from two new municipalities (Naha city in Okinawa Prefecture and Tosu city in Saga Prefecture). Thereafter, JSTAR implemented the third wave to collect data from third interviews with respondents in the second round in the initial five municipalities, second interviews with respondents in the first round in two municipalities, and baseline interviews for new samples in three new municipalities (Chofu city in Tokyo Metropolis, Tondabayashi city in Osaka Prefecture, and Hiroshima city in Hiroshima Prefecture).

The sample at the baseline in each municipality is males and females aged 50 to 74 years, who were randomly chosen from household registration. The sample size at the baseline in each municipality is approximately 8,000 and the average response rate at the baseline is approximately 60 percent. We pool all the observations from first to third waves in the estimation. We have a sample of roughly 647 male and 690 female person-year observations for the regressions; a further 5,157 male and 5,194 female person-year observations are used in our simulations of work capacity.

We estimate a linear probability model to predict a binary variable of employment, which is equal to 1 if the individual is employed, by a set of health measures, including dummy variables for self-reported health status, limitations on physical activity, limitations on activities of daily living (ADLs) and instrumental activities of daily living (IADLs), individual health conditions, being over- or underweight, and being a current or former smoker. We also include variables for educational attainment, marital status, and pension coverage as explanatory variables.

We estimate an alternative version of this regression model where the full set of health variables is replaced by a single health index value, developed using the approach described in Poterba et al. (2013). We construct a health index based on 23 questions, including self-reported health diagnoses, functional limitations, medical care usage, and other health indicators. To this end, we first obtain the first principal component of a set of health measures. The estimated coefficients from the analysis are then used to predict a percentile score for each respondent, referred to as the health index.

Tables 2a and 2b show summary statistics for the male and female samples. The share of employed men remains above 90 percent at ages 55-59, gradually declines in the 60s, and then reaches to 36% at ages 70-74. Employment rates for women are 20-30 percentage points lower in each age group. The health measures tend to be stable between ages 50-69, but worsen after that age. The share of men in fair or poor health rises gradually from 10.8 percent at ages 51-54, 12.4 percent at ages 55-59, 15.6 percent at ages 60-64, 17.7 percent at ages 65-69, to 28 percent at ages 70-74. The values for women are similar. The share of men with one or more limits on their physical activity gradually rises from 4.3 percent at ages 51-54, 6.0 percent at ages 55-59, 8.2 percent at ages 60-65, 15.2 percent at ages 65-69, to 24.0 percent at ages 70-74. Values for women are substantially higher with a somewhat steeper gradient: from 10 percent at ages 51-54 to 37 percent at ages 70-74. The share of individuals with limitations in ADLs gradually rises from 3 percent to 6 percent for men across the five age categories, and from 2 to 9 percent for women; the share with limitations in IADLs show a similar trend, rising from 2 to 8 percent for both men and women. The share of individuals with diagnosed medical conditions also rises with age. High blood pressure is one of the most common issues, rising from 37 percent at ages 51-54 to 50 percent at ages 70-74 for men and from 29 percent at ages 51-54 to 51 percent at ages 70-74 for women. More serious health conditions such as cancer and stroke also rise with age. Overall, the health conditions of the elderly decline gradually with no sharp deterioration between the ages of 50 and 74.

Tables 3a and 3b provide the estimation results of the regression models for all health variables and for the health index versions of our model, respectively. Table 3a reveals that there are modestly significant effects of several health variables on employment. For example, relative to men in excellent health, men in poor health are 36 percentage points less likely to be employed; for women, the value is 31 points. CESD (Center for Epidemiologic Studies Depression Scale) and psychiatric problems modestly reduce the probability of employment. Compared with men, health variables are more closely associated with employment for women. Having limits on physical activity, experiencing a stroke, cancer, or diabetes, or being underweight reduce the probability of employment by 5-12 percentage points. Table 3b shows a close association between the health index and employment, consistent with the results in Table 3a. A ten-percentage point increase in the index raises the probability of employment by 0.9 percentage points for men and by 3.9 percentage points for women. We focus on the results from Table 3b in what follows.

Table 4 summarizes the simulation results: for men and women in 5-year age groups from age 55 to 74, it shows the share employed, the predicted share employed (calculated by combining the coefficients from the regression analysis and the actual characteristics of these individuals), and the difference between these, which we term the estimated additional work capacity. On the basis of the health index results (right-hand part), we predict the share of men employed to be 96 percent at ages 55-59 and 60-64, 94 percent at ages 65-59, and 94 percent at ages 70-74. The projected share of men employed declines, albeit modestly, with age, because health declines with age and employment is modestly related to health as shown in our regression results. However, the share of men actually working declines more quickly with age than do our predictions, from 94 percent at ages 55-59 to 80 percent, 54 percent, and 38 percent in the older age groups. As a result, the estimated capacity to work is substantial and rises sharply with age, from 2 percent at ages 55-59 to 16 percent at ages 60-64, 40 percent at ages 65-69, and 56 percent at ages 70-74. Results using the model including individual health variables (left-hand part) are quite similar. For women, both the predicted and actual share working are somewhat lower than those for men. Their work capacity is estimated to be 8 percent, 20 percent, 31 percent, and 42 percent across the four age groups. The numbers are somewhat higher for younger groups and lower for older ones, compared with the cases for men. The share of individuals working and additional work capacity are depicted in Figures 9 and 10 for men and women, respectively.

We can compare these results with those obtained using the Milligan-Wise method. As seen in Table 1, that method suggested that employment could be 20-32 percentage points higher at ages 60-64 and 35-41 percentage points higher at ages 65-69 if people today worked as much as people with the same mortality rate worked in 1975. These values are slightly higher and are affected by the choice of base year, but it is noteworthy that they are in the same ballpark as the 16 percentage points at ages 60-64 and 40 percent points at ages 65-69 found here in the Cutler et al. method.

Finally, we augment our basic results with an analysis that estimates work capacity separately by education, considering the possibility that the ability to work longer depends on educational attainment. We re-estimate the regression model separately by education group. It might be the case that workers with less education are concentrated in blue-collar jobs where it is more difficult to continue working once one experiences a health problem than it would be in the white-collar jobs held by more highly educated workers.

Tables 5a and 5b, along with Figures 11 and 12, present our simulation results of work capacity by education group for men and women, respectively. As seen in Table 5a, the actual and predicted share working do not vary substantially by education group except for ages 65–69. More interestingly, we observe no clear tendency for the less educated to have a smaller estimated additional work capacity from either the model using all health variables or the one using the health index. There is no clear tendency for women, either, as seen in Table 5b. These results are confirmed by Figures 11 and 12.

However, we cannot rule out the risk that estimation results are biased through limited sample sizes. We condense the four education groups into two—that is, high school or below and any college—and re-estimate work capacity. Tables 6a and 6b summarize the results. There is no substantial difference between less and more educated individuals for both men and women aged below 65. For men and women aged 65 and above, more educated individuals tend to have more work capacity (except for the results for men aged 70-74 in the model using the health index).

