Health Capacity to Work among Korean Elderly

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ABSTRACT

South Korea is one of the most rapidly aging countries in the world as a consequence of stark declines in fertility coupled with remarkable improvements in longevity. Faced with the potential problem of labor shortages as well as financial pressure on pension funds, the Korean government has recently reformed policies regarding retirement to extend work lives, despite the already high rate of labor force participation among those aged 60 and above.

Whether the health of older Koreans would allow them to potentially extend their work lives is a critical question with important policy implications. We employ two analytic methods to empirically examine the health capacity to work of older Korean men. In addition, heterogeneity in health capacity to work by education level and urban residency is explored. For this study, we analyze data from the five waves (2006-2014) of the Korean Longitudinal Study of Ageing and also utilize various information on mortality, employment, and health outcomes by age and gender from National Statistical Office and Centers for Disease Control & Prevention.

Results indicate that there is substantial work capacity among Korean men over age 60. Specifically, men between ages 60 and 74 today (in 2015) would have had to work on average 22.3% more as much as men with the same mortality worked in 1986. Also, health capacity to work does not appear to be uniform across subgroups. College graduates and urban residents were found to have significantly larger margins of health capacity to work as compared to their counterparts.

INTRODUCTION

Over the past several decades, one of the most remarkable changes in global population health has been the substantial improvement in human longevity. South Korea (hereinafter, Korea) has been no exception where life expectancy at birth has increased quite rapidly over the past 45 years – from 62.3 years in 1970 to 71.7 years in 1990, and to 82.1 years in 2015 – currently exceeding the OECD average of 80.6 years among member countries (Statistics Korea, 2016). The rise of life expectancy has been reported to have remarkably extended the *active* life expectancy of elderly Koreans while reducing their *disabled* life expectancy (Kim, 2015). Such an increase in life expectancy has been accompanied by a sharp decline in fertility in recent years dramatically transforming the age structure of the nation. Specifically, the total fertility rate (TFR) in Korea has dropped from 2.06 in 1983 to 1.08 in 2005 ranking lowest in the world (Lee, 2009). Since then Korea's TFR has experienced some minor fluctuations, but it is still considered to be one of the lowest among OECD countries at 1.17 in 2016. As a result, population aging is proceeding at the fastest pace in Korea among all industrialized nations where the elderly population (aged 65 or older) has quadrupled during the period between 1970 and 2013 (Statistics Korea, 2016).

Faced with the many potential problems associated with an aging population including labor shortages and financial pressure on pension funds, the Korean government has recently reformed policies regarding retirement to extend the work lives of employees (Higo & Klassen, 2017). For example, in recent years, Korea has begun extending the eligible age for national pensions. From 2013 to 2033, the eligible age for pensioners is planned to increase by one year for every five years from age 60 in 2013 to reach age 65 in 2033. Currently, the eligible age of the national pension is at 61 in 2018. In addition, efforts to extend the mandatory retirement age of all employees (regardless of the sector or size of employer) were made by implementing a uniform national mandatory retirement age policy in 2016. Prior to 2016, employers in Korea were free to set a mandatory retirement age at the workplace resulting in substantial variation across industry and occupation. Most private sector employers used mandatory retirement ages between 55 and 58 (Higo & Klassen, 2017), but the new policy set age 60 as the national retirement age.

Policies aimed to extend and encourage the employment of older workers are not unique to Korea. They have been quite common in many western industrialized nations with rising old age dependency especially since most of these countries have experienced substantial declines in the labor force participation of older men during the 1970s through the 1990s (Coile, Milligan, & Wise, 2016). However, Korean older men were quite different from their counterparts in other OECD nations in that they substantially increased their labor force participation rates during the mid-1960s to the late-1990s (Lee, 2007). Such a phenomenon was primarily driven by the marked increase in labor force participation rates of rural elderly men who were most likely compensating for the selective out-migration of younger persons to urban areas (Lee, 2007). Korean older men experienced a drop in labor force participation rates during the late 1990s due to the Asian financial crisis in 1997, but by the early 2000s their participation rates quickly recovered and has since been consistently high relative to other developed nations. As a result, Korea was identified to have the highest average effective age of labor market exit at 72.9 years for men and 70.6 years for women in 2014 (OECD, 2015).

Given such high rates of elderly employment in Korea, one must ask whether reforming policies to further extend the age of retirement is a reasonable option. An important reason one may decide to retire can be deteriorating health conditions, either physical or mental, and such health conditions may differ substantially across socio-economic groups of older adults. Although recent research from other developed nations (i.e., 10 western countries and Japan) have confirmed that the health

capacity to work at older ages is typically much greater than actual employment, an attempt to estimate whether the health of older Koreans would allow them to work longer has yet to be made (Coile, Milligan, & Wise, 2016). The present study is the first attempt to measure the potential work capacity of older Koreans in general and also across educational attainment levels. The paper primarily focuses on men because a long-run analysis of the employment of women is complicated by the differential growth in Korean female labor force participation across cohorts during the past several decades similar to other OCED countries (Milligan & Wise, 2015). We provide equivalent results on the analysis of Korean women in the appendix section.

Two different empirical approaches are used to measure health capacity to work. The first method, referred to as the Milligan-Wise method, quantifies how much older Korean men with a given mortality rate in 2017 could work if they were to work as much as men with the same mortality rate worked in 1986 (Milligan & Wise, 2015). As improvements in mortality over the years have translated into substantially longer active and healthy life expectancy for Koreans (Kim, 2015), estimating the health capacity to work by differencing the employment rate of different cohorts of older men with identical mortality rates can be a valid a measure. However, limitations of the MW method is that mortality rates are not a perfect measure of health and are also calculated for the entire population, which makes it difficult to discern differences by socioeconomic group. The second method, referred to as the Cutler et al. (or CMR) method, estimates how much older Korean men with a given level of health could work if they were to work as much as their younger counterparts (ages 50 to 54) in similar health (Cutler et al., 2013). This approach is an improvement from the Milligan-Wise method in the sense that information on an individual's health is directly used and thus group differences in the relationship between health and employment can be accurately estimated. However, the Cutler et al. method requires extensive detailed health measures at the individual level which is typically only available when using survey data on a nationally representative sample of adults and cannot be obtained by simply using official estimates from national statistics based on the entire population.

