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Impact of Retirement and Re-employment on the Life Satisfaction of Older Adults in Korea

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Abstract

An aging workforce has adversely impacted the economy in Korea, amid growing fiscal challenges associated with providing pension and healthcare for older people. The increasing elderly population has raised concerns about the diminishing quality of life among seniors. This study explores the impact of retirement and re-employment on the life satisfaction of older individuals, utilizing longitudinal data from 2008 to 2020. To address endogeneity concerns, we use statutory eligibility ages for retirement pension benefits and the expected monetary value of these benefits as instrumental variables for retirement and re-employment status. Our findings suggest that retirement leads to a significant reduction in overall life satisfaction among older individuals. Conversely, life satisfaction improves significantly when retired individuals are re-employed. This study examines the dynamic effects of retirement on life satisfaction by employing the event study framework and investigating the reversal of retirement through re-employment. The findings emphasize that the life satisfaction of older individuals can be enhanced through policies that enable them to extend their employment or pursue new opportunities after retirement.

Keywords: aging, retirement, re-employment, life satisfaction, longitudinal study, pension

JEL Classification Codes: I31, J14, J21, J26

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Declaration

Conflict of interest: The authors declare that they have no conflict of interest.

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1. Introduction

A rapid demographic shift characterized by population aging is a global megatrend that has transformed labor markets worldwide, posing economic and social challenges. A shrinking and aging workforce negatively impacts economic growth, amid fiscal challenges associated with providing pension and healthcare for older people. Additionally, an aging society has created significant social issues, particularly a decline in the quality of life among older citizens. Many older individuals struggle with insufficient post-retirement income, strained relationships with family and friends, and declining health, even as find themselves having more leisure time.

The Republic of Korea (henceforth Korea) is an illustrative example of a country undergoing a drastic demographic shift toward a super-aged society. Individuals aged over 65 are expected to account for 35% of the population by 2040, doubling to 17.5% by 2022. Meanwhile, the overall population began declining in 2021. According to estimates by Statistics Korea (2023b), the country's population is projected to continuously decrease from 51.7 million in 2022 to 37.7 million in 2070, as illustrated in Figure 1. Conversely, the proportion of people aged over 65 has been rapidly increasing and is expected to grow from the current 9.4 million to 17.6 million in 2070, surpassing the population aged 15–65.

[Insert Figure 1 around here]

Accordingly, labor force participation of older adults has become a significant issue for the Korean economy. The employment rate of the older population has increased significantly over the past decade (Imrohoroglu & Yu, 2024). The employment rate of the population aged 55 and older increased from 44.3% in 2010 to 51.7% in 2022. The employment rates of the population aged 65–69 and 70 and over reached 50.4% and 28.8%, respectively, in 2022 (Figure 2) (Statistics Korea, 2023a).

[Insert Figure 2 around here]

Meanwhile, employment opportunities for both older males and females has been increasing, with the employment rate for older males aged 65 and over increasing from 39.9% in 2010 to 46.7 % in 2022, and for older females in the same age group rising from 21.4% to 28% during the same period. Figure 3 illustrates the life-cycle employment rates by gender for selected years, 2010 and 2022, revealing that employment rates for males remained significantly higher compared to females in all age groups, except 15–24. This difference can be attributed to the fact that after marriage, Korean females primarily focus on household affairs and are involved in child-rearing, leading to lower participation in the labor market.

[Insert Figure 3 here]

A long and healthy life is considered a blessing in Korea. Life expectancy at birth has now reached 83 years, although it remains uncertain whether older Koreans experience greater life satisfaction. Many older individuals may desire to work but struggle to find suitable job opportunities. Even if they manage to secure employment, the available jobs may not be rewarding. Despite Korea's extended life expectancy, many middle-aged and elderly individuals experience early retirement. Korea has a relatively early retirement age compared to other developed countries, which have already extended or abolished their retirement age because of low birth rates and an aging population. For instance, in Japan, the official retirement age is 60, similar to Korea. Nevertheless, Japanese companies implement this strictly by protecting employment until the age of 60, and they often rehire workers who wish to continue working after retirement. In contrast, the average retirement age for Korean workers' primary jobs is only 49.4, more than ten years shorter than the official retirement age (Statistics Korea, 2023). Consequently, many baby boomers in Korea, born between 1955 and 1963, are seeking new jobs or starting their own business after early retirement. Unfortunately, when older individuals are re-employed, many of them end up working in

low-wage, low-productivity positions. The relative poverty rate of Koreans aged 65 and older stood at 39% in 2021, the highest among the Organisation for Economic Co-operation and Development (OECD) member-countries.[1] The government has attempted to address this situation by creating public sector jobs for older citizens. However, most of these opportunities are temporary, not full-time or high-paying. Consequently, the struggle to find suitable job opportunities and enjoy a better life after retirement continues to persist among older individuals in Korea.

To enhance the well-being of Korea's growing older population, it is crucial to comprehend the patterns of life satisfaction (or quality of life) over time, particularly concerning individuals' employment status. Retirement from the workforce stands as a pivotal event that triggers significant physical and psychological adjustments in the lives of older individuals.

This study aims to investigate the impact of retirement and re-employment on the life satisfaction of older individuals in Korea. The primary objective is to determine whether overall life satisfaction increases or decreases upon retirement and to assess whether retirees, upon being re-employed, experience greater life satisfaction. We utilize panel data on Korean older individuals to examine the causal impact of retirement and re-employment on life satisfaction, while controlling for individual characteristics that influence life satisfaction, such as educational attainment, gender, age, marital status, household income and assets, and chronic diseases. In addition, we address the endogeneity of retirement and re-employment using instrumental variables.

Our analysis utilizes data from the Korean Longitudinal Study of Aging (KLoSA) from 2008 to 2020 (Korea Employment Information Service, 2020). To construct our sample,

[1] Relative poverty rate is the ratio of the number of elderly people whose income falls below the poverty line; taken as half the median household income of the total population. Data are from OECD (2024).

we assemble a balanced panel comprising individuals aged 55 or older, covering seven surveys conducted at two-year intervals, from 2008 to 2020. We identified participants who had retired during the study period and those who were subsequently re-employed.

Previous studies have investigated the relationship between work, retirement, and life satisfaction in older adults (Maestas & Zissimopoulos, 2010; Blundell et al., 2016). Some empirical studies have revealed that engaging in occupational activities positively impacts life satisfaction of older individuals (Ruchlin et al., 2017). Contrastingly, some other studies have suggested that retirement does not necessarily diminish life satisfaction. Charles (2004) found that retirement positively influences life satisfaction when accounting for the simultaneous relationship between retirement and life satisfaction. Additionally, leisure activities enhance the quality of life of older adults (Lee et al., 2018).

Several studies, employing KLoSA data, have explored the influence of employment and retirement on the life satisfaction of older individuals in Korea. Shin (2007), Kim and Choi (2017), and Min and Cho (2018) demonstrated that retired older individuals display lower life satisfaction than their working counterparts in the labor market. Sung and Ahn (2010) and Son (2010) demonstrated the negative impact of involuntary retirement, including early retirement, on life satisfaction. These studies have consistently revealed the negative impact of retirement on the life satisfaction of Korean seniors. However, the lack of proper consideration of retirement endogeneity in these studies raises concerns about the establishment of a robust causal link between retirement and life satisfaction. It is conceivable that low life satisfaction may have influenced the decision to retire.

Some studies aimed to discern the influence of transitions from full-time employment to full retirement on life satisfaction. Calvo et al. (2009) investigated the impact of complete and phased retirement on retirees' happiness, noting that the perception of the transition's voluntariness rather than its type was crucial. Cho and Lee (2014) reported higher life

satisfaction among completely retired Korean workers than among those who opted for part-time work after retirement.

Limited research has examined the shift in life satisfaction of individuals who have exited and re-entered the labor market. Carlier et al. (2013) demonstrated that individuals who sought re-employment following retirement in the Netherlands exhibited higher life satisfaction compared to those who did not seek re-employment. Lee et al. (2008) reported that Korean elders have a higher level of life satisfaction when they are re-employed.

This study extends the existing body of literature and makes several contributions. First, we employ instrumental variables methods to address the endogeneity of retirement and re-employment decisions. One of the limitations in previous studies exploring the relationship between retirement and life satisfaction is the lack of valid exogenous variations in retirement status (or re-employment status) to prevent multiple sources of endogeneity. Therefore, there is limitation in interpreting the estimated effect of retirement (or re-employment) on life satisfaction as a causal effect. For instance, older people may decide whether to retire in the labor market based on their health status, which is intricately linked to life satisfaction. Older individuals with poor health and lower life satisfaction are more likely to retire than those with better health and higher life satisfaction. Similarly, any changes in unobserved health conditions of spouses or partners of older individuals could influence both their decisions to retire (or seek re-employment) and their life satisfaction. To address these endogeneity biases, we use statutory eligibility ages for retirement pension benefits and the expected monetary value of pension benefits as instruments for retirement and re-employment status. We demonstrate that these instrumental variables are suitable because exogenous variations in individuals' retirement status induced by instruments influence retirement decisions without directly affecting life satisfaction. Our approach aligns with a substantial body of literature that uses reforms in pension benefit eligibility ages as instruments for retirement. For instance,

Charles (2004) and Kämpfen and Maurer (2016) employed eligibility ages in US Social Security retirement benefits as instruments for retirement. Kuusi et al. (2020) analyzed Finnish data to estimate the causal effects of retirement on mental health, while Atalay and Barrett (2014) used Australian data to examine the same. In the Korean context, Kim and Jeong (2021) employed pension eligibility ages as instruments to examine the impact of retirement on health. Our study enhances existing literature by employing both reforms in pension eligibility ages and the amount of expected pension benefits as instruments for retirement to investigate the causal impact of retirement on life satisfaction. Moreover, to the best of our knowledge, our study is the first to employ these instrumental variables to examine the effect of re-employment on the life satisfaction of older people.

Second, this study examines the dynamic effects of retirement on life satisfaction by employing the event study framework and investigating the reversal of retirement through re-employment. We apply a novel strategy to estimate the dynamic effect of retirement on life satisfaction by combining the Wald estimator (Wald, 1940; Angrist and Pischke, 2008) with the event study framework (Cunningham, 2021), as detailed in Section 3.2. We also examine the effects of retirement on life satisfaction, distinguishing between individuals who sought re-employment after retirement and continuously retired individuals among older adults.