VI. Discussion and Conclusion

In this study, we have examined the health capacity of older Japanese based on two analytic approaches: the Milligan-Wise method (using aggregated data from the Population Census and Life Tables) and the Cutler et al. method (using microdata from the JSTAR). Results from both of these methods underscore a large work capacity among older people in Japan. The Milligan-Wise findings show that the amount of projected additional work capacity would be 3.7 years if we use the employment-mortality relationship that existed in 1975 as a basis for comparison and 2.2 years if we use 1995 as the base year. The Cutler et al. method suggests that roughly an additional one in five men and women aged 60 to 64 and one in three men and women aged 65 to 69 could be employed, relative to the share working today, based on their own health assessment and the estimated relationship between health and employment for younger workers. Finally, our analysis by education group finds somewhat higher work capacity for more educated individuals than less educated ones when they are at age 65 and above.

We can expand this analysis in many directions in the Japanese context. For example, we can divide work status into full- and part-time work, considering the fact that a substantial portion of Japanese employees shift to part-time work after retiring from primary full-time work, rather than completely going out of the labor force (Shimizutani, 2011; Shimizutani and Oshio, 2010, Usui, Shimizutani and Oshio, 2014). Second, it is of interest to compare work/retirement behavior between individuals who have been employed and self-employed (Usui, Shimizutani, and Oshio, 2015). Those who have been employed are likely to experience mandatory retirement and receive relatively high public pension benefits, making them inclined to retire or move to part-time work after retiring from primary full-time work regardless of their health condition. Meanwhile, the self-employed have no mandatory retirement and receive relatively low, fixed-rate pension benefits, probably making their work/retirement more closely associated with health conditions. This difference also may lead to their having different subjective assessments of employment: as being over- or underemployed.

References

Cutler, David M., Ellen Meara, and Seth Richards-Shubik (2012). "Health and Work Capacity of Older Adults: Estimates and Implications for Social Security Policy," mimeo.

Milligan, Kevin S. and David A. Wise (2012). "Health and Work at Older Ages: Using Mortality to Assess the Capacity to Work Across Countries," *NBER Working Paper* 18229.

OECD (2013). *Pensions at a Glance 2013: OECD and G20 indicators* http://www.oecd.org/pensions/public-pensions/OECDPensionsAtAGlance2013.pdf

Oshio, Takashi, Akiko S. Oishi, and Satoshi Shimizutani (2011). "Social Security Reforms and Labor Force Participation of the Elderly in Japan," *Japanese Economic Review* 62(2):248–271.

Poterba, James, Steve Venti, and David A. Wise (2013). "Health, Education, and the Post-Retirement Evolution of Household Assets," paper prepared for the RAND Conference on Health, Aging, and Human Capital.

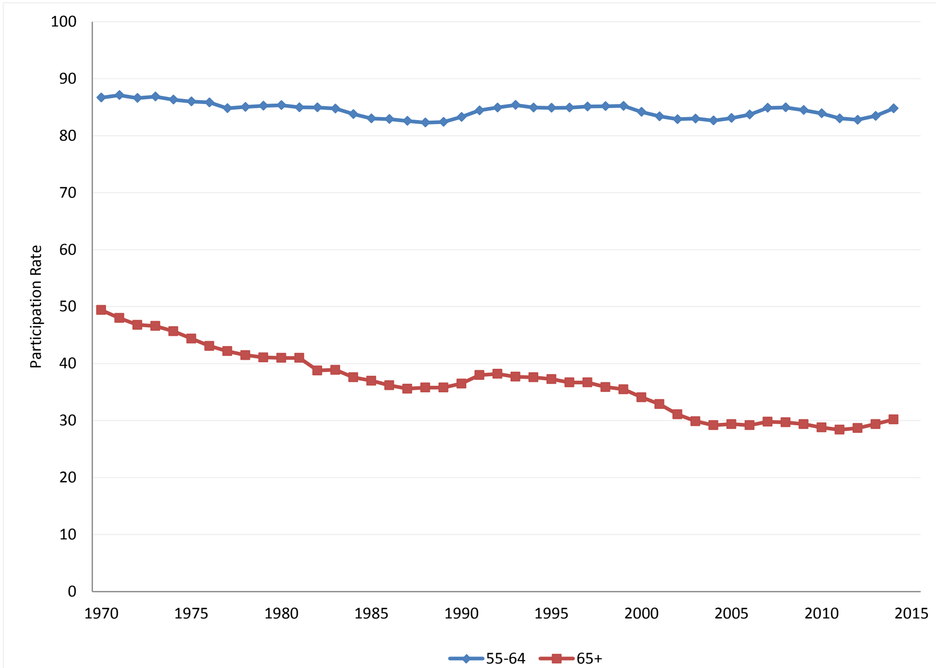
Shimizutani, Satoshi (2011). "A New Anatomy of the Retirement Process in Japan," *Japan and the World Economy*, 23(3):141–152.

Shimizutani, Satoshi and Takashi Oshio (2010). "New Evidence on the Initial Transition from Career Job to Retirement in Japan," *Industrial Relations* 49(2):248–274.

Usui, Emiko, Satoshi Shimizunani and Takashi Oshio (2014). "Work Capacity of Older Adults in Japan." *CIS Discussion paper series* 635.

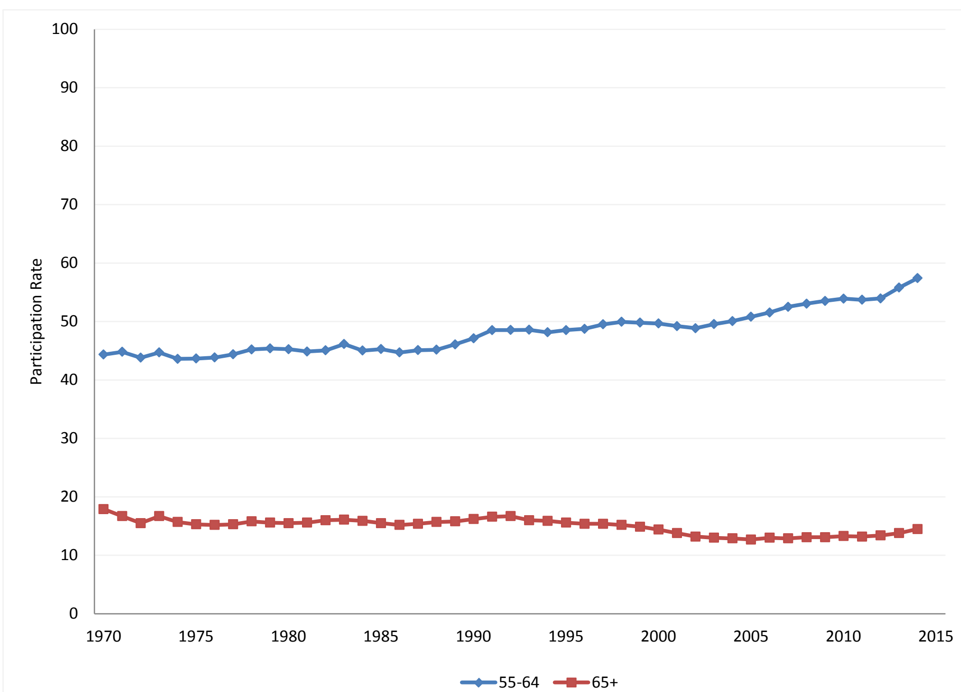
Usui, Emiko, Satoshi Shimizunani and Takashi Oshio (2015). "Are Japanese men of pensionable age underemployed or overemployed?", mimeo.