The present study uses data from multiple sources across many years including the Korean Longitudinal Study of Ageing (KLoSA; 2006-2014), the Korean National Health and Nutrition Examination Survey (KNHANES; 1998-2015), and detailed information on mortality and employment by age from the Korean National Statistical Office. Results indicate that there is indeed substantial work capacity among Korean men over age 55. Specifically, men between ages 55 and 69 in 2015 would have had to work on average additional 2.63 years compared to the men with the same mortality worked in 1986. Also, health capacity to work does not appear to be uniform across socioeconomic subgroups. Those who are more educated show significantly larger margins of health capacity to work as compared to their counterparts with less education.

The remainder of the paper is structured as follows. In the next section, trends in labor force participation, mortality, and self-assessed health of Korean older men since the late 1980s are discussed. We then describe the Milligan-Wise method to compute health capacity to work and present results from the estimation for those aged 55-69. Next, we discuss the Cutler et al. method and present the estimation results by educational attainment level. In the final section, the main findings are summarized with some discussion on policy implications.

TRENDS IN LABOR FORCE PARTICIPATION, MORTALITY, AND SELF-ASSESSED HEALTH IN KOREA

Figure 1 shows the labor force participation rates of Korean men ages 55 and above during the years between 1980 and 2014. Long-run trends in the labor force participation rate of Korean men aged

55-59 and 60-64 display somewhat similar trajectories. That is, prior to the Asian financial crisis in 1997, both cohorts show a gradual increase in labor force participation rates with some minor cyclical fluctuations. Specifically, the labor force participation rate of men aged 55-59 varied between 75.9 percent and 84.9 percent during the years from 1980 to 1997, while the labor force participation rate of men aged 60-64 varied between 65.7 percent and 73.7 percent during the years from 1989 to 1997. The labor force participation rate of both age cohorts dropped dramatically during the immediate years following the Asian financial crisis in 1997. However, shortly after the crisis participation rates began to rebound for both age cohorts, and in 2014 the labor force participation rates of men aged 55-59 and 60-64 were 87.3 percent and 73.8 percent, respectively.

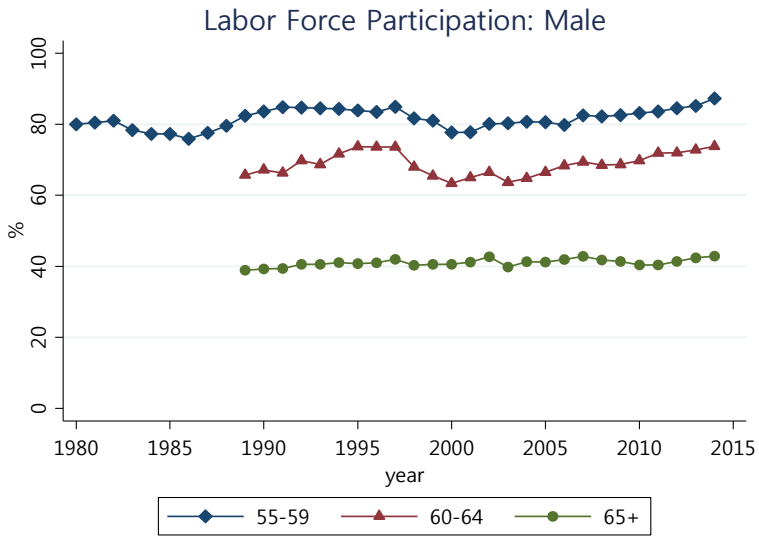

Figure 1. Men's Labor Force Participation, ages 55-59, 60-64, and 65+, 1980-2014
Source: Economically Active Population Survey (1980-2014), Korean National Statistical Office (http://kosis.kr)

In contrast to the younger cohorts, the labor force participation rate of Korean men aged 65 and above has been remarkably stable between 38.9 percent and 42.9 percent since 1989. This implies that the employment of Korean men aged 65 and above does not appear to be sensitive to secular or cyclical fluctuations nor to policy change which is in direct contrast to other developed nations (Blöndal & Scarpetta, 1999). It should also be noted that for this age group 40 percent is considered quite a high level of participation. That is, in the past 35 years Korea has always been ranked within top third place (with Iceland and Mexico) among 36 OECD countries in terms of elderly (i.e., aged 65 and above) labor force participation rates (OECD, 2017).

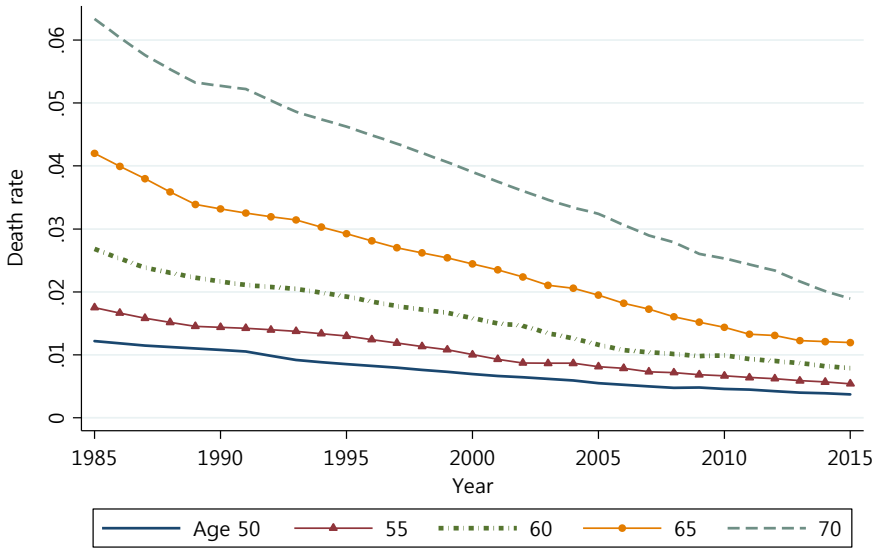

Figure 2. Trend in Mortality of Men, ages 50, 55, 60, 65, and 69, 1985-2015
Source: Death Records in Vital Statistics (1985-2015), Korean National Statistical Office (http://kosis.kr)

