Research Paper | 13-10

Promoting Employment Among Older Koreans:

Healthy Ageing, Work and Fiscal Impacts

December 2013 | Eunkyeong Lee

Korea Institute of Public Finance
28, Songpa-daero 28-gil, Songpa-gu, Seoul 138-774, Korea
Tel: 82-2-2186-2114 Fax: 82-2-2186-2179
URL: www.kipf.re.kr

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I

Introduction

As of 2013, the population aged 65 years and over in Korea accounts for 12 percent of the total population. Korea became an ageing society in 2000 when the proportion of elderly 65 and older exceeded seven percent of the population, and is projected to be an aged society by 2017 and a super-aged society by 2026, with the ratio of the elderly population at 14 percent and 20 percent, respectively. According to the United Nations' *World Population Prospects 2008*, South Korea was listed as one of the world's most quickly ageing countries, along with Japan, Germany, Italy, and Spain, which is a trend projected to continue beyond 2050.

Combined with low fertility and the increased life expectancy (LE), population ageing has wide-ranging impact on politics, society, economy and culture. In the economic aspect, the biggest change is a decline in the working-age population (aged from 15 to 64). According to the data from Statistics Korea, the working-age population accounted for 72.8 percent of the total population in 2010, but the ratio began to drop in 2014 and is prospected to drop further to 56.5 percent by 2040. In particular, prime workers aged from 25 to 49, which comprise the leading workforce in the national economy, are expected to see a significant drop from 41.3 percent in 2010 to 26.9 percent in 2040. The declining proportion of the prime-age population in the overall working-age population inversely indicates the increased proportion of the middle-aged and elderly population aged 50 to 64. Furthermore, the elderly population aged 65 and over is prospected to almost triple from 12 percent in 2012 to 32.3 percent

in 2040. The trend of the ageing society raises concerns that it will lead to an increase in the absolute number of the elderly population and the overall ageing of the working population, which would lower labor productivity and weaken the impetus for economic growth in the long term.

Furthermore, population ageing would eventually place an enormous burden on the nation’s public finance, since a diminished working-age population and greater elderly population would lead to a reduction in tax revenues while increasing welfare expenditure on support for the latter group. An increased retired population would reduce tax revenues generated through earned incomes and consumption, while a decline in the working-age population can lower corporate productivity, in turn leading to decreased corporate tax revenue. The rising proportion of older people is expected to correspond to a sharp increase in expenditure on social insurance including pension and healthcare, as the main pillar of welfare. Launched in 1988, the public pension service remains at an immature stage in terms of institutional structure, with government expenditure on public pensions relative to GDP amounting to a mere 0.9 percent in 2010. According to the OECD (2011), however, Korea’s spending on pension is prospected to grow to 6.5 percent of its GDP by 2060, approximately a seven-fold rise from 2010, which is the largest projected increase among OECD countries. Health care expenditure stood at 3.3 percent relative to the average GDP for the period from 2006 to 2010, but is also expected to see an increase to the maximum of 10.9 percent by 2060, while long-term care spending is prospected to grow from 0.3 percent of GDP between 2006 and 2010 to 2 percent by 2060. Combining expenditures on health care and long-term care, the spending level is expected to see a 9.6 percent increase, from 3.6 percent on average for the period from 2006 to 2010 to 13.2 percent in 2060, which is the biggest increase among OECD countries.

As part of the solution to the potential risk in public finance posed by population ageing, this study suggested the proactive utilization of the elderly workforce through the extension of the retirement age, which would allow elderly workers to participate longer in the labor market. In order for the policy of promoting elderly workforce participation to become effective, it is vital to identify the determinants behind the decision of elderly individuals to supply their labor. Therefore, with a focus on middle-aged and elderly people as labor

suppliers, this study investigates the following issues: First, there must be a discussion on whether higher life expectancy leads to increased healthy life expectancy, which is made necessary in that the extension of the retirement age can be justified only when the health status of the elderly population has improved as Korea gradually becomes an aged society. Second, this paper examines the effects of the health status of aged people on the labor market, using the Korean Longitudinal Study of Ageing (KLoSA). Indeed, an improvement in overall health among the elderly may encourage more of them to continue in active employment. Third, the increase in the labor supply from the elderly (labor participation period) will be examined for a possible influence on the government's fiscal status. Extension of the retirement age would lead to a reduction in the government's fiscal expenditure on retirees and an increase in tax revenues incurred from their income-generating activity, thereby reducing the overall burden on public finance. This study analyzed the effect of the increased elderly workforce on government finance, under the assumption that after being passed this year, the Act on Extension of Retirement has subsequently entered into effect.