Figure 1: Men's Labor Force Participation, Ages 55-64 and 65+, 1970-2014



Source: Statistics Bureau, Labor Force Survey

Figure 2: Women's Labor Force Participation, Ages 55-64 and 65+, 1970-2014



Source: Statistics Bureau, Labor Force Survey

Figure 3: SAH and Mortality for Men Age 50 to 75

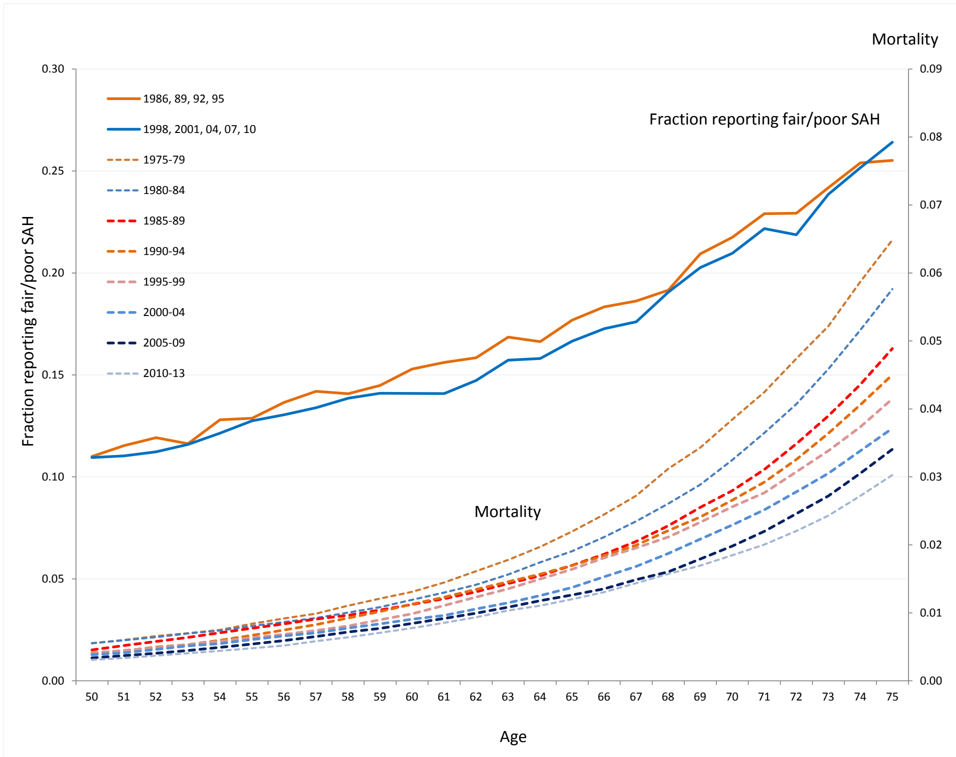


Figure 4: Employment vs Mortality, 2010 vs. 1975