Next, in Figure 2, the trend in mortality rates among Korean men between ages 50 and 69 is presented. As is shown, mortality rates rise with age and have continuously fallen over the past thirty five years. However, the rate at which mortality improved over the years is not uniform across age. Rather improvements in mortality were more pronounced at older ages, especially for men aged 60 and above, as compared to men aged 50 or 55. Specifically, the mortality rates for men aged 60, 65, and 69 have declined significantly in 2015 and are about a quarter of what they used to be in 1980. For example, for men aged 69, the mortality rate declined from 0.07 (i.e., 70 deaths per 1,000 males) in 1980 to less than 0.02 (i.e., 20 deaths per 1,000 males) in 2015. In addition, mortality appears to have declined more rapidly in the 1980s for all age groups as compared to recent years.

Finally, Figure 3 depicts the trends in mortality and self-assessed health (SAH) for men aged 50 to 74 over the past two decades. Data on SAH measures were based on individual survey responses of a nationally representative sample of household members in the Korean National Health and Nutrition Examination Survey (KNHANES). The KNHANES has been collected by the Korean Center for Disease Control & Prevention (KCDC) since 1998. As was discussed in Figure 2, it is evident that there was a downward shift in the age-mortality curve over time. Interestingly, SAH also shows marked improvements over the last two decades although the data is noisier due to smaller sample sizes. For example, at age 55 roughly 25.4 percent of men reported to be in poor or very poor health in 1998, but in 2015 that number decreased to 20.9 percent. Similarly, although roughly 29 percent of men reported to be in poor or very poor health at age 65 in 1998, only 18.4 percent were reported to be in that state in 2015. This implies that over time both objective and subjective measures of health have substantially improved for older men in Korea.

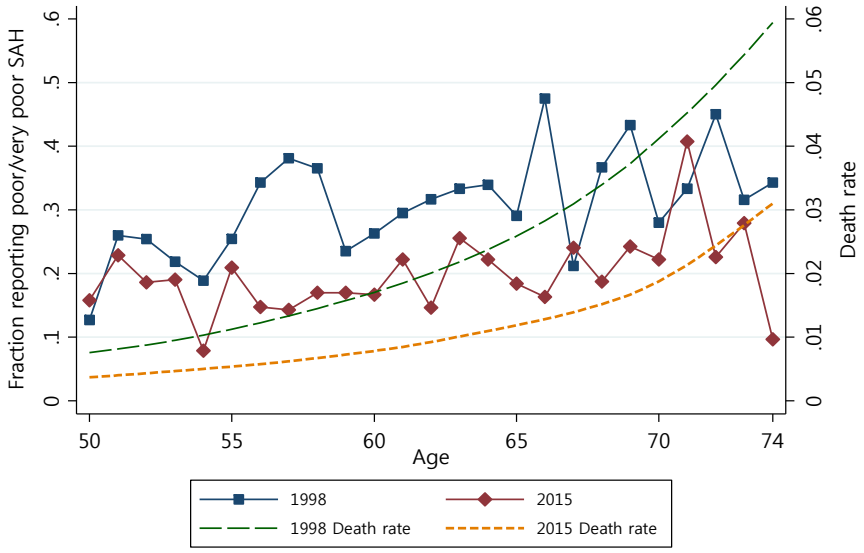

Figure 3. Men's Mortality and Self-assessed Health, aged 50 to 74, 1998 vs. 2015
Source: Death Records in Vital Statistics (1980-2015), Korean National Statistical Office (http://kosis.kr); Korean National Health and Nutrition Examination Survey (1998, 2015), Korean Center for Disease Control & Prevention (http://www.cdc.go.kr)

To summarize, Figure 1 confirms that the labor force participation rate of men aged 55-64 has been slightly increasing in the past three decades, while that of men aged 65 and above has been pretty much stable. Figure 2 and 3 indicate that health in terms of both mortality and SAH has improved markedly for Korean adult men aged 50 and above and that health gains over time may be larger at older ages. In the below sections, change over time in the relationship between employment and mortality will be explored employing two methods suggested by Milligan-Wise (2012) and Cutler et al. (2013).

MILLIGAN-WISE METHOD

Data and Variable Construction for Milligan-Wise Method

As mentioned earlier, the method suggested by Milligan and Wise (2012) essentially relies on comparing the difference in the relationship between employment and mortality rates across time points to predict how much more people today could work if they behaved like people in the past. To calculate an estimate of the ability to work at older ages, average employment rates at a given level of mortality for years 1986 and 2015 were mapped, respectively, and later differenced. Thus, the difference in employment rates across years indicates how much people today should work if they are to work as much as people with the same mortality rate worked thirty years ago (Coile, Milligan, & Wise, 2016).

For such calculations, data on mortality and employment rates for adults in different age groups were necessary. Annual mortality rate was computed using microdata from two sources: the Vital Statistics for death record and the 2% sample of Korean Census. The vital statistics data provide information on changes in the size of the population by tracking the total number of people who are born, die, get married, and get divorced during a year. The Korean Census is a survey conducted by the National Statistical Office of Korea every five years and provides information on the number of people for each age group as well as the number of people who are employed. Because mortality

rate based on Vital Statistics is available from 1983, we set the baseline period of our analysis to 1986 when both data sources are available. As a result, health capacity to work for the elderly in 2015 is estimated for those who are aged between 55 and 69.