The study is composed as follows: Chapter II examines the current status of population ageing and the labor market among the elderly; Chapter III provides a review of previous studies; Chapter IV illustrates the result of empirical research; and Chapter V presents the conclusion and policy implications.

Ⅱ

Population Ageing and Labor Market for Elderly People

1 Trend of Population Ageing

A. Life expectancy and healthy life expectancy

Advanced medical technology and increased income have led to the extension of life expectancy around the world, and Korea is no exception. As of 2013, Korea's average life expectancy is 81 years, an increase of approximately 20 years since the 1970s; by 2060, it is expected to continue to rise by 10 years or more, reaching 90. Based on the 2013 OECD Health Data, the comparison of life expectancy by country shows that Switzerland had the longest life expectancy at 82.8, while Korea was also one of the countries with a higher life expectancy than the OECD average of 80.1 years, along with Italy, Japan, Iceland, Spain, France and North European countries. In contrast, Eastern European countries including the Czech Republic, Turkey, and Hungary, as well as the U.S. and Mexico, recorded life expectancy below the OECD average.

Healthy life expectancy (HALE) is an estimate calculated by deducting the time spent in illness from the life expectancy, which demonstrates the expected number of years a newborn may live in good health without facing critical health problems. According to the latest WHO data collated by *The World*

Health Statistics (2010), healthy life expectancy among Koreans is 71, which is slightly lower than the OECD average of 71.5. Major countries with a relatively higher healthy life expectancy include Japan, Switzerland, Australia, Iceland, and Italy, while on the other end of the spectrum are Turkey, Hungary, and Estonia, showing a similar pattern as with the overall life expectancy. A notable feature is that Korea has shorter HALE than LE, so the time for which elderly people suffer from diseases until their death is relatively longer.

B. Ageing index

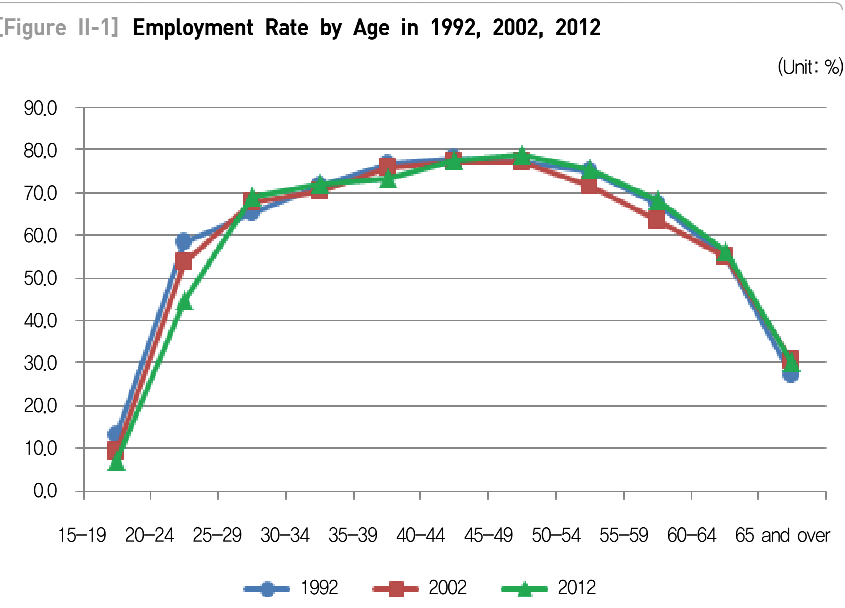
A number of demographic indicators were used in order to identify population ageing, such as the ratio of the elderly aged 65 years and older to the total population, and the old-age dependency ratio, i.e. the ratio of the elderly population to the economically active population aged from 15 to 64. As of 2012, Korea's elderly population (65 years old and over) comprised a moderate proportion of 11.8 percent relative to the total population, but by 2050 it is prospected to more than triple to 37.4 percent. The old-age dependency ratio was also somewhat low at 77.8 percent in 2012, but is expected to rise to 376.1 percent by 2050, a five-fold increase. This would indicate that an economically active person needs to support 3.76 elderly persons. Calculated as the ratio of persons 60 years old and over per hundred persons under the age 15, the ageing index is prospected to sharply rise from 16.1 in 2012 to 71.0 in 2050, rising to a level far surpassing a quadruple increase.