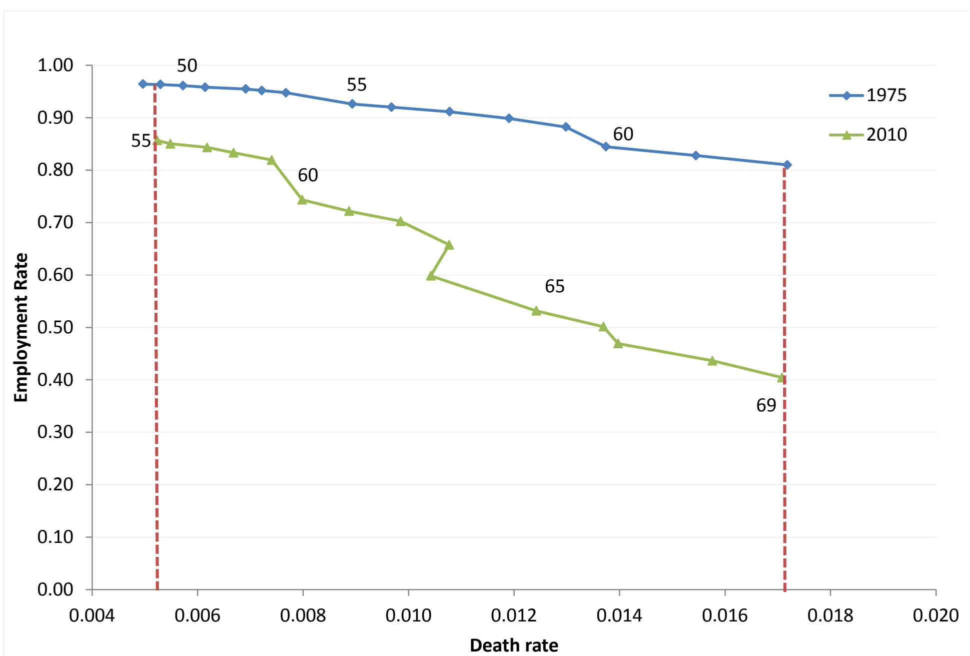


Figure 5: Employment vs Mortality, 2010 vs. 1995

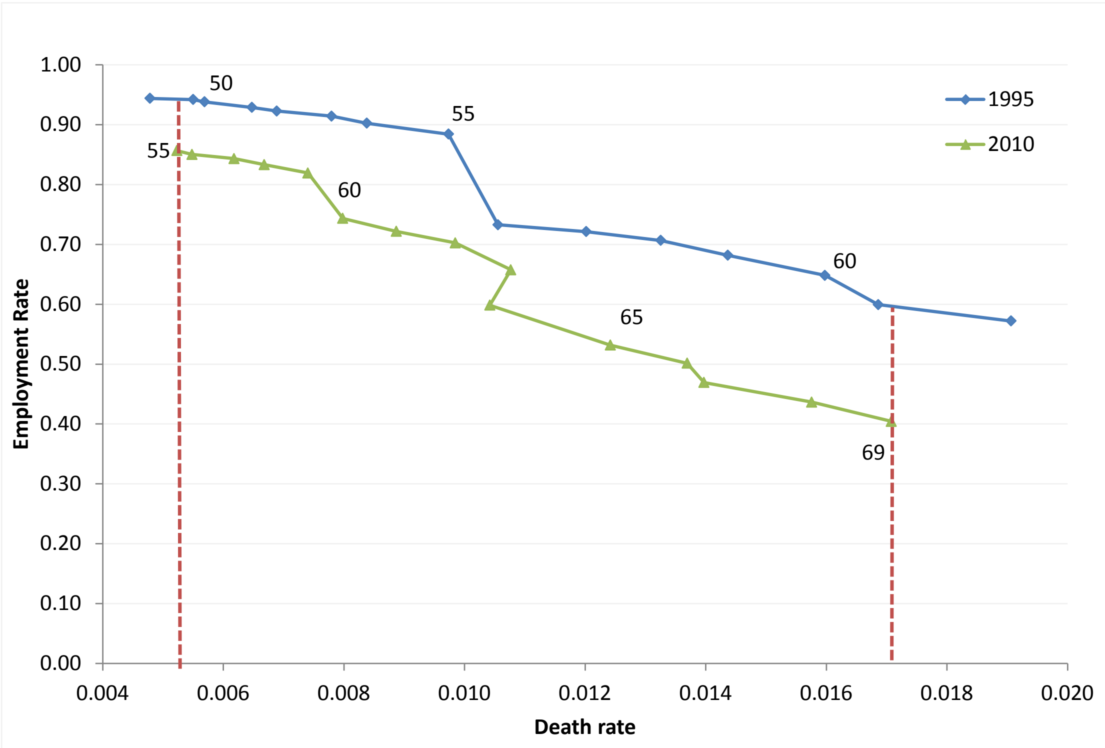


Figure 6: Estimated Additional Employment Capacity by Year of Comparison

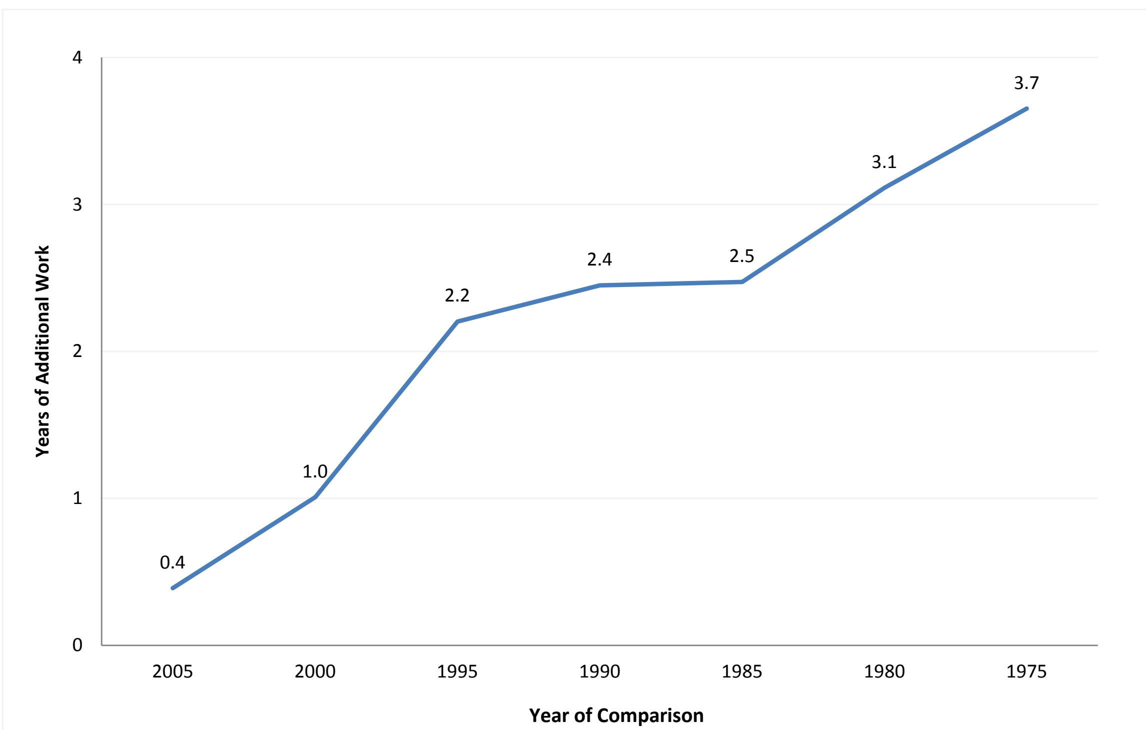


Figure 7: Employment vs. SAH, late 1980s and 2000s

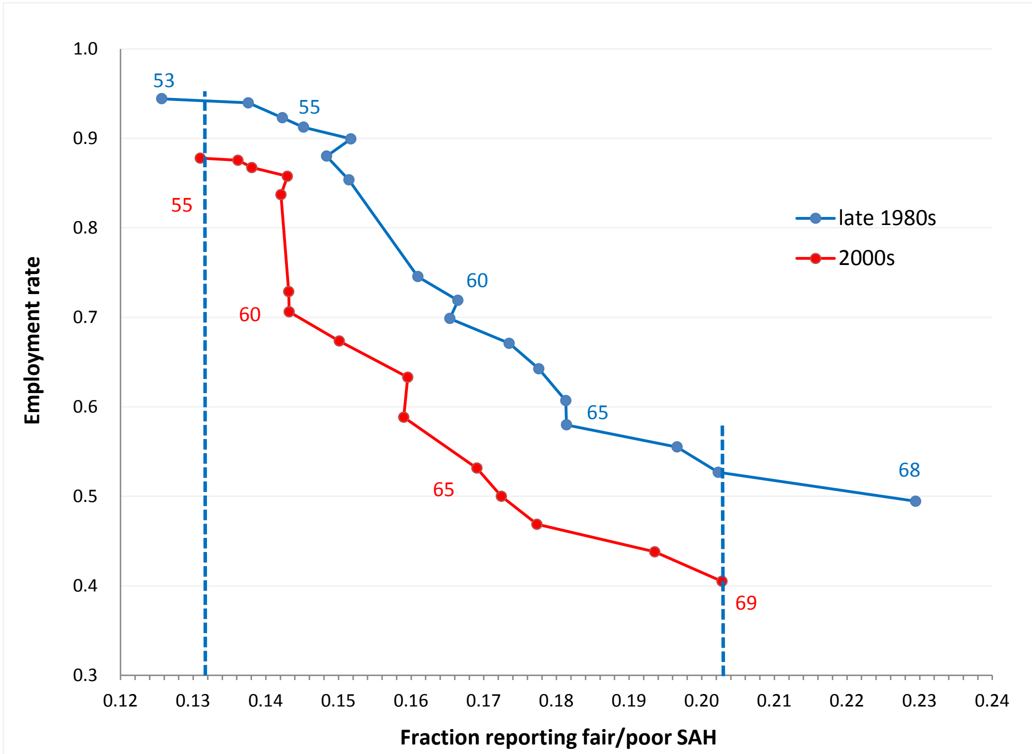


Figure 8: Employment vs. Daily Activity Limitations, around 1990 and 2000s