Result for Milligan-Wise Method

Figure 4 illustrates the findings from the Milligan-Wise method by plotting the employment-mortality curve for men in 1986 and 2015. To compute the difference in employment rates across years given a certain level of mortality, identical mortality rates must be available across age groups and years. However, since it is extremely rare for this to occur naturally, we used the idea of linear interpolation and calculated the weighted average of employment rates when necessary. For instance, in 2015, 55-year-old men displayed a mortality rate of roughly 0.54 percent (i.e., 5.4 deaths per 1000 males) and an employment rate of 87.4 percent. However, as mentioned above, the low mortality rate of 55-year-old men observed in 2015 is a result of substantial mortality improvements over time – the mortality rate of 55-year-old men in 1986 was 1.82 percent. In 1986, men with mortality rates similar to 0.54 percent were around ages 40 and 41, with each age group displaying mortality rates of 0.53 percent and 0.586 percent, respectively. Therefore, to compute the employment rate of men who had a mortality rate of 0.54 percent in 1986, we calculated the weighted average of employment rates for 40- and 41-year-olds in 1986 which were 93.05 percent and 93.094 percent, respectively. This resulted in an average of about 93.06 percent. In the end, differences in employment rates between 55-year-old men in 2015 and those with identical mortality rates in 1986 were computed. That is, if 55-year-old men in 2015 had worked as much as men with the same mortality rate did in 1986, the employment rate should have been roughly 5.6%p higher resulting in 93.06 percent instead of 87.42 percent. We can translate this estimate into a unit indicating the number of additional years of work. That is, since at age 55 an additional 5.6 percent of men could have worked, the health capacity to work can be estimated as, on average, 0.056 additional work years (=1 year * 0.056) for this age group.

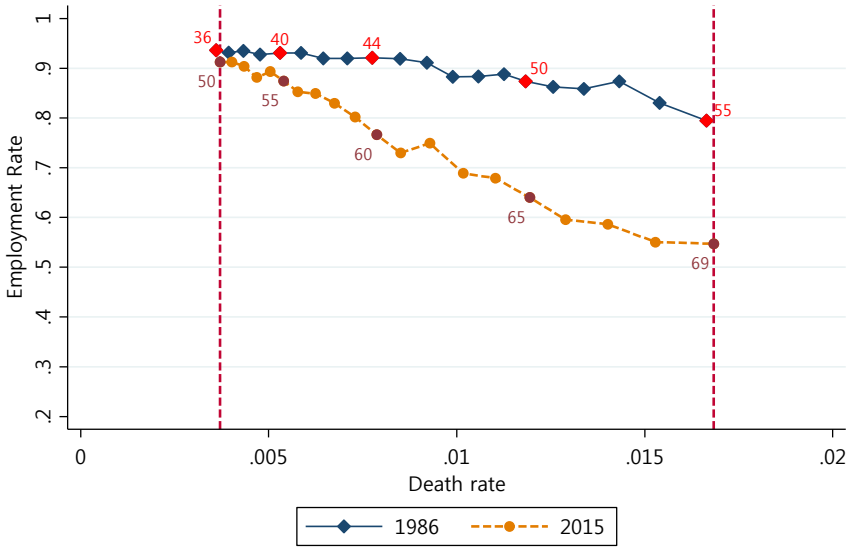

Figure 4. Employment vs. Mortality, 1986 vs. 2015

We apply this exercise for men between ages 55 and 69 and present the results in Table 1. As is shown, the estimated additional employment capacity increases quite rapidly with age which is not surprising given the disproportionate gains in mortality across age groups over the past three decades (see Figure 2). For example, at age 56 an additional 7.8 percent of men could have worked

for an additional 0.078 work years, whereas at age 69 an additional 24.7 percent of men could have worked for an additional 0.247 work years. Potentially, the total additional employment capacity for men aged 55-69 can be computed by accumulating each age group's additional work years, resulting in 2.63 years. Considering that the actual years of employment for Korean men ages from 55 through 69 in 2015 was on average 10.74 years, an additional 2.63years would amount to about a 24.5 percent increase.

Age	Death Rate in 2015 (%)	Employment Rate in 2015 (%)	Employment Rate in 1986 at Same Death Rate (%)	Additional Employment Capacity (%)
55	0.54	87.42	93.06	5.63
56	0.58	85.23	93.09	7.86
57	0.62	84.92	92.37	7.45
58	0.68	82.98	91.97	8.98
59	0.73	80.18	91.99	11.81
60	0.79	76.63	92.03	15.39
61	0.85	72.94	91.85	18.91
62	0.93	74.92	90.78	15.86
63	1.02	68.87	88.28	19.41
64	1.10	67.88	88.67	20.79
65	1.19	63.99	87.19	23.20
66	1.29	59.57	86.07	26.51
67	1.40	58.63	86.86	28.24
68	1.53	55.05	83.44	28.40
69	1.68	54.72	79.38	24.66

Table 1. Additional Employment Capacity for Men in 2015 (Milligan-Wise Method)

Our results in Table 1 critically depend on the choice of a baseline year for comparison to 2015. To check on the sensitivity of our estimates in terms of choosing a different baseline period, we also applied the same method using 1995 and 2005 each as the baseline comparison years (please see Appendix Table 1 for details). When we use 1995 as the baseline year, health capacity to work from ages 55 to 69 is estimated as 2.78 years, while when we use 2005 as the baseline year, health capacity to work from ages 55 to 69 becomes 0.79 years. Not surprisingly, the estimated capacity measures are smaller than our original estimate of 3.7 years with 1986 as the baseline year. The difference in estimates is mainly due to two factors – first, as the gap between periods gets smaller, the improvement in mortality rate gets smaller; and second, mortality rates declined faster in the 1980s and 1990s as compared to the 2000s. Overall, estimates obtained from using the Milligan-Wise method suggest a significant amount of additional work capacity among Korean older adults.

CUTLER ET AL. METHOD

Data and Variable Construction for Cutler et al. Method

A weakness of the Milligan-Wise method is that mortality rates are not a perfect measure of health. Although we were able to show that mortality and self-assessed health (SAH) are strongly correlated (see Figure 3), it is evident that there are other health-related factors that will influence one's capacity to work. To overcome these issues, we apply another method suggested by Cutler et al. (2013). The goal here is to estimate the health capacity to work by taking into consideration a full set of information on health and examining how much more older individuals in a given state of health could work if they were to work as much as their younger counterparts.