Third, compared to existing literature, our analysis utilizes a more extensive time series of Korean panel data, encompassing 12 years of surveys for individuals aged 55 and older. These extensive data significantly enhance the comprehensiveness of our investigation.

The remainder of this paper is structured as follows: Section 2 provides an explanation of the Korean longitudinal data utilized in this study. Section 3 investigates the influence of retirement on life satisfaction of older individuals in Korea. Section 4 evaluates the impact of re-employment on the life satisfaction of older individuals, while Section 5 presents concluding remarks and policy implications.

2. Data

We used panel data from KLoSA. Participants were randomly selected through multistage stratified probability sampling, resulting in a nationally representative sample of Koreans aged 45 and older. The survey focuses mainly on seven main categories: demographics, family, health, employment, income and consumption, assets, subjective expectations, and life satisfaction. KLoSA data are publicly available and can be downloaded from the Korea Employment Information Service website.[2]

The original sample comprised 10,254 adults aged 45 or older in 2006. Subsequent surveys were conducted every two years thereafter, with the eighth survey completed in 2020. The retention rate of the original sample until the eighth survey was 77.1%, resulting in 5,717 respondents available for balanced panel data analysis. From Wave 5 of 2016, 920 individuals were included in the sample. Including this added sample, the total number of participants in the 2020 survey was 7,000.

The survey classifies respondents' economic activity status into three categories: “employed,” “unemployed,” and “economically inactive.” The “employed” category includes individuals who are currently earning income through wage work or self-employment. It also includes unpaid family workers who work 18 hours or more per week. The “unemployed (job seeker)” category includes individuals who are not currently employed for income but are actively seeking a job as well as unpaid family workers working for less than 18 hours per week. The third category, “economically inactive,” comprises individuals who are not currently employed for income and are identified as retired, have never worked, or have worked but do not have a clear job. Retired persons are identified as

[2] https://survey.keis.or.kr/eng/klosa/klosa01.jsp

"not presently working, having no income-related activities, and having no intention to work in the future unless circumstances change."

We constructed the sample using a survival panel of adults aged 55 or older from 2008 to 2020 and identified older participants who experienced retirement during the study period. This sample consisted of 17,535 observations from 2,505 individuals spanning seven surveys. To identify respondents' employment status before 2008, we used the 2006 survey. Based on their employment history, the sample can be categorized into two groups: "retired" and "economically active or never worked." The "retired" group consists of observations in which the respondents reported being retired. The "economically active or never worked" group includes the remaining observations, which can be categorized into two groups, comprising both economically active individuals (both employed and unemployed) and inactive individuals (both "never worked" and or "with no clear job"). Of the total observations in the sample, "retired" observations constitute 53.5%. Among the 2,505 individuals in the sample, 1,944 (78%) reported retiring at some point (Table 1).[3] Among the retired group, we identified the "re-employed" group that comprises observations where respondents reported being retired in an earlier survey but reported being re-employed in the current survey. The "re-employed" observations constitute 6.8% of overall observations and 432 individuals have ever reported as being re-employed.[4]

In addition to employment status, the degree of overall life satisfaction was another important variable of interest. Life satisfaction was measured using the question "Compared to your friends, how satisfied are you with your life overall (or how happy do you feel)?" Respondents provided answers on a scale of 0–100 points with intervals of 10 points.

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[3] Among the retires, we identify "newly retired" for those who had not retired at time t-1 but retired at time t. In the total observations of the sample, the "newly retired" category constitutes 9.7%.

[4] The "newly re-employed," indicating those who were not re-employed at time t-1 but were re-employed at time t, constitutes 2.8%.

[Insert Table 1 around here]

Table 1 presents the characteristics of the respondents. On average, the respondents were about 71.2 years old. Approximately 53% of patients were female. Approximately 40% of observations were made by respondents residing in metropolitan cities. Respondents who completed high school at their highest education level constituted 23% of the sample, whereas those with college degrees accounted for 9%. The mean life satisfaction score was 61.1. Approximately 54% of overall observations were reported as retired, while 7% were reported as re-employed. On average, the respondents reported experiencing 1.45 chronic diseases. The average household income and net assets were reported as 21.4 million won and 247.2 million won, respectively.

Table 1 outlines the traits of respondents who retired within our sample. The overall sociodemographic characteristics of this subset are comparable to those of the total observational sample. However, a higher proportion of respondents resided in metropolitan cities within this subset. Among these observations, those classified as “re-employed” comprised 8.8% of total observations.

This study investigated the association between retirement and re-employment and life satisfaction. Figure 4 illustrates these associations using longitudinal data where the association is drawn without controlling for other variables. The “retired” group consists of observations that respondents reported as being retired at some point during the survey period (indicated as the survey year “t”) and remain retired in the next survey at time “t+1.” Please note that our survey data were collected at two-year intervals. Therefore, we presume that respondents identified as retired in two consecutive surveys remained retired through these years. Conversely, the “re-employed” group comprises individuals who retired earlier but re-entered the workforce at survey year “t” and remained employed at time “t+1” (i.e., two years after “t”). The retirement–life satisfaction profile in Figure 4 shows that the overall life

satisfaction of an older person decreased upon retirement, on average, by about 2.4 points, from 61.5 to 59.1, and remained unchanged after two years. Furthermore, the re-employment–life satisfaction profile shows that retirees, upon being re-employed, experienced higher life satisfaction. The overall life satisfaction of retirees, on average, increased upon re-employment by about 2.0 points, from 60.4 to 62.4, and further increased to 63.9 after two years, reaching the average level of life satisfaction of older individuals who were "economically active or never worked" in the entire period.

[Insert Figure 4 around here]

The patterns shown in Figure 4 can be interpreted as implying that retirement reduces life satisfaction, whereas re-employment restores it over time. However, as mentioned in previous studies, although employment is an essential determinant of life satisfaction, many other older adult characteristics are crucial. For instance, factors such as age, family, place of residence, health, income, and wealth play significant roles in life satisfaction. For instance, Figure 4 shows that the average life satisfaction of retirees is lower than that of older people who were "never retired and never re-employed," even at time "t-1" before the year of their retirement. This could be because retirees tend to be older and poorer than those in the "never retired and never re-employed" group. Therefore, to gain a comprehensive understanding, it is essential to estimate the causal effects of retirement and re-employment on the life satisfaction of older individuals while controlling for these important factors. As some of these factors are unobserved, we must use a convincing identification strategy.

3. Estimation of the Effects of Retirement on Life Satisfaction of Older Individuals

3.1 Empirical specification and estimation results

First, to investigate the effects of retirement on the life satisfaction of older individuals, we established a statistical model applicable to balanced panel data for older people aged 55 and above across multiple survey years as follows:

(1) $Life\ satisfaction_{i,t} = \alpha + \beta_1 Retire_{i,t} + \boldsymbol{X}_{i,t}\beta_2 + u_i + \mu_t + e_{i,t}$.

where $Life\ satisfaction_{i,t}$ is the life satisfaction score of individual i at time t (the year of the survey); $Retire_{i,t}$ is the retirement indicator, which is 1 if individual i reported as retired at time t and 0 otherwise; and $\boldsymbol{X}_{i,t}$ a vector of individual characteristics that influence life satisfaction, such as educational attainment, gender, age, number of unmarried children, marital status, chronic diseases, household income, and household net assets, among others. This specification also controls for individual and time (survey–year) fixed effects. In this formulation, the coefficient of retirement (i.e., β_1) measures the impact of retirement, on life satisfaction, controlling for other factors such as observed individual characteristics and fixed effects.

Table 2 reports the regression results for Equation (1), both with and without controlling for individual fixed effects. Columns (1)–(4) present the results from the ordinary least squares (OLS) regressions. The estimation results are consistent with our predictions. In Column (1) of Table 2, without controlling for any other factors in $\boldsymbol{X}_{i,t}$,, the coefficient of retirement is statistically significant at -3.75, implying that retirement decreases overall life satisfaction of older individuals, on average, by about 3.8 points when compared to their counterparts who had not retired or have never worked.

In Column (2), we incorporate controls for time-invariant individual characteristics such as gender status and educational attainment. In this specification, the coefficient of retirement remains statistically significant at -4.40, indicating a more substantial negative impact of retirement on life satisfaction. The estimation results indicate that among older

people, males generally report higher life satisfaction scores than females, while older individuals with higher levels of education tend to experience greater life satisfaction than those with lower educational attainment.

Column (3) includes both the age and its squared terms. The age variable is marginally statistically significant at 10%, and its square term is not statistically significant. In this specification, the coefficient of retirement remains statistically significant, but decreases in absolute magnitude to -3.46, compared to the estimate in Column (2). This suggests that a proportion of reduction in life satisfaction observed in older individuals who retire, compared to those who are not retired or have never worked, may be attributed to the fact that retirees tend to be older than others.

In Column (4), we control for all individual characteristics in $\boldsymbol{X}_{i,t}$ by adding time-varying individual characteristic variables such as marital status, living in a metropolitan city (against rural and city areas), living with an unmarried child, household income, household net assets, and chronic diseases. The coefficient of retirement is statistically significant and drops further to -2.01. The estimate implies that retirement decreases the overall life satisfaction of older adults, on average, by approximately two points when compared to older individuals who have not retired or have never worked, while controlling for all other individual characteristics. The outcomes derived from this OLS estimation underscore the fact that life satisfaction among older individuals tends to be lower among those who are unmarried, have insufficient income and assets, and suffer from chronic diseases.

[Insert Table 2 around here]

Columns (5)–(8) present the results of fixed effects estimation controlling for individual fixed effects. Retirement is found to be statistically significant across all four specifications. In Column (5), where no other explanatory variables are controlled for, the retirement variable is statistically significant at -1.62. Consequently, compared with the OLS

estimate of -3.75 in Column (1), the fixed effects estimate exhibits a much smaller absolute magnitude.