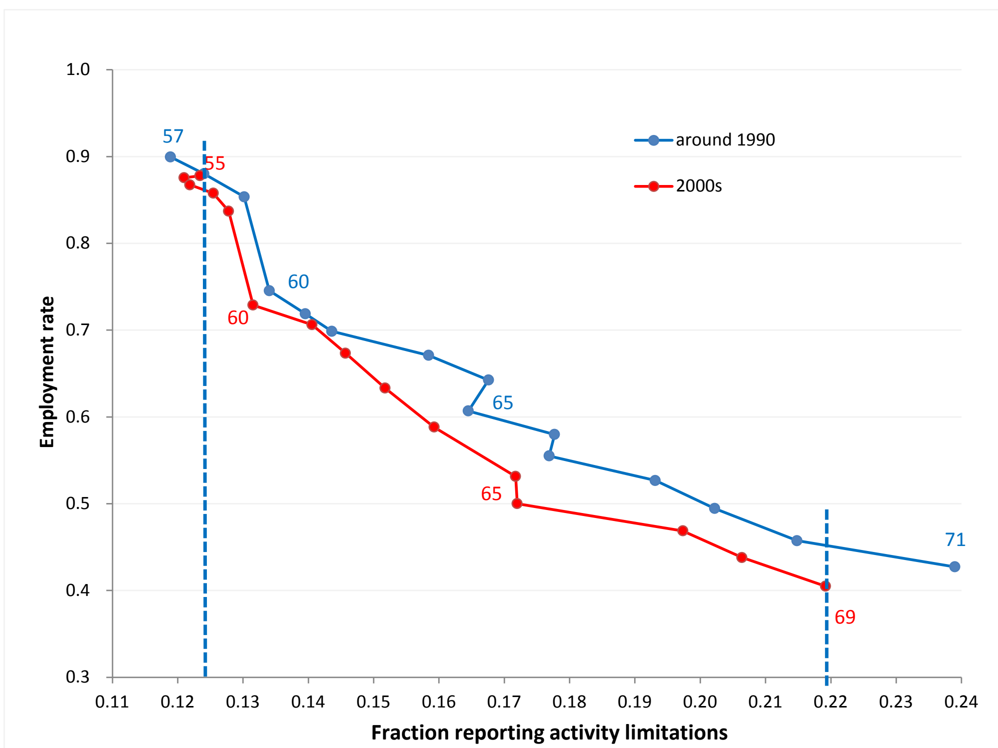


Figure 9: Share of JSTAR Men Working and Additional Work Capacity, By Age

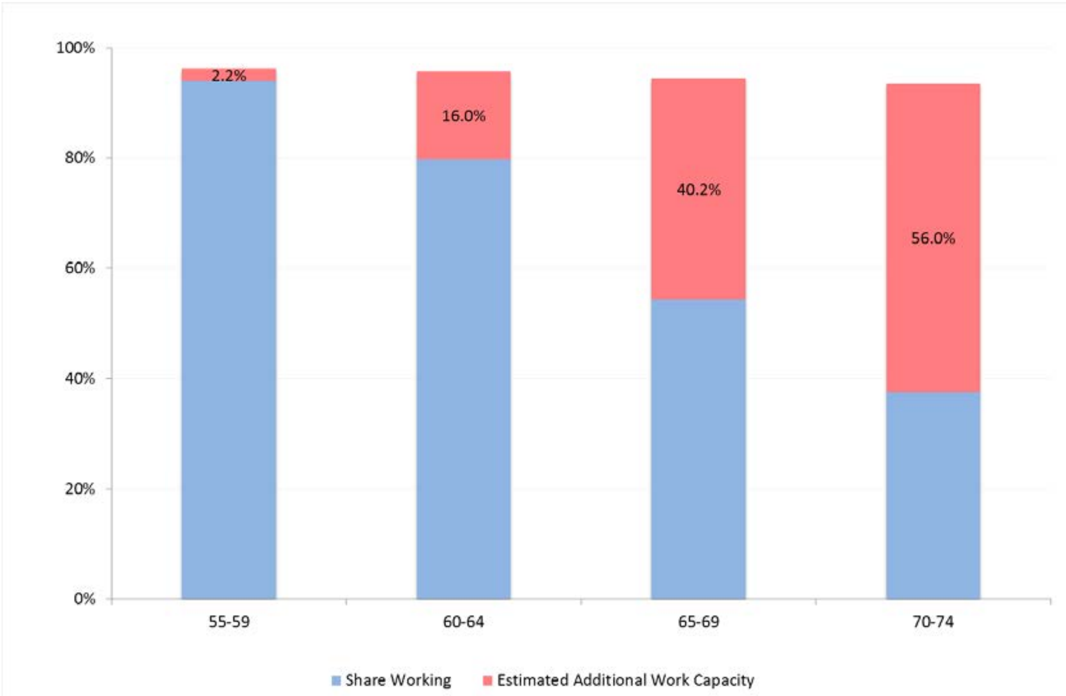


Figure 10: Share of JSTAR Men Working and Additional Work Capacity, By Age

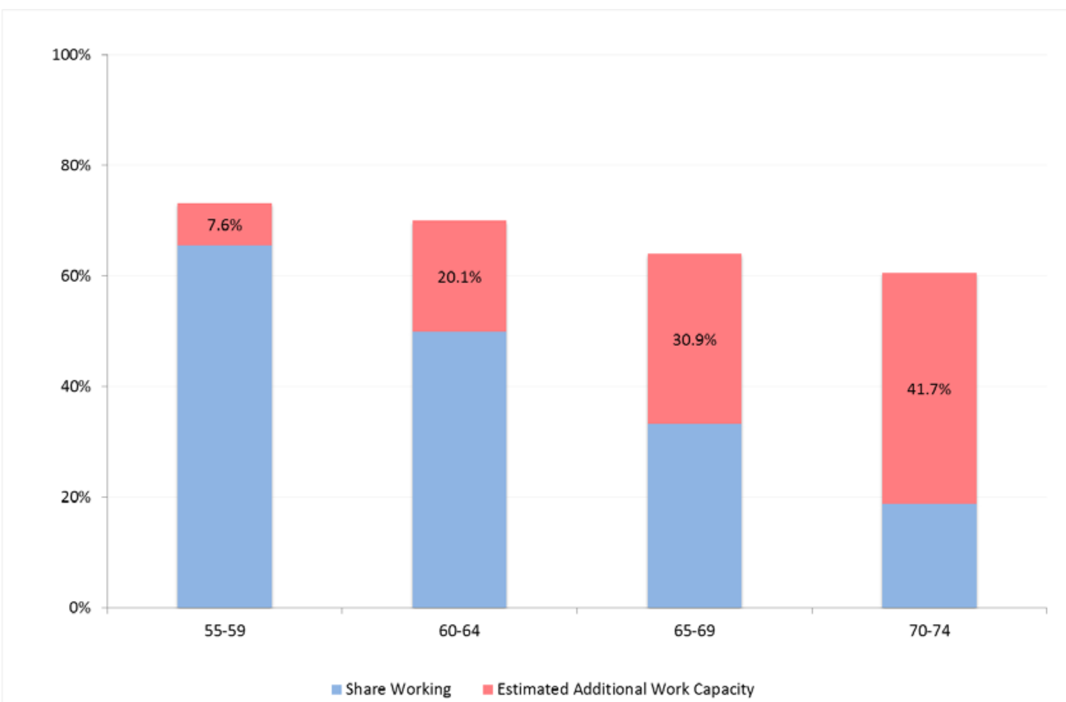


Figure 11: Share of JSAR Men Working and Additional Work Capacity, by Age and Education