To apply the Cutler et al. (2013) method, detailed individual information on demographic characteristics, employment status, and health conditions is needed. We used data from the Korean Longitudinal Study of Ageing (KLoSA) which is collected every even-numbered year beginning in 2006 by the Korea Employment Information Service. It is a nationally representative panel dataset with a sample size of 10,254 adults (i.e., 4,463 men and 5,791 women) aged 45 or above. To facilitate cross-country comparative studies, the KLoSA was created to collect information on a comparable set of survey inquiries as the Health and Retirement Study (HRS) of the U.S. and the Japanese Study on Aging and Retirement (JSTAR) of Japan. As a result, survey questionnaires cover a wide range of topics including health, employment, economic status, and demographic characteristics. We used information from waves 1 through 5 of the KLoSA in our analysis. Our final analytic sample includes 3,243 unique respondents with 10,763 person-year observations who were aged 50-69.

We implement this method through the following steps. First, regressions are estimated to examine the relationship between health and employment, controlling for sociodemographic characteristics, among a sample of Korean adults aged 50-54. Results from this estimation should reflect employment decisions for adults irrespective of any policy inducement to retire since those aged 50-54 are not eligible for national pension benefits or other early retirement benefits in Korea[1]. This is consistent with the works by Coile et al. (2016) in the U.S. and Usui et al. (2016) in Japan. Next, we predict the ability to work of adults aged 55-69 by multiplying regression coefficient values obtained from first step of the analysis with actual values of the older individuals' (ages 55-69) health and demographic characteristics.

Specifically, to examine the relationship between employment and health conditions along with other demographic characteristics, we run a regression of the following specification:

$$Employment_{it} = \beta_0 + \beta_1 Health_{it} + \beta_2 Demographic_{it} + \mu_t + e_{it} \quad (1)$$

, where *employment* is a dummy variable that is equal to 1 if an individual is employed and 0 otherwise. *Health* includes a set of health measures. Among the health measures, SAH was measured as an answer for the following question: 'How would you rate your overall health status?' Responses for this question ranged from 'very good' (coded as 1) to 'very poor' (coded as 5). The responses 2-5 were coded into four dummy variables excluding the benchmark group of 'very good' as a reference category. In addition, *Health* included two dummy variables indicating whether a respondent answered that he/she has difficulty in work because of bad health and whether his/her activity was limited due to physical pain. Information regarding limitations on activities of daily living (ADLs) and limitations on instrumental activities of daily living (IADLs) were collected using seven and ten items, respectively. Dummy variables were created, each separately for measures of ADLs and IADLs, with a value of 1 if one replies yes to at least one of the seven/ten survey items and 0 otherwise. As a measure of depressive symptoms, we used information on one's CES-D score. Health information on whether a respondent has any major diseases such as high blood pressure, diabetes, cancer, etc., whether a respondent is obese, overweight, or underweight, and whether a respondent was a former smoker, currently smokes, or has no experience of smoking at all was included. In terms of *demographic* characteristics, we control for educational attainment, marital status, and

[1] As mentioned earlier, the eligible age of the national pension was raised from 60 to 61 in 2013 and is expected to increase by one year every five years until it reaches 65 in 2033. Equivalently, the eligible age for early retirement benefits was raised from 55 to 56 in 2013 and is expected to increase by one year every five years until it reaches 60 in 2033.

pension coverage. Finally, fixed effects for survey waves were controlled for, μ_t, to capture any time-specific factors affecting employment.

Result for Cutler et al. Method

In Table 2, summary statistics for the variables used in our regression analysis are presented. Overall, the employment rate for Korean men ages between 50 and 69 is 69 percent. Not surprisingly, we find the employment rates of younger respondents to be higher than those of older ones. For example, employment rates were 89 percent for men aged 50-54, but employment rates were only 47 percent for men aged 65-69. On the other hand, self-assessed health (SAH) showed an inverse relationship with age in which the proportion of respondents in poor or very poor health was 27 percent for men aged 50-54 and 53 percent for men aged 65-69. The pattern of declining health conditions with age is pretty much prevalent across all measures of health: there is an increasing proportion of respondents who report they have limitations in ADL or IADL with age; the share of people who experience physical limitations to work increases from 14 percent at ages 50-54 to 30 percent at ages 65-69; CES-D scores rise with age; and the proportion of people reporting that they have chronic diseases such as high blood pressure or diabetes also increases with age.

	Age Group				
	50-54	55-59	60-64	65-69	All
Employed	0.89	0.79	0.63	0.47	0.69
Self assessed health					
Very good	0.02	0.02	0.02	0.01	0.02
Good	0.18	0.12	0.08	0.07	0.11
Fair	0.53	0.52	0.46	0.39	0.47
Poor	0.20	0.24	0.31	0.33	0.27
Very poor	0.07	0.10	0.14	0.20	0.13
Any limitation in ADL	0.01	0.02	0.02	0.04	0.02
Any limitation in IADL	0.10	0.11	0.12	0.14	0.12
CES-D Score (0-10)	2.49	2.62	2.80	3.25	2.80
Physical limit for work	0.14	0.18	0.22	0.30	0.21
Physical limit from pain	0.07	0.09	0.12	0.17	0.11
Major disease					
High blood pressure	0.17	0.24	0.31	0.37	0.28
Diabetes	0.08	0.13	0.17	0.20	0.15
Cancer	0.01	0.02	0.04	0.05	0.03
Lung disease	0.01	0.01	0.02	0.04	0.02
Liver disease	0.03	0.04	0.03	0.03	0.03
Heart disease	0.02	0.04	0.06	0.09	0.05
Cerebrovascular disease	0.02	0.03	0.04	0.06	0.04
Psychiatric condition	0.02	0.02	0.02	0.03	0.02
Arthritis	0.03	0.05	0.08	0.10	0.07
Weight status					
Obese	0.25	0.24	0.22	0.20	0.23
Over	0.36	0.35	0.33	0.32	0.34
Under	0.01	0.02	0.02	0.04	0.02
Smoking (Reference: Never smoke)					
Smoke now	0.48	0.45	0.39	0.31	0.41
Smoked before	0.21	0.25	0.29	0.32	0.27
Educational attainment					
MS dropout or below	0.10	0.15	0.26	0.37	0.22
MS graduate	0.15	0.20	0.22	0.19	0.19
HS graduate	0.49	0.45	0.36	0.30	0.40
2-year col. grad. or above	0.26	0.19	0.16	0.13	0.18
Married	0.91	0.94	0.94	0.92	0.93
National pension	0.73	0.68	0.34	0.11	0.46
Observation	2461	2781	2735	2786	10763