In Columns (6)–(8), where additional explanatory variables are considered, the coefficients for retirement show minimal variation, ranging from -1.49 to -1.63. Notably, the overall life satisfaction of older individuals experiences an average decrease of approximately 1.5 points upon retirement in Column (8) with fixed effects estimation, in contrast to the approximately 2.0 points observed in Column (4) with OLS estimation. Furthermore, examining the coefficients of the explanatory variables in Column (8) reveals that relocating from rural areas or cities to metropolitan cities, experiencing declines in household income or net assets, and encountering an increase in chronic diseases result in diminished life satisfaction among older people. Conversely, a change in marital status from married to single, whether due to divorce or death of a spouse, is associated with increased life satisfaction among older individuals.

There are concerns that OLS and fixed effects estimations may not be sufficient to account for all confounding factors. A set of control variables reflecting individual and household characteristics, along with individual and survey–year fixed effects, could help reduce biases, but could not eliminate it completely. It is plausible that unobserved omitted variables influencing both employment status and life satisfaction could cause bias. For instance, older individuals' unobserved health condition and family background may be linked to both their decision to retire and life satisfaction. For example, an older person can decide whether to retire from the labor market after considering their health status, which could be closely related to life satisfaction. Those with poorer health and lower life satisfaction scores are more likely to retire than those with better health and higher life satisfaction scores.

In principle, this endogeneity bias can be addressed using instrumental variables, but finding suitable variables to assess the causal effects of retirement on life satisfaction is challenging. In addition to the strong correlation between instrumental variables and individuals' retirement status, it is necessary to have exogenous variations in individuals' retirement status induced by instrumental variables that influence retirement decisions without directly affecting life satisfaction.

We used the statutory eligibility ages for retirement pension benefits as instrumental variables for retirement status. Specifically, we generate an indicator variable to identify whether an individual has reached the pension eligibility age and use it as an instrument for retirement. As shown in Table 3, during our study period, the retirement eligibility age, which determines full pension benefits, varies based on an individual's year of birth.

[Insert Table 3 around here]

For individuals born in 1952 or earlier, the pension eligibility age is 60. The pension eligibility age increased to 61 for individuals born between 1953 and 1956, 62 for those born between 1957 and 1960, 63 for those born between 1961 and 1964, and 64 for those born between 1965 and 1968. The pension eligibility age for those born after 1969 was capped at 65. Consequently, we calculated a respondent-specific indicator for retirement eligibility ages based on the exact year of birth in accordance with these rules.

Given that retirement eligibility ages of 60–65 mainly reflect the institutional aspects of the Korean retirement system, they are unlikely to directly affect life satisfaction, except through the process of retirement. In the terminology of exogenous variation of instrumental variables, for instance, those born on December 31, 1952, and those born on January 1, 1953, should not be systematically different in their characteristics affecting life satisfaction (i.e., the validity of the instrument), but being eligible for pension benefits must be strongly correlated with retirement status (i.e., the relevance of the instrument). First, for validity of

the instrument, it must be satisfied that those born on December 31, 1952, and January 1, 1953, should not differ in their factors affecting life satisfaction, except whether they are eligible for pension benefits.[5] For example, the choice of December 31, 1952, as the birthday cutoff for eligibility for pension benefits is somewhat arbitrary; therefore, the division of older and younger cohorts by this cutoff birthday is not directly correlated with factors affecting life satisfaction. Furthermore, given that individuals cannot choose or manipulate their birthday, a selection between being born on December 31, 1952, and January 1, 1953, is like a random assignment, so that individuals' characteristics on average between these two groups are not systematically different. This random assignment argument is essential for pension eligibility ages to serve as a valid instrument for retirement in our econometric models of life satisfaction. Second, regarding the relevance of the instrument, we can directly test whether eligibility for pension benefits significantly increases the probability of retirement using the data.

Therefore, we apply the two-stage least squares (2SLS) method, using eligibility for pension benefits as an instrument for retirement, to estimate the causal effects of retirement on the life satisfaction of older individuals. The following models are used to implement the 2SLS method:

(2) $Life\ satisfaction_{i,t} = \alpha + \beta_1 \widehat{\text{Retire}}_{i,t} + \boldsymbol{X}_{i,t}\beta_2 + \mu_t + e_{i,t}.$

(3) $Retire_{i,t} = \pi_0 + \pi_1 PE_{i,t} + \boldsymbol{X}_{i,t}\pi_3 + \mu_t + \varepsilon_{i,t}.$

[5] Some complications may arise concerning the validity of the statutory pension eligibility age as instrumental variables when a person receives early retirement pension. First, the Korean system permits individuals to receive a pension up to 5 years earlier than the normal eligibility age, provided they have subscribed to the pension for 10 years or more and their annual income does not exceed a certain threshold. The earlier pension is disbursed at a reduced rate. We do not perceive this issue as significant since the proportion of people receiving early retirement benefits is limited. Furthermore, in Figure 6 we show that any time before the pension eligibility age, there is no significant change in retirement probability. Only after the pension eligibility age, there are substantial increases in retirement probability. Second, another complication can arise because of the broader impacts of pension on people's behavior. For instance, considering expected pension benefits, older adults may alter their lifestyle prior to retirement, significantly impacting life satisfaction. However, as shown in Figure 5, this concern does not look substantial in our dataset because any discernible change does not appear during the time before the pension eligibility age.

where $PE_{i,t}$ is an indicator of whether individual i at time t is eligible for retirement pension benefits. Note that compared to $\boldsymbol{X}_{i,t}$ in Equation (1), the $\boldsymbol{X}_{i,t}$ in Equations (2) and (3) do not include age and age-squared variables because pension benefit eligibility age is entirely determined by age. Additionally, in the 2SLS estimation, we exclude individual fixed effects owing to the lack of over-time variation in the instruments, which results in a lower precision of coefficient estimates.

Table 4 reports the 2SLS results using Equations (2) and (3). The specifications from Columns (1) to (4) differ by included control variables in $\boldsymbol{X}_{i,t}$ in Equations (2) and (3). In Panel B, we report first stage estimation results that relate retirement pension eligibility and actual retirement. We determine that becoming eligible for pension benefits increases retirement probability by around 18 percentage points (%p) in Column (4) to 23%p in Column (2) and these estimated increases in retirement probability are highly significant as F-statistics are all greater than 10, which is the cutoff for preventing weak instrumental variables.

Panel A of Table 4 reports the second stage estimation. In Column (1), we incorporate survey year fixed effects and policy variables (i.e., retirement status) without including control variables in $\boldsymbol{X}_{i,t}$. The coefficient of retirement is statistically significant, and the effect is -12.49, a magnitude approximately three times greater than the OLS estimate in Column (1) of Table 2, where individual characteristics are not controlled for. In Column (2), we augment the model by including predetermined individual characteristics in $\boldsymbol{X}_{i,t}$ such as gender and education. In this specification, the coefficient of retirement is statistically significant, and the effect is at -8.2, about two times greater than the OLS estimate in Column (2) of Table 2. This 2SLS estimate implies that retirement reduces older adults' overall life satisfaction by approximately 8.2 points. In Column (3), we add time-varying individual characteristics in $\boldsymbol{X}_{i,t}$ such as marital status, living in a metropolitan city, living with a child,

household income, and household assets, finding that the coefficient of retirement is statistically insignificant, while the magnitude of the estimate is -5.4, which is still approximately 2.5 times greater in magnitude compared to the OLS estimate with full control variables in Column (4) of Table 2.

In estimating the impact of retirement on life satisfaction through the 2SLS estimation, it may be desirable to exclude the control variables that were additionally included in Column (3) compared to Column (2). This exclusion is warranted because changing marital status, such as an increase in twilight divorces or relocations from rural areas or cities to metropolitan cities, such as the recent trend of post-retirement returns to farming, can be a consequence of retirement. Subsequently, these changes affect life satisfaction. These time-varying control variables, which are potential intermediate outcomes in the chain of consequences from retirement to life satisfaction, should not be included when assessing the effects of retirement on life satisfaction. The same rationale applies to household income and household assets, because a transition to retirement typically entails a reduction in income and assets, which could subsequently contribute to lower life satisfaction.

Finally, in Column (4), we added the number of chronic diseases. We observe that the coefficient of retirement is statistically insignificant at -1.3. This 2SLS estimate is smaller in absolute magnitude compared to the OLS estimate (-2.0) in Column (4) of Table 2 and similar to the fixed effects estimate (-1.5) in Column (8). Similar to income and assets, retirement also significantly affects health status and could serve as a pathway that impacts life satisfaction. Numerous studies (van Solinge, 2007; Jokela et al., 2010; Coe & Zamarro, 2011; Behncke, 2012; van der Heide et al., 2013; Atalay & Barrett, 2014; Insler, 2014; Eibich, 2015; Kim et al., 2016; Kim & Choi, 2017; Kim & Jeong, 2021) have reported a significant effect of retirement on health. For instance, Behncke (2012) found that retirement significantly decreased the mental and physical health of older individuals. Kwak and Lee

(2024) demonstrate that after controlling for endogeneity using pension eligibility as instrumental variables, retirement has a detrimental impact on the health of older individuals in Korea, particularly on their mental well-being. Conversely, Jokela et al. (2010) observed that statutory and voluntary retirement had positive effects on mental health and physical functionality. Examining 22 longitudinal studies, van der Heide et al. (2013) found strong evidence that retirement has a positive effect on mental health.

Therefore, we adopt the specification used in Column (2) to allow pathways through relocation, divorce, income, and health to impact life satisfaction as our primary specification for subsequent estimations, employing the eligibility age for pension benefits and their expected amounts as instrumental variables. Based on our primary estimates in Column (2), retirement results in a reduction in life satisfaction score by 8.3. When we account for behaviors that may be influenced by retirement, such as divorce, relocation from rural areas or cities to metropolitan cities (or vice versa), as well as income and assets, which are also affected by retirement, the negative impact of retirement on life satisfaction declines to 5.4 in Column (3). This suggests that a decrease of 2.9 (=8.3-5.4) in the overall impact can be attributed to these factors. Moreover, if we introduce an additional control for the number of chronic diseases as a health proxy, the effect of retirement on life satisfaction further declines to 1.3, resulting in an additional reduction of the impact by 4.1 (=5.4-1.3) owing to health considerations.

[Insert Table 4 around here]

3.2 Robustness of the results

(1) Additional instruments – expected pension amount

We now use the expected monetary value of pension benefits as an instrument in addition to the eligibility for pension benefits indicator. Employing a continuous variable, as opposed to binary variables, can enhance estimation precision in certain cases. This is

because the source of variation for the policy variable—in this instance, the expected monetary value of pension benefits—exhibits a greater variance.