2 Elderly Population's Labor Force Participation

Korea's current employment rate by age group demonstrates a consistent rise in the curve from 10s to 40s and a sharp drop after ages 50-54. In addition, the employment rate at age 65 and older marks a sharp decline to 30 percent. This bell-shaped curve pattern has persisted over the past 20 years despite generation shifts.

[Figure II-1] **Employment Rate by Age in 1992, 2002, 2012**

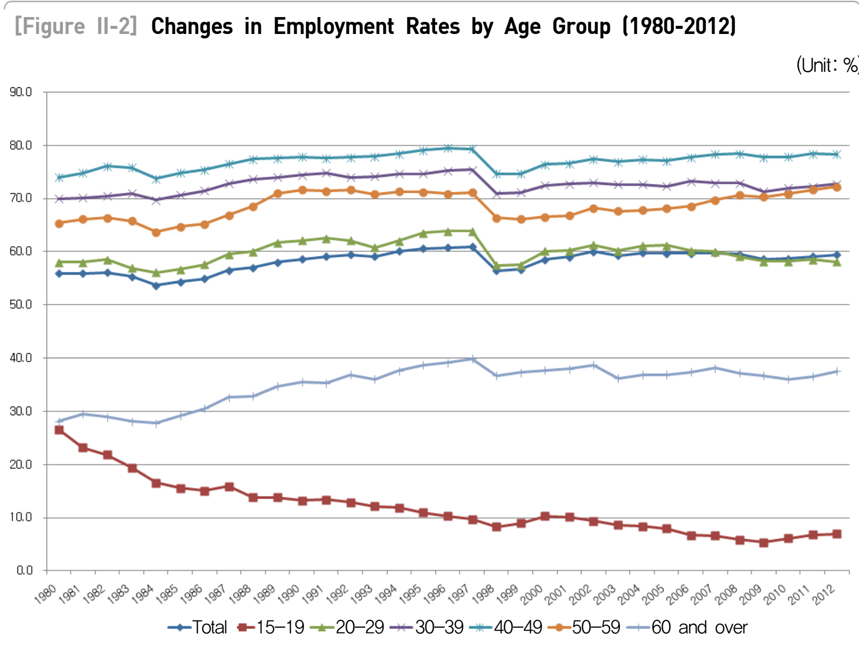
(Unit: %)



Source: Statistics Korea, *Economically Active Population Survey*

Changes in employment by age on a longitudinal section shows that the employment rate for the 50-59 age group has been on a steady rise since the 1990s, while that of 15-19 year olds has been on a continuous decline since the late 1990s. Overall, the age cohorts of 30s and 40s show the highest employment rate while the age cohort of 20s displays a similar pattern to the overall rate. The employment rate for 60s and older rose to 40 percent during the Asian financial crisis in 1997 and this level has been maintained until the present day.

[Figure II-2] **Changes in Employment Rates by Age Group (1980-2012)**



Source: Statistics Korea, Economically Active Population Survey

3 Elderly-Friendly Employment Policy

A. Laws

1) Act on Prohibition of Age Discrimination in Employment and Elderly Employment Promotion (June 4, 2010)

The purposes of this Act are to contribute to the employment security of the aged and to the development of the national economy, by preventing discrimination in hiring practices on the grounds of age without justifiable reasons and by supporting and promoting the employment of the aged to ensure their

attainment of occupations suitable for their abilities. The term “the aged” refers to persons aged 55 and over and “the middle-aged and elderly” refers to those in the age range of 50 to 54. In addition, employers at businesses of a certain size are entitled to tax assistance when employing the elderly in excess of the standard employment ratio stipulated by presidential decree.