Table 2. Summary Statistics for Men aged 50-69 (KLoSA)

Related to health behaviors, the proportion of those who currently smoke decreases with age, while the fraction of respondents who are neither over- or under-weight increases slightly with age. As to educational attainment, the older cohorts have lower education than their younger counterparts reflecting the rapid industrialization Korea experienced during the 1970s and 1980s. Among men who are aged 65-69, 37 percent of respondents belong to the lowest educational category of middle school dropout or below, whereas only 13 percent tertiary education. In contrast, only 10 percent of men aged 50-54 have attainment levels of middle school dropout or below, while 26 percent have attainment levels of two-year graduate or above.

Variable	All (1)		<= MS (2)		HS (3)		HS < (4)	
	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Self assessed health								
Good	-0.04	(0.04)	-0.01	(0.12)	-0.05	(0.06)	-0.04	(0.06)
Fair	-0.05	(0.04)	-0.02	(0.11)	-0.06	(0.05)	-0.04	(0.06)
Poor	-0.09**	(0.04)	-0.05	(0.11)	-0.10*	(0.06)	-0.13**	(0.06)
Very poor	-0.20***	(0.05)	-0.11	(0.12)	-0.15**	(0.07)	-0.47***	(0.09)
Any limitation in ADL	-0.19***	(0.06)	-0.16	(0.12)	-0.18*	(0.09)	-0.13	(0.11)
Any limitation in IADL	-0.04**	(0.02)	-0.07	(0.05)	-0.02	(0.03)	0.02	(0.04)
CES-D Score (0-10)	-0.01***	(0.00)	-0.02***	(0.01)	-0.00	(0.00)	-0.00	(0.00)
Physical limit for work	-0.15***	(0.02)	-0.23***	(0.04)	-0.10***	(0.03)	-0.09**	(0.04)
Physical limit from pain	-0.02	(0.03)	-0.01	(0.05)	-0.02	(0.04)	-0.09	(0.07)
Major disease								
High blood pressure	0.00	(0.02)	0.05	(0.04)	-0.03	(0.02)	0.00	(0.03)
Diabetes	-0.05**	(0.02)	-0.02	(0.05)	-0.07**	(0.03)	0.03	(0.04)
Cancer	0.11*	(0.06)	0.01	(0.14)	0.09	(0.08)	0.20*	(0.12)
Lung disease	0.21***	(0.06)	0.31***	(0.10)	0.13	(0.13)	0.23**	(0.11)
Liver disease	0.00	(0.03)	-0.05	(0.07)	0.02	(0.05)	0.01	(0.06)
Heart disease	0.09**	(0.04)	0.17**	(0.08)	0.04	(0.06)	0.20**	(0.09)
Cerebrovascular disease	-0.20***	(0.05)	-0.19*	(0.11)	-0.30***	(0.07)	0.19	(0.12)
Psychiatric condition	-0.37***	(0.05)	-0.32***	(0.08)	-0.37***	(0.09)	-0.37***	(0.12)
Arthritis	0.04	(0.04)	0.10*	(0.06)	0.00	(0.06)	-0.05	(0.08)
Weight status								
Obese	0.02	(0.01)	0.03	(0.04)	0.04**	(0.02)	-0.02	(0.03)
Over	0.02	(0.01)	0.01	(0.03)	0.05**	(0.02)	-0.05**	(0.02)
Under	-0.19***	(0.05)	-0.31***	(0.11)	0.01	(0.07)	-0.62***	(0.11)
Smoking (Reference: Never smoke)								
Smoke now	-0.02	(0.01)	-0.01	(0.03)	-0.00	(0.02)	-0.03	(0.02)
Smoked before	-0.01	(0.02)	-0.02	(0.04)	0.01	(0.02)	-0.06**	(0.03)
Education (Reference: HS graduate)								
MS dropout	-0.06***	(0.02)						
MS graduate	-0.00	(0.02)						
2-year col. grad. or above	0.00	(0.01)						
Married	0.17***	(0.02)	0.19***	(0.04)	0.11***	(0.04)	0.09*	(0.05)
Observations	2,436		610		1,195		631	

* : p<0.10, ** : p<0.05, ***: p<0.01

Table 3. Regression Results for Employment on Health Measures for Korean Men aged 50-54

We present results on the relationship between employment and health in Table 3 by estimating equation (1) using a sample of Korean men aged 50-54. The first column in Table 3 shows the results when using all respondents regardless of their educational attainment levels. Results indicate that one's health is strongly correlated with the decision to become employed. Specifically, those who reported that their SAH were very poor appeared to be 20%p less likely to work compared to men whose SAH were very good. There are also statistically significant associations between employment and having any ADL or IADL limitations. Those who have any ADL (or IADL) limitations are 19%p (or 4%p) less likely to work. Having physical limits to work also shows a strong association with employment status by lowering the probability of working by 15%p. Several major diseases are also associated with decreases in the probability of working such as psychiatric condition (37%p), cerebrovascular disease (20%p), or diabetes (5%p). In columns (2), (3), and (4) of Table 3, results on the relationship between employment and health by educational attainment levels are presented. The overall pattern of a positive association between employment and health is consistently observed across groups, but we find that reporting SAH to be very poor seems to have a stronger

negative effect on employment for men with tertiary education as compared to men who are high school graduates or below.