In 2SLS implementation, we use the following first stage estimation regression model:

(4) $Retire_{i,t} = \pi_0 + \pi_1 PE_{i,t} + \pi_2 PE_{i,t} * \mathrm{E}(\mathrm{Pension}_{i,t}) + \boldsymbol{X}_{i,t}\pi_3 + \mu_t + \varepsilon_{i,t}$.

where $\mathrm{E}(\mathrm{Pension}_{i,t})$ is the expected monetary value of pension benefits, and we use the leads of future realized pension benefits at $\mathrm{Pension}_{i,t+1}$, $\mathrm{Pension}_{i,t+2}$, and $\mathrm{Pension}_{i,t+3}$. Pension benefits are defined as the total amount of public pension, comprising national pension (old-age, disability, and survivor) and specific corporate pension (private school teacher, government employee, military personnel, and specific post office). The data were sourced from KLoSA, which includes questions about the pension benefits received by older individuals in a specific calendar year.

In Table 5, we report the results when the multiplicative term between eligibility for pension benefits and the expected monetary value of pension benefits is added as another instrument for implementing 2SLS. In Column (1), with a lead of k=2, the model suffers from the weak instrumental variables problem with low first stage F-statistics. Meanwhile, in Columns (2) and (3), with leads of k=4 and k=6, we find that the instruments are strong, as the F-statistics are greater than 10. For overidentification tests in both specifications, the p-value was greater than 0.1. Therefore, they passed tests for the validity of instrumental variables. Using alternative instruments, we find that retirement reduces life satisfaction score by 17.8, two-fold greater than the results shown in Table 4.

[Insert Table 5 around here]

(2) Event study estimation for the reduced form

When the instrument is binary, the instrumental variable estimator is equivalent to the Wald estimator (Wald, 1940; Angrist & Pischke, 2009), which is the ratio of two OLS estimators, as follows:

$$(5)\quad \widehat{\beta}_{IV,Wald} = \frac{\hat{E}(y|z=1)-\hat{E}(y|z=0)}{\hat{E}(x|z=1)-\hat{E}(x|z=0)} = \frac{\sum_{i=1}^{n}(z_i-\bar{z})(y_i-\bar{y})}{\sum_{i=1}^{n}(z_i-\bar{z})(x_i-\bar{x})} = \frac{\frac{\sum_{i=1}^{n}(z_i-\bar{z})(y_i-\bar{y})}{\sum_{i=1}^{n}(z_i-\bar{z})(z_i-\bar{z})}}{\frac{\sum_{i=1}^{n}(z_i-\bar{z})(x-\bar{x})}{\sum_{i=1}^{n}(z_i-\bar{z})(z_i-\bar{z})}} = \frac{\widehat{\beta}_{OLS,yz}}{\widehat{\beta}_{OLS,xz}}$$

where $\widehat{\beta}_{OLS,yz}$ could be obtained from the reduced-form estimation where y is life satisfaction and z is eligibility for pension benefit. Furthermore, as in our case, if the policy variable is also binary, the denominator is the probability difference between eligible and non-eligible individuals. For the denominator in Equation (5), first stage estimation results in Table 4 imply that the retirement probability difference is around 20%p. This implies that about 5 times ($=\frac{1}{0.2} = 5$) of the coefficient on retirement in the reduced-form estimates (i.e., the numerator, $\widehat{\beta}_{OLS,yz}$) is equivalent to the instrumental variables estimate, $\widehat{\beta}_{IV,Wald}$. We visualize the effects of retirement on life satisfaction using the event study framework as follows:

$$(6)\ Life\ satisfaction_{i,t} = \alpha + \sum_{k=-3}^{-1}\gamma_k \mathrm{PE(k)_{i,t}} + \sum_{j=0}^{4}\delta_j \mathrm{PE(j)_{i,t}} + \beta_2 X_{i,t} + \mu_t + e_{i,t}.$$

where $\mathrm{PE(k)_{i,t}}$ is an indicator having 1 when year t is k number of years before the event started. Similarly, $\mathrm{PE(j)_{i,t}}$ is an indicator equal to 1 when year t is j years after the event started. Here, the event is "becoming eligible for retirement pension benefits." For instance, suppose that individual i retires in 2010. Then, $\mathrm{PE(k=-1)_{i,t}}$ is 1 if $\mathrm{t}=2008$ and 0 in all other years; for individual i, $\mathrm{PE(j=0)_{i,t}}$ is 1 if $\mathrm{t}=2010$ and 0 in all other years. Employing the Wald estimator in Equation (5), we can obtain the causal effect of retirement on life satisfaction by multiplying 5 for each estimate in Equation (6).

The estimation results for Equation (6) are shown in Figure 5. In all the estimations of Equation (6), we use the same control variables as in Column (4) of Table 4.[6] For all $k =$

[6] When controlling for reemployment, the estimates of γ_k and δ_j change only slightly, confirming the robustness of the results presented here.

$-6, -4, -2$, γ_k and their 95% confidence intervals contain 0. As γ_k captures the mean difference of life satisfaction between treatment (i.e., pension benefits eligible individuals) and control (i.e., individuals not eligible for pension benefits) groups, this means that life satisfaction is not statistically significantly different between treatment and control groups before the event started. However, starting from j=4 and onward (i.e., $j = 4, 6, 8$), which covers four years or more after the event starts, life satisfaction is statistically significantly lower for the treatment group than for the control group. The weighted average of δ_j for $j = 0, 2, 4, 6, 8$ that is multiplied by 5 is comparable to the 2SLS estimates in Table 4.

The estimates for δ_j in Figure 5 are consistent with the estimate, -8.3 in Table 4 because -8.3 divided by 5 (=1/0.2) is -1.66, which is close to the weighted average of δ_j in Figure 5.

[Insert Figure 5 and 6 around here]

We also estimated a reduced-form model that links pension eligibility and retirement as follows:

(7) $Retire_{i,t} = \alpha + \sum_{k=-3}^{-1} \gamma_k \, PE(k)_{i,t} + \sum_{j=0}^{4} \delta_j \, PE(j)_{i,t} + \beta_2 X_{i,t} + \mu_t + e_{i,t}$.

In Figure 6, we plot γ_k for k =-3, -2, -1 and δ_j for j=0,1,2,3,4. γ_k captures the differences of mean retirement proportion between a group eligible for retirement pension benefits and a group not eligible before the event, which is the initial year by pension eligibility rule. Therefore, without any significantly different shocks between these two groups, γ_k should not be significantly different from 0. Meanwhile, δ_j captures the differences of mean retirement proportion between these groups after the event. The main finding is that prior to individuals being eligible for retirement pension benefits, the proportion of retired individuals was approximately 15%. However, it gradually increased

from year 0 (i.e., event year) onward and up to 35% around six years after individuals were eligible for retirement pension benefits.

4. Effects of Re-employment after Retirement Reversion on Life Satisfaction

In this section, we examine the effect of re-employment on life satisfaction. In Section 3, we determined that retirement results in a significant reduction in life satisfaction among older individuals. Conversely, for individuals who have already retired, re-employment represents a reversal of the retired state. Therefore, we anticipate that the impact of re-employment on life satisfaction is opposite to that of retirement on life satisfaction.

First, we investigate the effects of re-employment on the life satisfaction of older individuals by adopting the OLS and fixed effects techniques using balanced panel data for older people aged 55 and above who retired during the sample period.

(8) $Life\ satisfaction_{i,t} = \alpha + \beta_1 Reemploy_{i,t} + \beta_3 X_{i,t} + u_j + \mu_t + e_{i,t}.$

where $Reemploy_{i,t}$ is the re-employment indicator, which equals 1 if individual i reported as re-employed at time t after experiencing retirement during the sample period, and 0 otherwise. In this formulation, β_1 measures the impact of re-employment on life satisfaction, controlling for other factors, compared to when remaining retired.

[Insert Table 6 around here]

Table 6 presents regression results for Equation (8) with and without controlling for individual fixed effects. Columns (1)–(4) display OLS regression outcomes. The results consistently show an increase in life satisfaction among retired individuals when they are re-employed. In Table 6, Column (1) reveals a statistically significant impact of re-employment, and the effect is at 2.85, without controlling for other factors in $\boldsymbol{X}_{i,t}$. This indicates that, on average, the overall life satisfaction of a retired older adult increases by approximately 2.9

points when re-employed. This coefficient, though marginally smaller in absolute magnitude, is opposite in sign to the OLS coefficient of retirement (i.e., -3.75) in Column (1) of Table 2.

In Column (2), controlling for time-invariant characteristics such as gender and education, the coefficient of re-employment remains statistically significant but decreases marginally to 2.53. Column (3), which incorporates age and its squared terms, shows a substantial decrease in the re-employment coefficient to 1.35. In Column (4), where all individual characteristics in $\boldsymbol{X}_{i,t}$ are controlled for, the re-employment coefficient is statistically significant and drops further to 1.09. This coefficient, although insignificant in absolute magnitude, is opposite in sign to the retirement coefficient (i.e., -2.01) in Column (4) of Table 2.

Columns (5)–(8) present the results of fixed effects estimation controlling for individual fixed effects. Across all four specifications, coefficients of re-employment are statistically significant. The coefficients of re-employment do not vary significantly, ranging from 1.60 to 1.74. These estimates imply that re-employment increases the overall life satisfaction of an older individual, on average, by about 1.6~1.7 points, controlling for all individual characteristics as well as individual fixed effects.

The estimation of Equation (8) using the OLS and fixed effects methods cannot address endogeneity issues related to the re-employment of older individuals, as these methods cannot address issues related to retirement. For instance, the decision of whether an older individual seeks a new job in the labor market may be influenced by their health status, a factor inherently linked to life satisfaction. Consequently, interpreting re-employment coefficients derived using the OLS and fixed effects methods in Table 6 as indicative of a causal effect on life satisfaction raises some concerns.

Therefore, we apply 2SLS, in which we use the lags of eligibility for pension benefits as an instrument for re-employment, to identify the causal effects of re-employment on life

satisfaction of older individuals.

We start with the first-stage estimation regression model to examine whether pension eligibility helps re-employment.