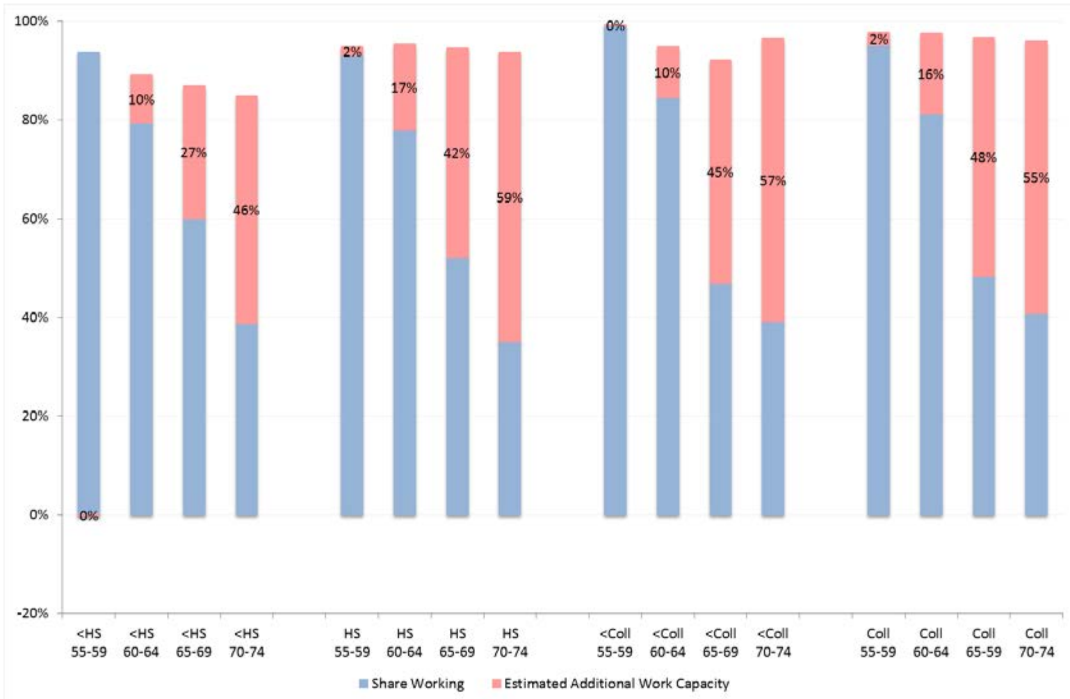


Figure 12: Share of JTSAR Women Working and Additional Work Capacity, by Age an Education

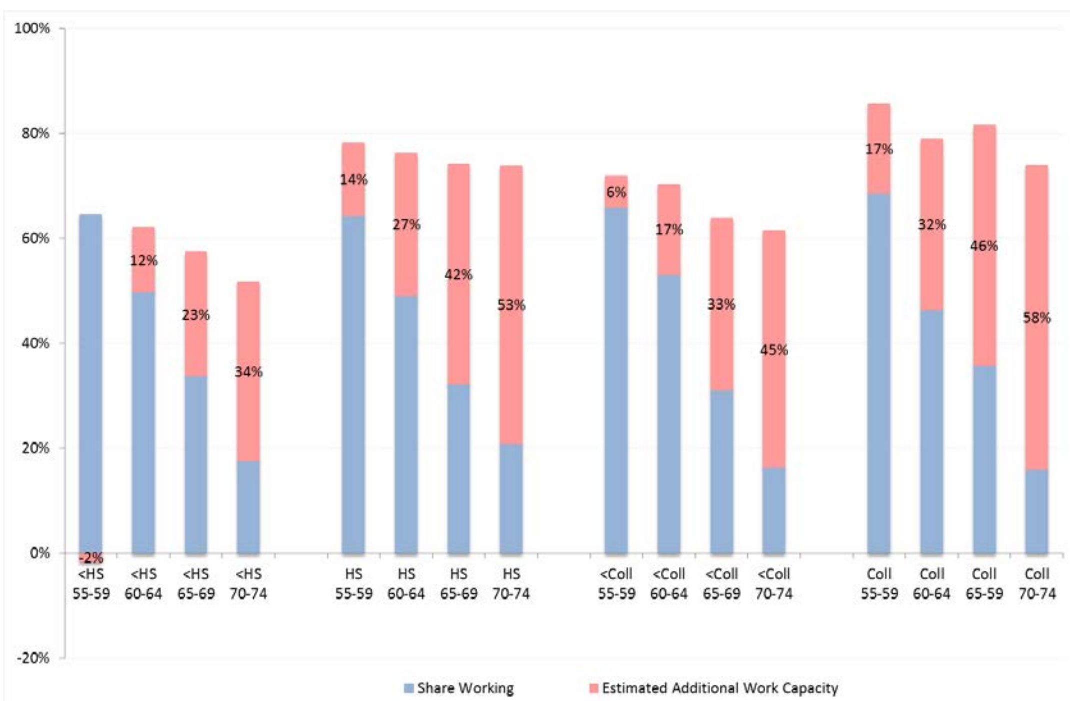


Table 1: Additional Employment Capacity in 2010

Using 1975 Employment-Mortality Relationship

Age	Death Rate in 2010	Employment Rate in 2010	Employment Rate in 1975 at Same Death Rate	Additional Employment Capacity
55	0.52%	85.7%	96.4%	10.7%
56	0.55%	85.0%	96.2%	11.2%
57	0.62%	84.3%	95.8%	11.4%
58	0.67%	83.3%	95.6%	12.3%
59	0.74%	81.9%	95.0%	13.1%
60	0.80%	74.4%	94.5%	20.1%
61	0.89%	72.2%	92.7%	20.5%
62	0.98%	70.3%	91.9%	21.6%
63	1.08%	65.8%	91.1%	25.4%
64	1.04%	59.8%	91.4%	31.6%
65	1.24%	53.2%	89.1%	35.9%
66	1.37%	50.1%	84.7%	34.6%
67	1.40%	46.9%	84.2%	37.3%
68	1.58%	43.7%	82.5%	38.8%
69	1.71%	40.4%	81.1%	40.7%
Total Years		10.0		3.7