	Observation	Actual % Working	Predicted % Working	Estimated Work Capacity
Panel A. All				
Aged 55-59	2736	79.6%	86.5%	6.9%
Aged 60-64	2681	63.6%	84.5%	20.9%
Aged 65-69	2717	46.7%	79.8%	33.0%
Panel B. MS graduate or below				
Aged 55-59	967	76.2%	82.8%	6.6%
Aged 60-64	1293	65.4%	82.8%	17.4%
Aged 65-69	1526	49.2%	77.8%	28.6%
Panel C. HS graduate				
Aged 55-59	1234	82.7%	89.0%	6.3%
Aged 60-64	963	64.0%	87.7%	23.8%
Aged 65-69	824	48.2%	84.8%	36.6%
Panel D. 2-year college graduate or above				
Aged 55-59	535	78.7%	89.9%	11.2%
Aged 60-64	425	56.9%	89.0%	32.1%
Aged 65-69	367	33.2%	89.5%	56.3%

Table 4. Simulations of Work Capacity (Cutler et al. Method)

Next, to predict the ability to work of adults aged 55-69, we present results of the simulation exercise for three age groups in 5-year intervals from ages 55-59, 60-64, and 65-69 in Table 4. As mentioned above, the simulation exercise basically involves combining the estimated effect of health on employment for men aged 50-54 with the actual health of men between ages 55 and 69. Therefore, the predicted values from this simulation should indicate how much more men aged 55-59 in a given state of health could work if they were to work as much as those aged 50-54. Of course, these estimates are only valid as long as one assumes that the relationship between employment and health are consistent across age groups.

In Panel A, we presented both the share of people who were actually employed and the predicted share of people who would be employed if one uses the coefficients from the regression analysis in Column (1) of Table 3 and the actual characteristics of the respondents. The difference between the actual and predicted shares indicate a measure for the additional work capacity of each age group given health and demographic characteristics. For instance, the share of men who actually worked is 79.6 percent at ages 55-59, however, the predicted share of men who would work from the simulation turns out to be 86.5 percent, resulting in a 6.9 percent additional work capacity for this age group. The estimated work capacity is three times larger at 20.9 percent for men ages 60-64 and almost five times larger at 33.0 percent for men ages 65-69 because the share of men who actually work declines faster with age than do the predicted values in the older age groups. The total sum of additional years of work for men between ages 55 and 69 (i.e., total work capacity) amounts to 3.04 years. Such a result is interesting because it implies that if older men were to make employment decisions related to health as do their younger counterparts, a lot more older men should be

working in the labor market than we currently see. It is also consistent with a scenario in which differences in individual employment are not strongly determined by one's health but rather by incentives to retire induced though social policy or other related programs as argued by Gruber and Wise (2004).

We also explore the potential heterogeneity in health capacity to work by educational attainment levels in Panels B, C, and D of Table 4. Using regression estimation results conducted separately for each education group, as presented in columns (2)-(4) of Table 3, the simulation exercise was repeated for men in three age groups (55-59, 60-64, and 65-69) and three education groups(middle school graduates or below, high school graduates, and 2-year college graduates or above). Allowing the relationship between employment and health to differ by educational attainment should address some of the concerns related to differences in occupational composition across different education groups and the potential for such compositional differences to affect the relationship between employment and health. For example, if men with less education are more concentrated in blue-collar occupations as compared to white-collar occupations, and if it is more difficult to continue working in blue-collar occupations than in white-collar occupations after one experiences a health problem, then we should find that the relationship between employment and health is stronger for men with less, rather than more, education (Coile et al., 2016).

As is shown in Panels B, C, and D of Table 4, the group with the highest age and educational attainment level, i.e., ages 65-69 and 2-year college graduate or above, appears to have the largest estimated work capacity as compared to other groups. Specifically, men aged 65-69 with educational attainment level of 2-year college graduate or above is simulated to have 56.3 percent of additional capacity to work. We also calculated the implied total additional years of work between ages 55 and 69 for each education group based on the simulation results. The value for middle school graduates or below is 2.62 years, for high school graduates the value increases to 3.34 years, and for those who are 2-year college graduates or above the value reaches 4.98 years. In sum, we find that higher educational attainment levels correspond to larger work capacity.

DISCUSSION AND CONCLUSION

South Korea is currently experiencing rapid aging due to stark declines in fertility coupled with remarkable improvements in longevity. To address concerns about to future imbalances in the labor force and sustainability of pension systems, the Korean government has recently reformed policies regarding retirement and attempted to extend people's work lives. However, whether the health of older Koreans would allow them to potentially work more than they currently do is a critical question which has yet to be examined. This paper employs multiple sources of empirical data to estimate the potential health capacity of Koreans to work at old age using two empirical methods – the Milligan-Wise method and the Cutler et al. method. Each method compares the actual working behavior of older Koreans to workers in the past given identical mortality and to younger workers assuming identical employment decisions regarding health, respectively.

Our findings indicate that there is substantial work capacity among Korean elderly males. Specifically, men between ages 55 and 69 in 2015 would have had to work on average an additional 3.7 years to work as much as men with the same mortality worked in 1986. Similarly, men between ages 55 and 69 would have had to work on average an additional 3.04 years to work as much as men between ages 50 and 54 worked in similar health conditions. We also found that health capacity to work is not uniform across subgroups. Those who are more educated show significantly larger margins of health capacity to work as compared to their counterparts with less education.

However, we warn against automatically concluding that older Koreans should work three to four more years than they currently do based on results from the present study. This is because there are many other factors to consider in the decision to exit the labor market such as individual preferences, financial situation, and other unobserved characteristics. Rather, our results should be interpreted as indicating that health is not a major factor inhibiting increased labor market participation among the elderly in Korea. This is an important contribution to policy debates or discussions related to aging society since one of the most common criticisms against policies that induce older workers to prolong exiting from the labor market is its potential to compromise their health.