(9) $Reemploy_{i,t} = \pi_0 + \pi_1 PE_{i,t-k} + \boldsymbol{X}_{i,t}\pi_3 + \mu_t + \varepsilon_{i,t}$.

where the estimation of Equation (9) uses only retired individuals and we use the lagged pension eligibility indicator $PE_{i,t-k}$ for k=2,4. This is because the majority of individuals retire immediately after they are eligible for pension benefits and it takes some time before they are re-employed. Therefore, it takes at least a few years for eligibility to help with re-employment. This was also confirmed by the observation that $PE_{i,t}$ was not a sufficiently strong instrument, as reflected in F-statistics below 10. However, this weak instrumentation issue is mitigated when lagged terms are used.

Table 7 reports the results of the reduced-form estimation. The coefficient estimates for the lagged pension eligibility indicator are highly significant and consistent across the various lags. The result in Column (1) indicates that the probability of re-employment for older individuals increases by approximately 5%p compared to when they were not eligible, two years after becoming eligible for pension benefits. In Column (2), the probability of re-employment also increases by 5%p four years after eligibility for retirement pension benefits. In Column (3), when two lagged pension eligibility indicators are included, both terms are statistically significant. The coefficients suggest that the probability of re-employment increases by approximately 3.9%p and 3.3%p two and four years after becoming eligible for retirement pension benefits, respectively.

[Insert Table 7 around here]

Now we estimate the following equation by 2SLS:

(10) $Life\ satisfaction_{i,t} = \alpha + \beta_1 \text{Reemploy}_{i,t} + \boldsymbol{X}_{i,t}\beta_2 + \mu_t + e_{i,t}$.

where we use the lagged pension eligibility indicators as instruments for re-employment. Table 8 reports 2SLS estimation results. In Columns (1) and (2), we find that for the unemployed, re-employment increases life satisfaction by 40 points and 23 points, respectively. This means that 5% of individuals who were successfully re-employed by being eligible for pension benefits expressed extreme satisfaction at having a job again.

[Insert Table 8 around here]

5. Concluding remarks

Korea is currently experiencing a rapid demographic transition, characterized by a low fertility rate and rapid population aging. The growing older population has prompted concerns regarding the declining quality of life among seniors.

Our study explored the impact of retirement and re-employment on the life satisfaction of older individuals using longitudinal data from 2008 to 2020. To address endogeneity concerns, we employed statutory eligibility ages for retirement pension benefits and the expected monetary value of pension benefits as instrumental variables for retirement and re-employment status. Our findings indicated that retirement leads to a significant reduction in overall life satisfaction of older individuals. Conversely, retirees experience a noteworthy improvement in life satisfaction upon re-employment.

Our study highlights the potential enhancement of life satisfaction among older individuals when they prolong their employment or seek new opportunities after retirement. Therefore, it is imperative that the Korean government explore effective policy responses to foster opportunities for seniors' employment. Desirable policy measures include extending the retirement age and enhancing labor market flexibility, which may involve reforms of the seniority wage system.

It is also important to strengthen effective training programs aimed at imparting new skills for transitioning into a new job. High-quality training programs can help improve the productivity and employability of older workers. Contrary to the perception that older workers may be less productive and innovative owing to age-related decline in physical and cognitive abilities, studies have suggested that job-related training can help older workers remain productive. Training in new skills, particularly those related to information and communication technology (ICT), is essential. Our previous study (Lee et al., 2022) supports the idea that productivity decline associated with the aging process can be mitigated by equipping aging workers with ICT skills through training programs.

This study has certain limitations that warrant acknowledgment. First, we did not specify the decision of adults with heterogeneous characteristics to work and retire. However, it is essential to note that the effects of retirement on life satisfaction may vary depending on individual and household characteristics. For instance, individuals with low post-retirement income, poor health, weak family support, and unsatisfactory leisure activities may experience lower life satisfaction following retirement than others. It is also possible that older individuals respond differently depending on the characteristics of retirement, such as expected and unexpected retirement and compensation for retirement. These factors can have varying effects on life satisfaction. A careful study of the causal effects of different retirement decisions on life satisfaction depending on individual characteristics requires more information, such as exogenous variations in individual and household characteristics. However, this is beyond the scope of the present study.

It would also be interesting and important to examine why life satisfaction declines after retirement, which could be attributed to various factors; therefore, it requires in-depth investigation, which is beyond the scope of this study. Future studies may consider factors such as a sense of loss from not being able to work, a decrease in income, health

deterioration, and increased family conflict as potentially important factors that interact with retirement to reduce life satisfaction. Therefore, we intend to investigate these specific pathways in future studies.

Concerning re-employment, it is also important to examine whether older individuals with certain characteristics were more likely to be re-employed, and how re-employment's impact on life satisfaction differs among groups with distinct individual and household characteristics. Additionally, the impact of re-employment can vary significantly depending on the nature of work. It is imperative to explore this issue in future studies.

References

Angrist, J. D., & Pischke, J. S. (2009). Parallel worlds: fixed effects, differences-in-differences, and panel data. In *Mostly Harmless Econometrics: An Empiricist's Companion* (pp. 221–248). Princeton University Press.

Atalay, K., & Barrett, G. F. (2014). The causal effect of retirement on health: New evidence from Australian pension reform. *Economics Letters*, *125*(3), 392–395.

Behncke, S. (2012). Does retirement trigger ill health? *Health Economics*, *21*(3), 282–300. https://doi.org/10.1002/hec.1712

Blundell, R., E. French, E., &. Tetlow, G. (2016). Retirement Incentives and Labor Supply. In J. Piggott, A. Woodland (Eds), *Handbook of the Economics of Population Aging*, North-Holland, Volume 1, 457–566,

Calvo, E., Haverstick, K., & Sass, S. A. (2009). Gradual retirement, sense of control, and retirees' happiness. *Research on Aging*, 31(1), 112-135.

Carlier, B. E., Schuring, M., Lotters, F. J., Bakker, B., Borgers, N., & Burdorf, A. (2013). The influence of re-employment on quality of life and self-rated health, a longitudinal study among unemployed persons in the Netherlands. *BMC Public Health*, *13*, 503. https://doi.org/10.1186/1471-2458-13-503

Charles, Kofi K. (2004). Is retirement depressing?: Labor force inactivity and psychological well-being in later life. In *Accounting for Worker Well-being* (pp. 269–299). Emerald Group Publishing Limited.

Cho, J., & Lee, A. (2013). Life Satisfaction of the Aged in the Retirement Process: A Comparative Study of South Korea with Germany and Switzerland. *Applied Research in Quality of Life*, *9*(2), 179–195. https://doi.org/10.1007/s11482-013-9237-7

Coe, N. B., & Zamarro, G. (2011). Retirement effects on health in Europe. *Journal of Health Economics*, *30*(1), 77–86.

Cunningham, S. (2021). *Causal Inference: The Mixtape*. Yale University Press.

Eibich, P. (2015). Understanding the effect of retirement on health: Mechanisms and heterogeneity. *Journal of Health Economics*, *43*, 1–12.

Insler, M. (2014). The health consequences of retirement. *Journal of Human Resources*, *49*(1), 195–233.

Imrohoroglu, S. & Yu, Z. (2024). Labor Supply, Income, and Wellbeing of Older Individuals in China, Japan, and Korea: An Empirical Study, forthcoming *Japanese Economic Review*.

Jokela, M., Ferrie, J. E., Gimeno, D., Chandola, T., Shipley, M. J., Head, J., Vahtera, J., Westerlund, H., Marmot, M. G., & Kivimaki, M. (2010). From midlife to early old age: health trajectories associated with retirement. *Epidemiology*, *21*(3), 284–290.

Kämpfen, F., & Maurer, J. (2016). Time to burn (calories)? The impact of retirement on physical activity among mature Americans. *Journal of Health Economics*, *45*, 91–102.

Kim, B., & Choi, E.-y. (2017). Effects of Retirement on Health and Life Satisfaction (in Korean). *Quarterly Journal of Labor Policy*, *17*(1), 85–107.

Kim, J., Cha, S. E., Kawachi, I., & Lee, S. (2016). Does retirement promote healthy behaviors in young elderly Korean people. *Journal of Behavioral Health*, *5*(2), 45–54.

Kim, J., & Jeong, S. Y. (2021). Impact of Retirement on Health (in Korean). *Journal of Korean Economic Analysis*, *27*(2), 1–30.

Korea Employment Information Service. (2021). User's Guide for 2020

Korean Longitudinal Study of Ageing (KLoSA): Wave 8. https://survey.keis.or.kr/eng/klosa/userguide/List.jsp (*Last access*: *July 1, 2023*)

Kuusi, T., Martikainen, P., & Valkonen, T. (2020). The influence of old-age retirement on health: Causal evidence from the Finnish register data. *The Journal of the Economics of Ageing*, *17*, 100257.

Kwak, D. & Lee, J.-W. (2024). Retirement, re-employment and health of older individuals in Korea, working paper.

Lee, J.H., Kang, H. G., Jung, W. S..Chae, Y.-M., Ji, Y. G. (2008). The Impact of Employment on Elder's Quality of Life (in Korean). *Journal of the Korea Gerontological Society*, *28*(1), 143–156.

Lee, J. H., Lee, J. H., & Park, S. H. (2014). Leisure activity participation as predictor of quality of life in Korean urban-dwelling elderly. *Occupational Therapy International*, *21*(3), 124–132. https://doi.org/10.1002/oti.1371

Lee, J.-W., D.-W. Kwak, and E. Song. (2022). Can older workers stay productive? The role of ICT skills and training. *Journal of Asian Economics, 79*, 101438.

Maestas, N. & Zissimopoulos J. (2010). How longer work lives ease the crunch of population aging. *Journal of Economic Perspectives*, *24*(1): 139–60.

Min, D., & Cho, E. (2018). Patterns in quality of life according to employment among the older adults: the Korean longitudinal study of aging (2008–2014). *BMC Public Health*, *18*(1), 379. https://doi.org/10.1186/s12889-018-5296-x

OECD (2024), Poverty rate (indicator), https://doi.org/10.1787/0fe1315d-en (accessed on 21 January 2024).