Table 2a: Summary Statistics, Men

	Age Group				
	51-54	**55-59**	**60-64**	**65-69**	**70-74**
employed	0.960	0.934	0.758	0.531	0.362
health_exc	0.305	0.269	0.302	0.218	0.139
health_vgood	0.229	0.261	0.225	0.261	0.251
health_good	0.358	0.346	0.318	0.344	0.326
health_fair	0.093	0.102	0.130	0.138	0.230
health_poor	0.015	0.022	0.026	0.039	0.054
physlimit >1	0.011	0.026	0.038	0.054	0.080
physlimit = 1	0.032	0.034	0.044	0.098	0.158
ADLany	0.027	0.028	0.041	0.052	0.062
IADLany	0.021	0.019	0.043	0.051	0.075
cesd	12.05	11.86	11.12	10.79	11.63
hearte	0.087	0.119	0.130	0.181	0.229
stroke	0.015	0.026	0.050	0.095	0.088
psyche	0.033	0.026	0.009	0.013	0.009
lunge	0.015	0.015	0.026	0.030	0.026
cancre	0.029	0.031	0.084	0.089	0.073
hibpe	0.367	0.429	0.484	0.458	0.495
arthre	0.040	0.022	0.022	0.040	0.050
diabe	0.167	0.207	0.186	0.238	0.204
weightunder	0.031	0.019	0.022	0.025	0.037
weightover	0.285	0.254	0.267	0.265	0.264
weightobese	0.038	0.034	0.016	0.021	0.018
smokerform	0.341	0.402	0.402	0.470	0.534
smokercurr	0.412	0.392	0.352	0.270	0.204
educ_hsdrop	0.110	0.164	0.233	0.319	0.430
educ_hsgrad	0.370	0.465	0.441	0.438	0.375
educ_somecoll	0.102	0.094	0.053	0.046	0.039
educ_collgrad	0.417	0.276	0.273	0.198	0.156
married	0.850	0.880	0.909	0.927	0.917
EPI	0.729	0.714	0.793	0.761	0.718
NPI	0.257	0.275	0.313	0.244	0.277
Chofu	0.038	0.036	0.058	0.063	0.060
Sendai	0.138	0.159	0.121	0.132	0.098
Kanazawa	0.136	0.153	0.167	0.102	0.110
Takikawa	0.040	0.071	0.104	0.101	0.110
Shirakawa	0.150	0.152	0.071	0.114	0.127
Adachi	0.119	0.116	0.105	0.139	0.133
Naha	0.138	0.127	0.090	0.088	0.125
Tosu	0.089	0.071	0.097	0.103	0.092
Hiroshima	0.097	0.079	0.125	0.108	0.089
Tondabayshi	0.055	0.035	0.061	0.048	0.056
# Obs	528	743	702	725	663

Table 2b: Summary Statistics, Women

	Age Group				
	51-54	55-59	60-64	65-69	70-74
employed	0.727	0.640	0.476	0.283	0.169
health_exc	0.283	0.267	0.266	0.183	0.153
health_vgood	0.264	0.266	0.236	0.221	0.237
health_good	0.330	0.342	0.338	0.375	0.332
health_fair	0.098	0.104	0.139	0.178	0.211
health_poor	0.024	0.021	0.021	0.044	0.067
physlimit >1	0.047	0.055	0.063	0.114	0.108
physlimit = 1	0.055	0.066	0.077	0.163	0.265
ADLany	0.022	0.039	0.044	0.063	0.085
IADLany	0.017	0.023	0.036	0.059	0.076
cesd	12.11	11.85	11.55	11.43	11.80
hearte	0.068	0.108	0.104	0.140	0.188
stroke	0.004	0.026	0.042	0.045	0.052
psyche	0.056	0.054	0.038	0.047	0.042
lunge	0.015	0.008	0.022	0.019	0.014
cancre	0.064	0.062	0.084	0.063	0.057
hibpe	0.293	0.365	0.420	0.453	0.509
arthre	0.109	0.113	0.102	0.112	0.138
diabe	0.060	0.087	0.106	0.140	0.129
weightunder	0.087	0.082	0.066	0.055	0.049
weightover	0.178	0.173	0.225	0.242	0.240
weightobese	0.032	0.024	0.019	0.030	0.036
smokerform	0.085	0.082	0.084	0.077	0.065
smokercurr	0.156	0.124	0.104	0.053	0.061
educ_hsdrop	0.078	0.153	0.250	0.374	0.481
educ_hsgrad	0.430	0.481	0.508	0.459	0.382
educ_somecoll	0.347	0.282	0.180	0.134	0.109
educ_collgrad	0.146	0.085	0.062	0.033	0.028
married	0.822	0.815	0.820	0.771	0.727
healthins_own	0.470	0.477	0.555	0.372	0.319
healthins_spous	0.526	0.500	0.634	0.565	0.593
Chofu	0.062	0.050	0.063	0.052	0.044
Sendai	0.121	0.131	0.126	0.122	0.111
Kanazawa	0.180	0.166	0.147	0.124	0.113
Takikawa	0.033	0.075	0.068	0.078	0.102
Shirakawa	0.092	0.079	0.073	0.098	0.162
Adachi	0.105	0.116	0.122	0.137	0.121
Naha	0.145	0.174	0.098	0.127	0.141
Tosu	0.069	0.066	0.104	0.105	0.082
Hiroshima	0.133	0.094	0.141	0.110	0.068
Tondabayshi	0.060	0.050	0.058	0.048	0.056
# Obs	579	724	778	735	733

Table 3a: Employment Regressions, All Health Variables

	Men 51-54		Women 51-54	
Variable	**Coefficient**	**Std Error**	**Coefficient**	**Std Error**
health_vgood	-0.0036	0.0164	-0.0446	0.0467
health_good	0.0021	0.0151	-0.0338	0.0446
health_fair	-0.0060	0.0413	-0.1384	0.0732 *
health_poor	-0.3605	0.2017 *	-0.3055	0.1370 **
physlimit one	-0.0904	0.1300	-0.2326	0.0951 **
cesd	-0.0035	0.0018 *	-0.0005	0.0024
hearte	-0.0153	0.0387	0.0330	0.1105
lunge	-0.0557	0.1140	-0.0429	0.2331
stroke	-0.1136	0.2015	0.4090	0.0956 ***
psyche	-0.2625	0.1447 *	-0.1683	0.1267
cancre	0.0894	0.0756	-0.2028	0.1232 *
hibpe	0.0221	0.0221	0.0388	0.0543
arthre	0.0045	0.0811	-0.1431	0.0904
diabe	0.0132	0.0350	0.1878	0.1021 *
weightunder	-0.0186	0.0533	0.1210	0.0456 ***
weightover	0.0137	0.0169	-0.0218	0.0514
weightobese	-0.0054	0.0450	-0.1374	0.1076
smokerform	-0.0054	0.0174	0.0731	0.0612
smokercurr	-0.0153	0.0188	0.0674	0.0463
educ_hsdrop	-0.0002	0.0289	-0.1194	0.0682 *
educ_some college	-0.0127	0.0292	-0.0487	0.0424
educ_collgege	0.0243	0.0191	0.0432	0.0526
married	0.0504	0.0328	-0.1315	0.0416 ***
# Obs	631		690	

Notes: Regressions include indicators for missing variables. All regressions control for municipalities and survey years.