(2) Act on Extension of Retirement Age (April 30, 2013): Passed in the plenary session of the National Assembly

The Act on Extension of Retirement Age is a revision of the Act on Prohibition of Age Discrimination in Employment and Elderly Employment Promotion, as the latest version of the legislation to have passed the National Assembly. Article 19 (1) of the said Act stipulates that the retirement age shall be set at 60 years and over; nevertheless, if an employer sets the retirement age at under 60, it is specified that the legal retirement age is deemed to be 60. Article 19 (2) of the same Act prescribes that compliance with the revised law shall entail necessary measures such as the subsequent reorganization of wage system in line with the extended retirement age, while the Ministry of Employment and Labor may provide support through funding for employment, consultation services and other required assistance. In accordance with the revision of this Act, the retirement age of at least 60 years is guaranteed for employees at state-owned enterprises (SOE), public institutions, local state-owned enterprises, and businesses employing over 300 workers, and from 2017, this Act will be extended to apply to businesses hiring fewer than 300 employees, as well as the central and local governments.

B. Master plans

(1) Plan for ageing society and population: Implemented on a five-year basis by the Ministry of Welfare since 2006

The first-phase plan for ageing society and population (2006-2010) was designed to accomplish four objectives: (a) to foster a friendly environment for childbirth and nurturing; (b) to establish the groundwork for improving the

quality of life in an aged society; (c) to secure growth drivers in a low-fertility and aged society; (d) to foster the necessary social atmosphere to aggressively respond to low fertility and population ageing, and to enhance the effectiveness of related policies. With regard to population ageing, the plan also presents several measures to substantiate an income security system for the elderly; to provide the elderly with healthy and secure lives; to promote the participation of the elderly in social activities; to establish elderly-friendly social infrastructure; and to build a productive age-related system for the utilization of the elderly. Specific policies related to the employment of elderly people include the gradual implementation of measures against age discrimination in employment; review on improving the retirement system to allow the linkage between the mandatory retirement age and the eligible age for pensions; reinforcement of support for the wage peak system; support for the diversification of working patterns; vitalization of subsidies to promote elderly employment; expansion of support services to assist job-seeking activities by the elderly; and development of career training programs for the elderly. The first-phase plan for ageing society and population was criticized for excessively emphasizing pension-based income security for the aged population, rather than focusing on utilizing the older workforce in the long term (National Assembly Budget Office, 2012).

The second phase of this plan (2011-2015) maintained the same objectives as the first, but attempted to pursue a different strategy in terms of specific action plans. While the first phase of the plan focused on consolidating the infrastructure to support income security for elderly people, its second phase emphasized on broadening the availability of diverse job opportunities to the elderly. In detail, the second-phase plan includes senior employment expansion measures (vitalization of the elderly-friendly wage peak system, strengthening of subsidies for promoting elderly employment, and extension of baby-boomer employment), support towards seniors-tailored services for job search and transition (reorganization of the grant system to better facilitate job transitions among the elderly, job training and employment assistance tailored to elderly people, and the operation of package programs for job-seeking activities by middle-aged and elderly people), measures for the creation of jobs and support for start-ups with regards to the middle-aged (substantiation of social services jobs for middle-aged people, fostering of socially responsible enterprises with

priority hiring policies for the elderly, assistance for business start-ups by seniors), and countermeasures to utilize retired elderly professionals (greater utilization of retired workforce in science and research, provision of employment counseling services that utilize middle-aged and elderly people, utilization of professionals retired from large companies, and expansion of mentoring services for utilization of middle-aged and elderly female professionals). Although a plan was in place to conduct a variety of promotional and monitoring activities in order to actually eradicate age discrimination in employment, practical and specific measures were not presented. The second-phase plan focused on expanding and supporting the employment of elderly people, but subsequent evaluation raised the concern that the beneficial effect of the plan may be concentrated on regular employees of large companies, while being limited in supporting elderly entrepreneurs in independent enterprises (National Assembly Budget Office, 2012).