Ruchlin, H. S., & Morris, J. N. (1991). Impact of work on the quality of life of community-residing young elderly. *American Journal of Public Health*, *81*(4), 498–500. https://doi.org/10.2105/AJPH.81.4.498

Shin, H. (2007). Retirement Satisfaction and Life Satisfaction of Labor Market Retirees (in Korean). *Monthly Labor Review*, *27*, 81–93.

Son, J.C. (2010). Determinants of retirement and retirement satisfaction in Korea (in Korean). *Quarterly Journal of Labor Policy*, *10*, 125–153.

Statistics Korea (2023a), Economically Active Population Survey, May.

Statistics Korea (2023b), Population Projections and Summary indicators (Korea), KOSIS (accessed January 19, 2023).

Sung, J., & Ahn, J. (2011). A study of retirees' satisfaction on retirement (in Korean). *Korean Economic Studies*, *29*(2), 175–212.

van der Heide, I., van Rijn, R. M., Robroek, S. J., Burdorf, A., & Proper, K. I. (2013). Is retirement good for your health? A systematic review of longitudinal studies. *BMC Public Health*, *13*, 1–11.

van Solinge, H. (2016). Health Change in Retirement. *Research on Aging*, *29*(3), 225-256. https://doi.org/10.1177/0164027506298223

Wald, A. (1940). The fitting of straight lines if both variables are subject to error. *The Annals of Mathematical Statistics*, *11*(3), 284–300.

Table 1 Descriptive Statistics of Our Sample, 2008–2020

Sample	**All**		**Ever Retired**	
Observations	17535		13608	
	Mean	SD	Mean	SD
Life satisfaction	61.13	16.88	60.38	17.36
Retirement (1 if retired, 0 otherwise)	0.535	0.50	0.690	0.46
Re-employment (1 if re-employed, 0 otherwise	0.068	0.25	0.088	0.28
Age	71.20	7.88	71.72	7.89
Gender (1 if male, 0 if female)	0.47	0.50	0.50	0.50
High school (1 if the highest level of education is high school, 0 otherwise)	0.23	0.42	0.23	0.42
College and above (1 if the highest level of education is college and above)	0.09	0.28	0.10	0.30
Marriage (1 if married and living with spouse, 0 otherwise)	0.76	0.43	0.75	0.43
Unmarried child (1 if living with unmarried children, 0 otherwise)	0.18	0.39	0.19	0.39
City (1 if residing in metropolitan area, 0 if residing in city or town)	0.40	0.49	0.44	0.50
Total household income (ten million won)	2.14	2.39	2.04	2.27
Total household net assets (assets–debts, ten million won)	24.69	34.83	23.18	32.94
Number of chronic diseases	1.45	1.25	1.53	1.27

Note: Data were sourced from The Korean Longitudinal Study of Aging. The sample comprises a survival panel of 2,505 adults aged 55 or older from 2008 to 2020, spanning 7 surveys.

Table 2. Impact of Retirement on Life Satisfaction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS1	OLS2	OLS3	OLS4	FE1	FE2	FE3	FE4
Retirement	-3.753***	-4.404***	-3.455***	-2.014***	-1.628***	-1.624***	-1.634***	-1.494***
	(0.261)	(0.256)	(0.261)	(0.262)	(0.338)	(0.338)	(0.338)	(0.339)
Gender		1.756***	1.899***	0.938***		-	-	-
		(0.265)	(0.263)	(0.273)				
High school		5.480***	4.316***	3.245***		-3.401	-3.490	-3.564
		(0.312)	(0.319)	(0.317)		(4.396)	(4.396)	(4.390)
College		9.935***	8.946***	5.904***		-5.945	-5.839	-5.185
		(0.462)	(0.463)	(0.471)		(5.066)	(5.065)	(5.057)
Age			-0.437*	-0.420*			-0.407	-0.401
			(0.237)	(0.235)			(0.252)	(0.259)
Age square			0.000941	0.00162			0.00320*	0.00317*
			(0.00162)	(0.00160)			(0.00176)	(0.00180)
Married				2.722***				-1.318**
				(0.321)				(0.600)
Unmarried child				-2.054***				0.181
				(0.333)				(0.457)
Metropolitan city				-1.805***				-2.932***
				(0.251)				(1.081)
Household income				0.589***				0.239***
				(0.0561)				(0.0569)
Household assets				0.0572***				0.0238***
				(0.00372)				(0.00532)
Chronic diseases				-1.653***				-0.648***
				(0.102)				(0.214)
Constant	63.21***	60.51***	84.91***	79.62***	62.47***	63.75***	76.55***	78.02***
	(0.347)	(0.359)	(8.511)	(8.473)	(0.278)	(1.358)	(9.128)	(9.437)
Observations	17,535	17,535	17,535	17,535	17,535	17,535	17,535	17,535
R-squared	0.013	0.061	0.074	0.120	0.005	0.005	0.005	0.010

Note: Data were sourced from The Korean Longitudinal Study of Aging. The sample comprises a survival panel of 2,505 adults aged 55 or older from 2008 to 2020, spanning 7 surveys. The dependent variable was respondents' overall life satisfaction score on a scale from 0 to 100 points. All regressions are controlled for survey-year fixed effects. Fixed effects (FE) estimation controls for individual fixed effects. Robust standard errors are reported in the parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Pension Eligibility Age by Birthday

Birthday	Pension Eligibility Age
~ Dec 31, 1952	60
Jan 1, 1953 ~ Dec 31, 1956	61
Jan 1, 1957 ~ Dec 31, 1960	62
Jan 1, 1961 ~ Dec 31, 1964	63
Jan 1, 1965 ~ Dec 31, 1968	64
Jan 1, 1969 ~	65

Table 4. Impact of Retirement on Life Satisfaction (2SLS Estimates)

	(1)	(2)	(3)	(4)
Panel A. 2nd Stage				
Retirement	-12.49**	-8.269*	-5.453	-1.334
	(4.998)	(4.339)	(4.681)	(5.373)
Gender		1.189	0.723	0.835
		(0.711)	(0.675)	(0.663)
High school		5.528***	4.414***	3.687***
		(0.739)	(0.738)	(0.794)
College		8.947***	5.988***	4.453**
		(1.288)	(1.405)	(1.575)
Married			4.518***	4.453***
			(1.113)	(1.087)
Unmarried child			-0.611	-0.637
			(0.617)	(0.609)
Metropolitan city			-1.368	-1.644*
			(0.723)	(0.730)
Household income			0.363**	0.399**
			(0.131)	(0.137)
Household assets			0.062***	0.063***
			(0.00823)	(0.00822)
Chronic diseases				-2.081***
				(0.476)
Constant	67.78***	63.47***	57.94***	58.92***
	(1.456)	(1.337)	(2.031)	(1.863)
Panel B. 1st Stage				
Retirement Pension Eligibility	0.217***	0.233***	0.208***	0.178***
	(0.035)	(0.035)	(0.035)	(0.034)
F-statistics (Weak IV test)	38.19	45.02	35.76	27.77
Observations	8652	8652	8652	8652
R-squared	0.01	0.04	0.09	0.12

Note: Data were sourced from The Korean Longitudinal Study of Aging. The sample comprises a survival panel of 2,505 adults aged 55 or older from 2008 to 2020, spanning 7 surveys. The dependent variable is respondents' overall life satisfaction score on a scale of 0 to 100 points. All regressions are controlled for survey-year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 5. Impact of Retirement on Life Satisfaction (2SLS Estimates)

	(1)	(2)	(3)
Panel A. 2nd Stage			
Retirement	-31.87 (20.50)	-19.10*** (6.434)	-17.76** (7.011)
Gender	0.108 (2.082)	0.750 (1.150)	1.057 (1.218)
High school	7.162*** (1.978)	6.579*** (1.120)	6.468*** (1.189)
College	14.95** (5.036)	11.98*** (2.017)	11.83*** (2.058)
Constant	78.35*** (11.96)	69.94*** (3.474)	66.69*** (3.493)
F-statistics (Weak IV test)	2.33	14.5	25.2
Fixed effects	Yes	Yes	Yes
Instruments	$PE_{i,t}$, $PE_{i,t+k} * \log(Pension_{i,t+k})$		
Pension Amount Expectation leads	k=2	k=4	k=4 and k=6
Overidentification Test (Hansen's J-test)	0.671	0.745	0.461
Observations	4566	4163	3005

Note: For the expected pension, we used the log-transformed actual pension amount received by individuals. Survey-year fixed effects are included in all estimations. See notes in Table 4.

Table 6. Impact of Re-employment on Life Satisfaction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS1	OLS2	OLS3	OLS4	FE1	FE2	FE3	FE4
Re-employment	2.852***	2.527***	1.352***	1.086**	1.607***	1.604***	1.739***	1.680***
	(0.527)	(0.515)	(0.518)	(0.504)	(0.522)	(0.522)	(0.524)	(0.523)
Gender		1.104***	1.477***	0.349				
		(0.311)	(0.310)	(0.323)				
High school		5.502***	4.214***	3.001***		-4.279	-4.401	-4.508
		(0.367)	(0.374)	(0.368)		(4.517)	(4.516)	(4.509)
College		10.58***	9.494***	5.941***		-4.265	-4.006	-3.140
		(0.512)	(0.512)	(0.520)		(5.316)	(5.315)	(5.307)
Age			-0.804***	-0.669**			-0.842***	-0.839***
			(0.277)	(0.273)			(0.295)	(0.303)
Age square			0.00325*	0.00322*			0.00593***	0.00594***
			(0.00189)	(0.00186)			(0.00204)	(0.00209)
Married				2.904***				-1.567**
				(0.371)				(0.694)
Unmarried child				-2.357***				-0.325
				(0.387)				(0.535)
Metropolitan city				-2.144***				-2.494**
				(0.285)				(1.217)
Household income				0.749***				0.290***
				(0.0697)				(0.0713)
Household assets				0.0718***				0.0231***
				(0.00463)				(0.00638)
Chronic diseases				-1.582***				-0.692***
				(0.116)				(0.240)
Constant	61.04***	58.22***	97.13***	87.55***	61.09***	62.48***	91.93***	93.81***
	(0.394)	(0.413)	(9.996)	(9.901)	(0.294)	(1.444)	(10.74)	(11.09)
Observations	13,608	13,608	13,608	13,608	13,608	13,608	13,608	13,608
R-squared	0.004	0.052	0.067	0.123	0.005	0.005	0.005	0.010