Unit: %

1) Currently Working		Education level				
	Age group	MS dropout	MS	HS	HS<	All
1. Want to Keep Working	55-59	95.3	95.5	96.3	92.7	95.2
	60-64	93.9	95.4	95.4	93.4	94.7
	65-69	90.2	92.6	92.9	92.1	91.7
2. Main Reason to Want to Keep Working						
Want to keep working if health permit	55-59	27.5	30.0	37.8	51.8	37.7
	60-64	31.3	37.2	43.5	57.8	41.0
	65-69	35.3	40.2	48.5	58.8	42.9
Need of money	55-59	69.7	65.8	56.9	36.4	56.2
	60-64	64.6	58.3	50.5	29.5	52.9
	65-69	59.8	53.8	44.8	25.8	50.2
3. Pension Take-up Rates	55-59	4.9	5.3	5.4	7.0	5.7
	60-64	48.5	49.3	52.0	48.8	50.0
	65-69	80.7	79.6	77.9	79.7	79.5
N		10,605	10,471	17,346	8,024	46,446
2) Currently Not Working						
1. Want to Keep Working	55-59	50.6	63.6	62.2	63.6	60.5
	60-64	49.2	55.8	54.3	51.7	52.8
	65-69	34.5	40.6	39.5	34.2	37.2
2. Main Reason to Want to Keep Working						
Want to keep working if health permit	55-59	16.8	21.5	25.6	39.6	26.2
	60-64	24.6	25.2	38.4	52.5	35.5
	65-69	26.1	29.1	39.6	52.2	35.4
Need of money	55-59	77.4	72.7	64.4	47.3	64.7
	60-64	68.2	65.3	48.9	26.3	51.9
	65-69	64.3	58.5	45.2	25.2	50.4
3. Pension Take-up Rates	55-59	12.6	13.3	20.2	31.1	19.5
	60-64	45.6	50.9	58.6	75.3	57.6
	65-69	79.3	81.2	82.9	85.9	82.0
N		4,304	3,422	5,657	3,269	16,652

< Table 5: >

To further explore the current living circumstances of older Koreans (ages 55-69), using a sample from the Economically Active Population Survey during years 2008 and 2017, we computed a simple cross-tabulation of both working and non-working men on their work desire, motivation, and pension receipt in Table 5. It is quite evident that across all age groups, working men work because they want to. That is, more than 90 percent of working men between ages 55-69 said they want to continue working for pay regardless of age. This is in contrast to non-working men who report much lower desire to work, ranging from 37.2 percent to 60.5 percent across age groups. In addition, the motivation for wanting to work did not vary by men's working status, probably since only respondents who replied that they want to work answered this survey question. Among older Korean men who want to work, slightly more than half reported that they wish to work primarily

because they need the money rather than other reasons. Lastly, the final item indicated whether respondents received any kind of pension benefits in the past year. Not surprisingly, working men were less likely to receive such benefits across all age groups as compared to non-working men, but especially for those between ages 55-59. Also, it is interesting how the proportion of men receiving pension benefits rapidly increases with age for both working and non-working men (reaching about 80-82 percent for men ages 65-69), yet there still exists a large fraction of them who want to work primarily for money.

In sum, it is pretty clear that not only do older Korean men have the health capacity to work more, but there is a large group of men who actually want to work. This is confirmed by the present study's analytic results combined with summary statistics presented in Table 5. In addition, a recent study examining the health effects of retirement on Korean elderly found that transitioning into retirement led to poor physical health, a result that is in direct contrast to findings from most studies in Western contexts, and that such an effect was mediated by both monetary and non-monetary factors (Lee & Kim, 2017). However, if one assumes that the ultimate policy goal for the elderly is be to enhance quality of life by emphasizing health, participation, and security as people age (World Health Organization, 2002), it is quite questionable whether simply creating a policy that prolongs the work lives of Korean elderly would suffice. One must remember that the poverty rate among adults aged 66 or above was 45.7 percent in Korea, in 2015, ranking number one among OECD countries (OECD, 2018). This suggests that a critical review of various labor market policies as well as social investment strategies targeting this population is warranted. Examples may include policies for overcoming age discrimination, providing further education or training opportunities, and externalizing care-giving responsibilities from the family (Hartlapp & Schmid, 2008).

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Appendix Table 1.

Additional Employment Capacity for Men in 2015 (Milligan-Wise Method) – Comparison Year 1995 and 2005 vs. 2015

Age	Death Rate in 2015 (%)	ER in 2015 (%)	ER in Comparison Year at Same Death Rate (%)	Additional Employment Capacity (%)
Panel A. Comparison Year is 1995				
55	0.54	87.42	94.41	6.99
56	0.58	85.23	94.60	9.38
57	0.62	84.92	94.33	9.41
58	0.68	82.98	93.95	10.97
59	0.73	80.18	93.38	13.20
60	0.79	76.63	92.89	16.26
61	0.85	72.94	93.25	20.31
62	0.93	74.92	90.33	15.41
63	1.02	68.87	89.89	21.02
64	1.10	67.88	89.32	21.44
65	1.19	63.99	89.04	25.05
66	1.29	59.57	87.07	27.50
67	1.40	58.63	85.43	26.81
68	1.53	55.05	82.83	27.78
69	1.68	54.72	81.65	26.93
Panel B. Comparison Year is 2005				
55	0.54	87.42	88.39	0.97
56	0.58	85.23	88.14	2.92
57	0.62	84.92	87.29	2.37
58	0.68	82.98	86.20	3.22
59	0.73	80.18	85.71	5.53
60	0.79	76.63	84.44	7.81
61	0.85	72.94	81.00	8.06
62	0.93	74.92	77.73	2.81
63	1.02	68.87	73.50	4.63
64	1.10	67.88	71.94	4.06
65	1.19	63.99	70.01	6.02
66	1.29	59.57	68.17	8.60
67	1.40	58.63	64.16	5.53
68	1.53	55.05	63.41	8.37
69	1.68	54.72	62.84	8.13