(2) Basic Plan for Promoting Employment of the Aged: Implemented on a four-year basis by the Ministry of Labor since 2007

Every five years since 2006, the Ministry of Health and Welfare has established and implemented a plan to address low fertility and ageing society; meanwhile, the Ministry of Labor simultaneously established and began to implement the four-year plan for promoting elderly employment in 2007, out of the necessity to provide more systematic and comprehensive measures for promotion of employment among the elderly.

The objective of this first basic plan (2007-2011) was the achievement of ‘active ageing,’ to become a society that may be aged but retains a sense of vigor and vitality. The implementation strategy for this objective was designed to guarantee the retirement age at 60 and over; promote reemployment of seniors; offer a variety of job opportunities for seniors; and foster an age-friendly environment. Detailed measures include support for reorganization of the wage peak system; development of performance-based wage models; establishment of assistance income programs to compensate shortfalls resulting from greater aged employment; consultation services offered to diversify employment patterns; incentives offered to companies to hire aged workers; creation of hiring

subsidies to promote the extension of the retirement age; development of vocational capacity among elderly people; assistance for elderly people's reemployment; enhancement of feasibility of mandatory quota system for elderly employment; extension of social service jobs working with the elderly; and the pursuit of programs to promote elderly people's employment in the public sector.

The second phase of this plan (2012-2016) intends to review the outcomes of the first phase and create a friendly environment to allow middle- and old-aged people to remain in employment for longer. To implement this plan, specific policy tasks include intergenerational job sharing; support to remain in the main workplace for longer; strengthening the assistance for retirement preparation and capacity development; expanded support for early reemployment and job creation; encouragement of social contribution and talent sharing; and bolstering systems and infrastructures in preparation for an aged society. Compared to the first-phase plan, the second-phase plan presents more diverse measures to offer incentives to promote elderly employment, such as the extension of assistance periods for companies hiring aged people, subsidies for extended employment for the aged; subsidies for wage peak systems, and greater assistance for activities to enhance workforce health.

C. Ministry programs

Among programs pursued by ministries to improve elderly employment, the following are intended to promote demand for elderly workers.

(1) Senior employment promotion program (Ministry of Health and Welfare)

Based on Articles 23 and 23-2 of the Welfare of the Aged Act and Article 11 of the Framework Act on Low Birthrate in an Ageing Society, this program is designed for the central government (Ministry of Health and Welfare) and local governments to collaborate with the executive institution of the program in providing jobs suitable for those aged 65 and over, thereby offering opportunities for income generation and social participation among the elderly. Public sector jobs for this project are created through the government support

for wages and expenses, while those in the private sector allocate wages for elderly workers through the participating companies or earnings from sales of products and services produced by the elderly workers participating in the program. Although those aged from 60 to 64 may find employment through this program depending on the business type and format, the program faces limitations because it does not include middle- and old-aged people.

(2) Support program for senior-friendly companies (Ministry of Health and Welfare)

This program is designed to support the establishment and operation of senior-friendly companies engaged in the consistent creation of quality jobs for elderly people through the full utilization of their experience and capacity while enhancing competitiveness in the private sector. Under this program, the ministry selects approximately 20 companies in which 70 percent or more of paid employees or participants are seniors aged 60 and over, and offers subsidies up to the maximum value of 300 million won in expenditure for professional employees, basic business expenses (cost of rent, investment in facilities, asset acquisition cost, cost of materials, etc.) and management and operational expenses (public utility charges, traveling expenses, expenses for consultation services, education, and promotion).

(3) Support programs for senior employment extension (Ministry of Employment and Labor)

This support program is designed to subsidize employers to raise or abolish their retirement age, or rehire retired employees. Under this program, the retiree reemployment subsidy provides a monthly subsidy of 300,000 won per applicable employee over a period from six months to one year[1)] to reward companies whose retirement age is set at 58 or older, if the company does not dismiss employees upon reaching the retirement age of 58 or older after working

1) The following cases are excluded where retirement years are reduced within three years prior to the three-year continued employment; and employees are made to change jobs because of employment adjustment three months prior to employment or six months after employment.