Note: Data were sourced from The Korean Longitudinal Study of Aging. The sample consists of a panel of 1,944 adults aged 55 years or older who reported being retired in the seven surveys conducted from 2008 to 2020. The dependent variable was respondents' overall life satisfaction score on a scale of 0 to 100 points. All regressions are controlled for survey-year fixed effects. Fixed effects estimation controls for individual fixed effects. Robust standard errors are reported in the parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 7. Impact of Pension Eligibility on Re-employment for Retired Individuals

	(1)	(2)	(3)
Lagged Retirement Pension Benefits Eligibility (1st lag term)	0.0490***	0.0489***	0.0391**
	(0.0106)	(0.0105)	(0.0130)
Lagged Retirement Pension Benefits Eligibility (2nd lag term)			0.0331**
			(0.0101)
Gender	0.0557***	0.0591***	0.0598***
	(0.0128)	(0.0145)	(0.0145)
High school	-0.00948	-0.0154	-0.0176
	(0.0147)	(0.0164)	(0.0165)
College	-0.0374	-0.0419	-0.0439*
	(0.0199)	(0.0224)	(0.0223)
Constant	0.0515***	0.0544***	0.0476***
	(0.00939)	(0.0111)	(0.0114)
Number of lags	k=2	k=4	k=2 and k=4
Observations	7547	5875	5875
R-squared	0.001	0.027	0.034

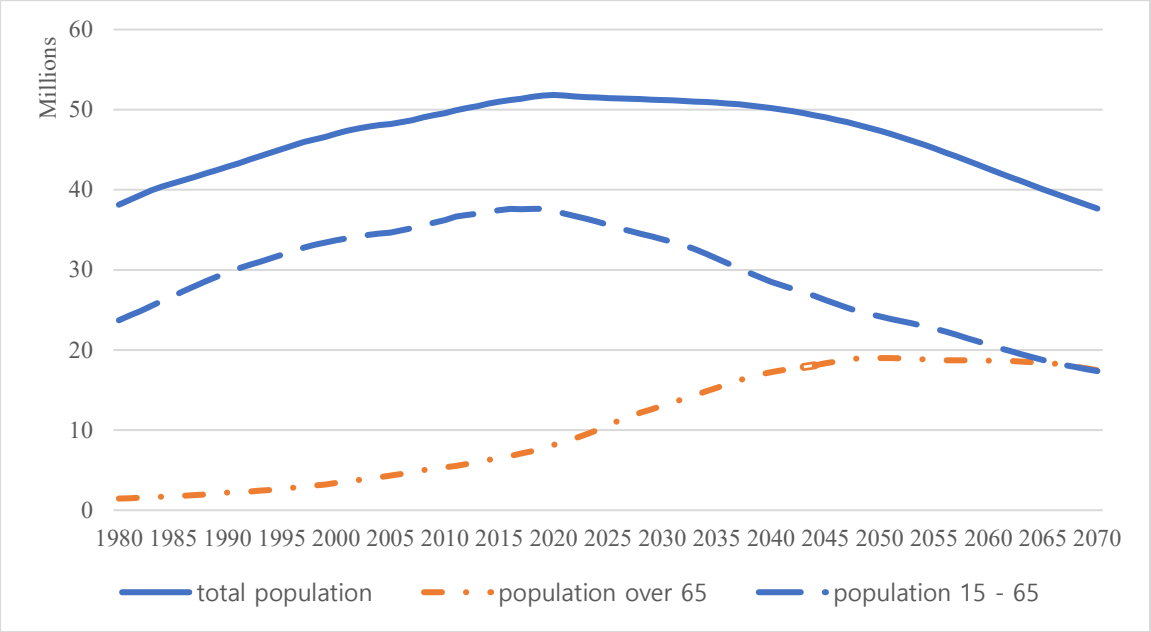
Note: The sample comprises a panel of 1,944 adults aged 55 or older who reported being retired in the seven surveys conducted from 2008 to 2020. The dependent variable is the re-employment indicator, which is 1 if individual i is reported as re-employed at time t after experiencing retirement during the sample period and 0 otherwise. Retirement pension benefits that lag beyond four are not statistically significant. All regressions are controlled for survey-year fixed effects. See notes in Table 6.

Table 8. Impact of Re-employment on Life Satisfaction (2SLS Estimates)

	(1)	(2)	(3)
Panel A. 2nd Stage			
Re-employment	39.98*** (9.856)	23.33** (7.492)	29.41*** (7.774)
Gender	-0.718 (0.833)	-0.259 (0.734)	-0.538 (0.765)
High school	5.036*** (0.849)	5.003*** (0.781)	5.021*** (0.816)
College	11.15*** (1.200)	10.76*** (1.089)	10.94*** (1.145)
Constant	54.78*** (1.371)	56.95*** (1.102)	56.20*** (1.145)
F-statistics (Weak IV test)	37.3	44.7	23.6
R-squared	Yes	Yes	Yes
Instruments	$PE_{i,t-k}$		
Lags of Retirement Pension Benefits Eligibility	k=2	k=4	k=2, k=4
Overidentification Test (Hansen's J-test)			0.06
Observations	9741	7867	7867

Note: The sample comprises a panel of 1,944 adults aged 55 years or older who reported being retired in seven surveys conducted from 2008 to 2020. The dependent variable is respondents' overall life satisfaction score on a scale from 0 to 100 points. See notes in Table 6.

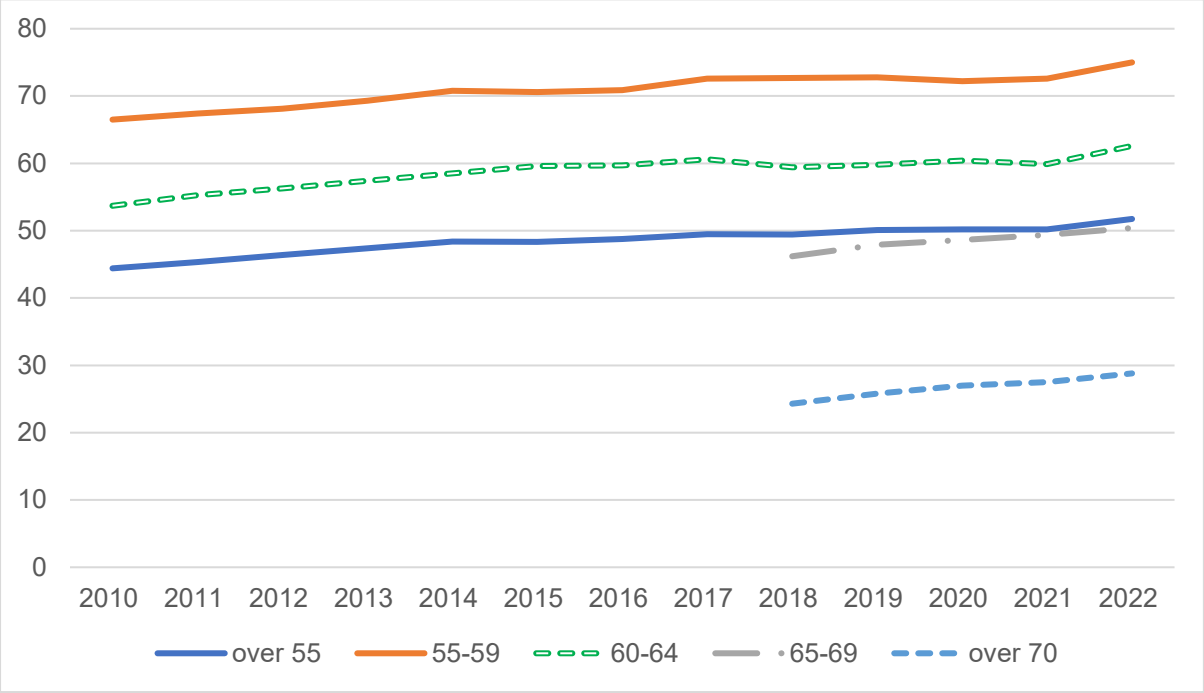
Fig. 1 Trend and Projection of Total Population and Population Structure, 1980~2070



Note: Projections are based on the medium scenario projection.

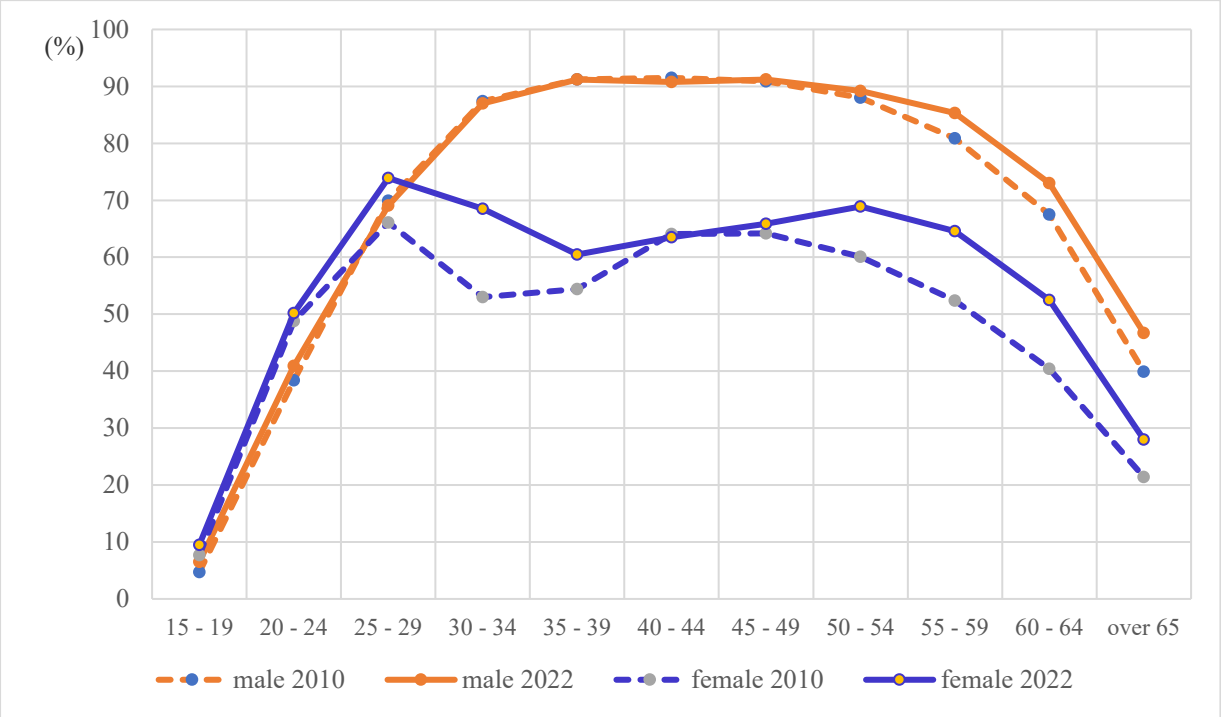
Source: Statistics Korea, Population Projections and Summary Indicators (Korea), KOSIS (accessed January 19, 2023b).