Table 3b: Employment Regressions, PVW Health Index

	Men 51-54			Women 51-54		
Variable	Coefficient	Std Error		Coefficient	Std Error	
PVW index	0.0009	0.0004	**	0.0039	0.0007	***
educ_hsdrop	-0.0029	0.0321		-0.2092	0.0734	***
educ_some college	-0.0051	0.0306		-0.0497	0.0415	
educ_collgege	0.0343	0.0183	*	0.0194	0.0526	
married	0.0570	0.0316	*	-0.0954	0.0432	**
# Obs	647			685		

Note: Municipalities and survey years are controlled for.

Table 4: Simulations of Work Capacity

	Men 51-54			Women 51-54		
Variable	Coefficient	Std Error		Coefficient	Std Error	
PVW index	0.0009	0.0004	**	0.0039	0.0007	***
educ_hsdrop	-0.0029	0.0321		-0.2092	0.0734	***
educ_some college	-0.0051	0.0306		-0.0497	0.0415	
educ_collgege	0.0343	0.0183	*	0.0194	0.0526	
married	0.0570	0.0316	*	-0.0954	0.0432	**
# Obs	647			685		

Note: See notes to Table 3a.

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

Education	Men, All Health Variables Model				Men, PVW Model		
	Actual % Working	Predicted % Working	Estimated Work Capacity		Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
< High School	92.2%	99.9%	7.7%		93.7%	93.5%	-0.2%
High School	93.1%	93.7%	0.5%		93.1%	94.8%	1.8%
Some College	99.2%	98.1%	-1.1%		99.1%	99.2%	0.1%
College Grad	94.8%	98.3%	3.5%		95.3%	97.7%	2.4%
				Age 60-64			
< High School	81.4%	101.9%	20.5%		79.4%	89.1%	9.7%
High School	76.6%	95.6%	19.1%		77.9%	95.4%	17.5%
Some College	83.3%	92.7%	9.3%		84.5%	94.8%	10.3%
College Grad	81.2%	97.7%	16.6%		81.3%	97.5%	16.2%
				Age 65-69			
< High School	60.3%	97.9%	37.6%		60.1%	87.0%	27.0%
High School	50.4%	95.8%	45.4%		52.1%	94.6%	42.4%
Some College	47.8%	86.7%	38.9%		46.9%	92.1%	45.2%
College Grad	47.5%	97.4%	49.9%		48.3%	96.7%	48.5%
				Age 70-74			
< High School	38.6%	97.1%	58.5%		38.7%	84.8%	46.1%
High School	35.0%	92.9%	57.9%		35.1%	93.7%	58.6%
Some College	31.6%	82.2%	50.6%		39.1%	96.5%	57.4%
College Grad	38.4%	97.9%	59.5%		40.9%	96.0%	55.1%

Note: Actual % working in All Health and PVW models vary due to differences in sample size.

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

Education	Women, All Health Variables Model				Women, PVW Model		
	Actual % Working	Predicted % Working	Estimated Work Capacity		Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
< High School	64.8%	82.5%	17.7%		64.5%	62.9%	-1.6%
High School	64.3%	78.5%	14.1%		64.3%	78.2%	13.9%
Some College	65.6%	75.0%	9.4%		66.0%	71.8%	5.8%
College Grad	69.0%	76.9%	7.9%		68.6%	85.5%	16.9%
				Age 60-64			
< High School	50.5%	79.5%	29.0%		49.8%	62.1%	12.3%
High School	48.8%	76.7%	27.9%		49.2%	76.2%	27.1%
Some College	54.5%	77.0%	22.5%		53.2%	70.3%	17.1%
College Grad	46.6%	72.5%	25.9%		46.6%	78.9%	32.3%
				Age 65-69			
< High School	34.1%	77.7%	43.6%		33.9%	57.3%	23.4%
High School	32.4%	73.2%	40.8%		32.3%	74.1%	41.8%
Some College	32.7%	70.4%	37.7%		31.2%	63.9%	32.7%
College Grad	33.3%	73.3%	40.0%		35.9%	81.6%	45.7%
				Age 70-74			
< High School	19.1%	78.4%	59.2%		17.7%	51.7%	34.0%
High School	22.0%	71.9%	50.0%		21.0%	73.8%	52.8%
Some College	16.7%	73.4%	56.7%		16.4%	61.4%	45.0%
College Grad	11.5%	81.4%	69.8%		16.0%	73.9%	57.9%

Note: Actual % working in All Health and PVW models vary due to differences in sample size.

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

Education	Men, All Health Variables Model				Men, PVW Model		
	Actual % Working	Predicted % Working	Estimated Work Capacity		Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
HS or less	92.9%	92.8%	-0.1%		93.3%	94.4%	1.2%
Any College	96.0%	97.7%	1.7%		96.3%	97.7%	1.4%
				Age 60-64			
HS or less	78.2%	92.9%	14.7%		78.4%	94.1%	15.7%
Any College	81.6%	96.8%	15.2%		81.9%	97.9%	15.9%
				Age 65-69			
HS or less	54.8%	89.7%	34.9%		55.6%	93.1%	37.6%
Any College	47.6%	97.2%	49.6%		48.0%	96.3%	48.3%
				Age 70-74			
HS or less	36.9%	87.0%	50.1%		37.0%	92.2%	55.1%
Any College	36.5%	96.0%	59.5%		40.4%	95.7%	55.2%

Note: Actual % working in All Health and PVW models vary due to differences in sample size

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

Education	Women, All Health Variables Model				Women, PVW Model		
	Actual % Working	Predicted % Working	Estimated Work Capacity		Actual % Working	Predicted % Working	Estimated Work Capacity
				Age 55-59			
HS or less	64.4%	77.3%	12.9%		64.4%	74.6%	10.3%
Any College	66.4%	77.5%	11.1%		66.7%	75.5%	8.8%
				Age 60-64			
HS or less	49.3%	76.4%	27.1%		49.4%	71.6%	22.2%
Any College	53.0%	77.2%	24.2%		51.8%	72.5%	20.7%
				Age 65-69			
HS or less	33.2%	70.7%	37.5%		33.0%	65.6%	32.6%
Any College	32.9%	74.3%	41.4%		32.2%	69.2%	36.9%
				Age 70-74			
HS or less	20.4%	66.4%	46.1%		19.1%	62.1%	43.0%
Any College	15.9%	75.8%	60.0%		16.3%	66.9%	50.6%

Note: Actual % working in All Health and PVW models vary due to differences in sample size