at the company for more than 18 months,[2] or re-employs them within three months after their retirement. The retirement age extension subsidy is given to a company that eliminates its mandatory retirement age or extends the age to higher than 58 by more than one year, providing a monthly subsidy of 300,000 won per applicable employee, if the company allows employees to remain in employment past the set retirement age after working at the company for more than 18 months. The 60 and over employment subsidy is given to companies without a mandatory retirement age, whose workforce comprises a certain percentage of elderly workers aged 60 and over who have worked at the company for longer than a year, providing a quarterly subsidy of 180,000 won per applicable employee when exceeding the elderly employment quota by a certain extent (this subsidy is a temporary measure available up to 2014). The senior-friendly work environment subsidy financially supports companies to install, improve, replace, and purchase facilities or equipment acknowledged as necessary to ensure job security or promote employment when the employer hires or plans to hire the middle-aged and elderly aged 50 and over. Under this scheme, the employer is permitted a loan of one billion won at maximum, which can be repaid after a five-year grace period over another five years by equal repayment with a three-percent annual interest. At present, the largest portion of public finance for this program is allocated to subsidies for employment extension for elderly workers (60 billion won was subsidized in creation of jobs for the elderly in 2012, of which more than 40 billion won was spent on the subsidizing programs for extending elderly employment).

(4) Subsidies for wage peak systems (Ministry of Employment and Labor)

The wage peak subsidy is designed to subsidize a portion of income loss back to workers when wages or working hours are reduced through a retirement-age extension, reemployment of retirees, or shortened working hours. Under this system, aged workers are guaranteed continued employment, while employers are able to secure an experienced workforce at low costs and cut

2) Subsidy is offered to a manufacture that employs fewer than 500 workers for one to two years.

down personnel expenses, savings from which can be used for recruiting new employees. There are a number of different wage peak systems. The retirement extension type allows wages to be reduced from the point when employees reach the age of 50 or above to the time of their retirement in exchange for the extension of the mandatory retirement age. The ministry provides an annual subsidy of 6 million won for up to 10 years. Adopted by most companies in Japan, the reemployment type can be categorized into two methods: to rehire workers upon reaching the retirement age in return for a wage adjustment, and to reemploy them as part-time (non-regular) or contract workers, while adjusting their wages. The ministry provides an annual subsidy of 6 million won at maximum for up to 10 years. The reduced working-hour type allows employees to work for shorter periods at adjusted wages on conditions such as an extension of the retirement age or guaranteed reemployment, either before or after they reach the retirement age. The ministry provides an annual subsidy of 3 million won at maximum for up to 10 years.

Previous Studies

The relationship between LE and HALE is generally approached not as a topic of independent study but cited as part of the basic premise or background of studies on effects of health on labor supply. Manton *et al*. (2006) analyzed the ratio of active life expectancy (ALE) to total life expectancy (TLE) from 1935 to 2000, using data from National Long Term Care Surveys (NLTCS) and found that the ratio (an indicator of morbidity compression) increased during this period at both age cohorts of 65 or older and 85 or older. This suggests that HALE is increasing faster than LE.

As the second topic of research, the effect of health on the supply of labor has been actively studied through empirical analysis in the U.S., European countries and Australia. Among existing literature, two notable studies have become the central axis in this field, comprising a compilation of research results with a focus on the U.S. by Currie and Madrian (1999) and literature study centering on European countries by Deschryvere (2005). Moreover, the second chapter of the *Handbook of Labor Economics*, by Currie and Madrian (1999), is dedicated to topics such as health capital, health measurement issues, the effect of health on the labor market (wages and labor hours), the endogeneity of health variables, and health and occupation type. Based on this study, Deschryvere (2005) added information on health and labor in European countries and more recent study results.