Fig. 2 Trend of the Employment Rate of the Older Population by Age Group, 2010-2022



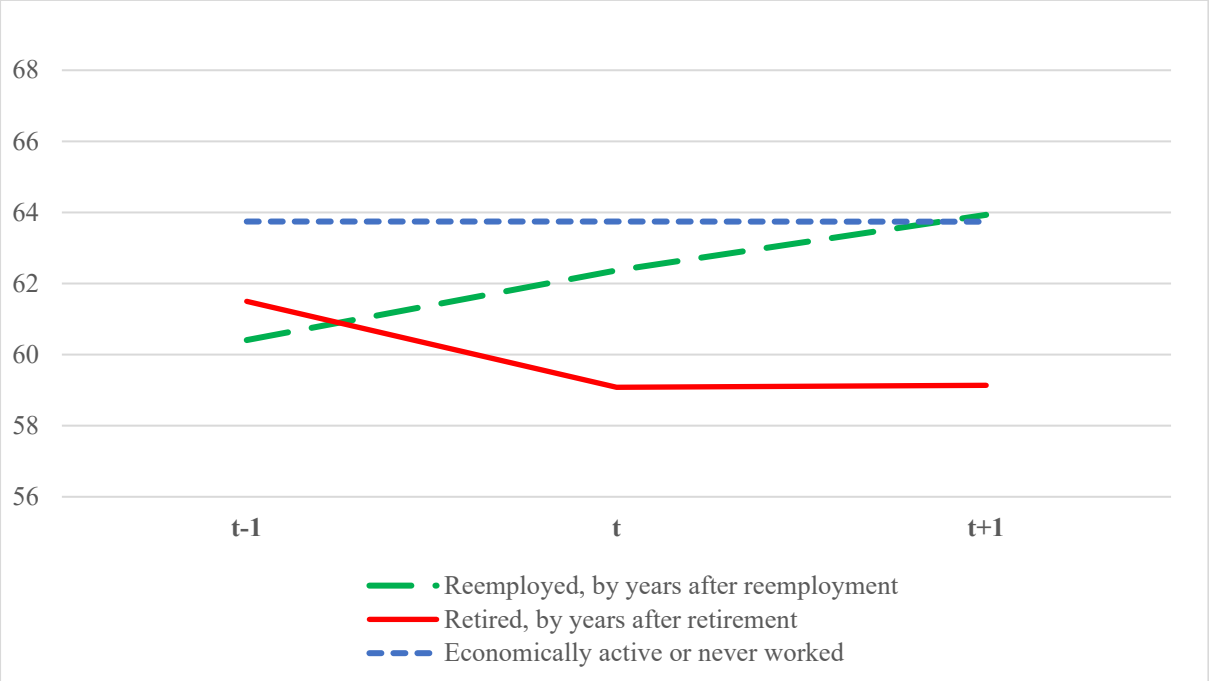
Source: Statistics Korea, Economically Active Population Survey, 2023a

Fig. 3 Life-cycle Employment Rate of the Older Population by Gender, 2010 and 2022



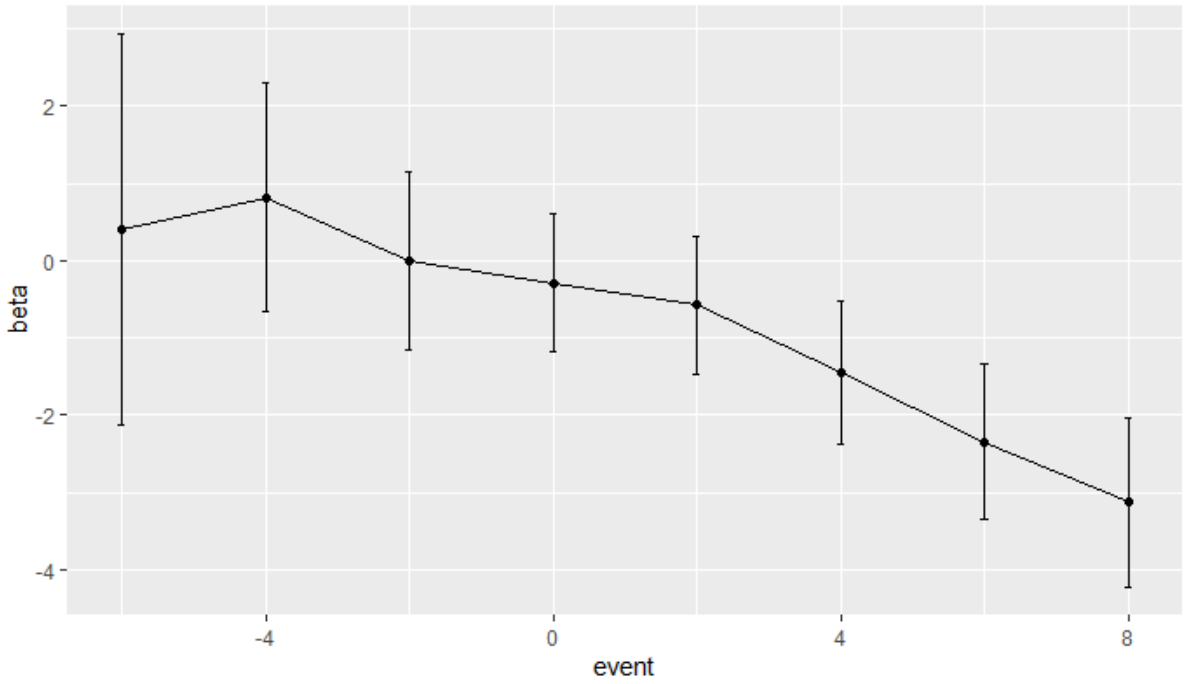
Source: Statistics Korea, Economically Active Population Survey, 2023a

Fig. 4 Change in Life Satisfaction after Retirement and Re-employment



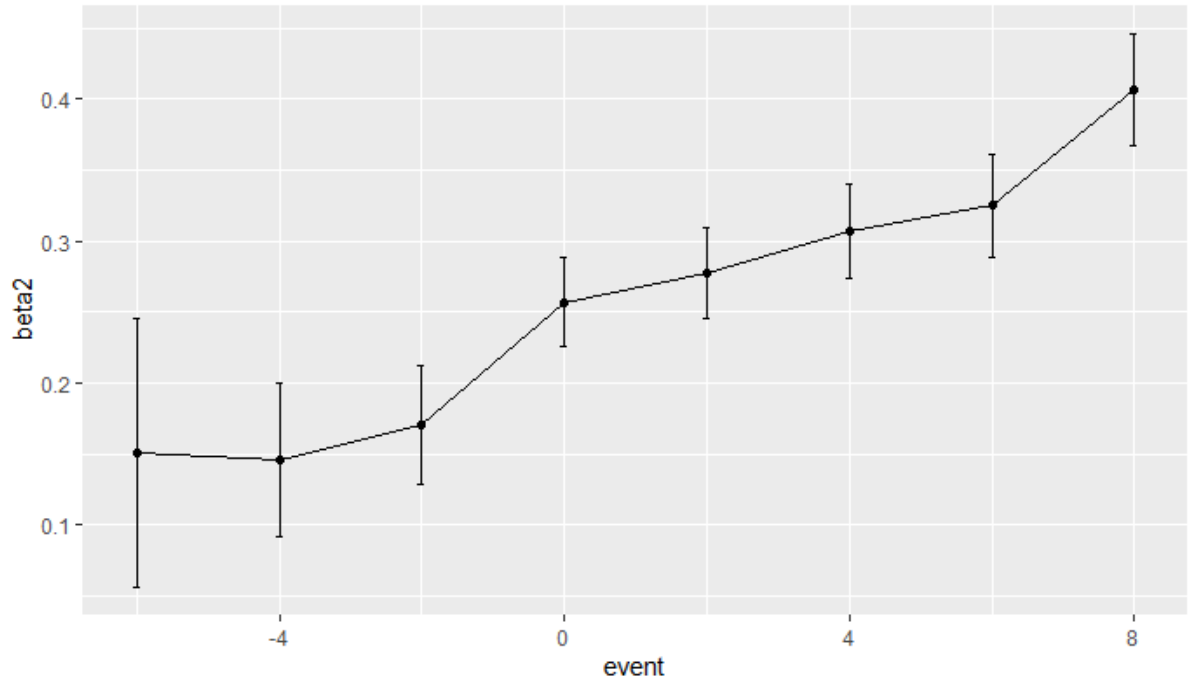
Note: Data were obtained from The Korean Longitudinal Study of Aging. Time "t" indicates the year of the survey in which respondents reported being retired or re-employed for the first time. Time "t-1" and "t+1" indicates the year of the previous and next survey, respectively, taken at a 2-year interval. The "economically active and never retired" group includes individuals who reported being either economically active (employed or unemployed) or inactive (never worked and had no clear job).

Fig. 5 Event Study Estimates: The Impact of Retirement Pension Eligibility on Life Satisfaction



Note: γ_k and δ_j estimates and their 95% confidence intervals are obtained by estimating Equation (6) by OLS. As the data were available every two years, it is plotted from k = -6 to j=8. Observations at k=-8 used as the baseline.

Fig. 6 Event Study Estimates: The Impact of Retirement Pension Eligibility on Retirement



Note: γ_k and δ_j estimates and their 95% confidence intervals are obtained by estimating Equation (7) by OLS. As the data were available every two years, it is plotted from k = -6 to j=8.