The theoretical ground for linking health and the labor market is that health is a necessary facet of labor. This perspective is based on the human capital theory in which health assumed to be an aspect of human capital such

as education, which has an impact on labor market outcomes (Becker, 1964; Grossman, 1972). Therefore health improvements would lead to greater accumulation of human capital required for work, thereby increasing the opportunity for labor participation. Along with economic variables such as income, assets, public pension, and old-age income security, health capital is one of the main factors that affect labor supply and retirement decisions. Various other routes for changes in health to influence labor supply include relative changes in the utility function, productivity, and eligibility for disability pension recipients. An individual's utility function is affected by income and leisure time: the more income and leisure time available to an individual, the higher the utility. Accordingly, deterioration of health requires time to be spent on recovery, which increases preferences for spare time and decreases the utility obtained through labor market participation, thereby resulting in a decrease in labor participation rates. Another effect of health on labor market participation is a change in productivity. A decline in health capital hampers labor productivity, which leads to a decline in income from the labor market and thereby lowers a worker's motivation to participate in economic activities. In addition, if the worker is eligible to receive a disability pension, a decline in health capital leads to a decline in the participation rate in the labor market.

In theory, a decline in health capital can increase or decrease the labor supply through the substitution effect and income effect. Based on the substitution effect, the deterioration of health capital can be expected to result in lowering workforce productivity, wages, preference for work, and labor time, in exchange for the time required for medical treatment. If the decline in health capital leads to eligibility for non-wage income such as disability pension, the subsequent income effect will result in a decline in labor supply. In addition, serious health aggravations can significantly reduce life expectancy, which may cause the appearance of increased income for the remaining lifetime. On the other hand, if the decline in health capital increases the demand for medical services and subsequently increases preference for higher income, this can cause an increase in labor supply due to the substitution effect. In summary, a reduction in health capital can theoretically lead to an increase or a decrease in labor supply, but there is a more diverse range of patterns for declining labor supply. Furthermore, examining the empirical analysis results from previous studies demonstrates the

overall consensus that a decline in health capital reduces the labor supply.

This paper is mainly indebted to the work of Romeu Gordo (2011). Laura Romeu Gordo demonstrated using data from the American Health and Retirement Study (HRS) that younger cohorts suffered less from functional problems than elderly cohorts, which demonstrated the trend of healthy ageing. As the enhancement of health standards can enhance the labor supply, the study result was used as a ground for the longer participation of the elderly in the labor force. Using probit and OLS models, Romeu Gordo (2011) estimated the correlation of health indicators related to functionality such as activities of daily living (ADL) and instrumental activities of daily living (IADL), with regards to the decision of labor market participation, and working hours. In order to control for the endogeneity of health variables, the author used medical history of chronic diseases (diabetes, high blood pressure, cancer, heart problems, stroke, etc.) and the body mass index as instrumental variables. However, the selection of instrumental variables requires detailed justification, due to the criticism that chronic diseases incur enduring effects on the patient's present and future health, thereby exhibiting the potential to directly influence labor market participation. The most notable shortcoming of the study was that the HRS data used in the test did not include income or asset variables, which rendered it unable to control for the effect of such variables. As expected, this study found that a bad health status leads to a reduced rate of participation in workforce, and when corrected for endogeneity, the effect can double at least. Therefore, endogeneity leads to a downward bias in the effect of health status on labor participation.

Using a probit model, Mete and Schultz (2002) examined the effect of health on labor participation among the elderly aged 60 and over by using data of the Survey of Health and Living Status of the Middle Aged and Elderly conducted in Taiwan during the years 1989, 1993 and 1996. A relatively diverse range of instrumental variables (IV) were selected to control the endogeneity of health variables: parent longevity (of whether either parent died before age 60), parental education, birthplace (Taiwan or Mainland China) rural/urban residence at age 12, vegetable and pork consumption per capita in the region of birth. Just as in Romeu Gordo (2011), Mete and Schultz (2002) also found that IV estimates of health's effect on labor participation, when exogenous variables were controlled for, were approximately twice the magnitude without

the controls.

Friters *et al*. (2010) estimated the effect of mental health on labor participation by using the Household, Income and Labour Dynamics in Australia (HILDA) survey, with a sample of individuals aged 22 to 64. Whether a respondent experienced the death of a close friend during the past 12 months was used as an IV, and the test result showed that a poor mental health reduced labor participation.

Dwyer and Mitchell (1999) used data drawn from early years of the Health and Retirement Study (HRS, 1991), a nationally representative survey of people aged 51-61 in the U.S., and analyzed the effects of health problems on expected retirement ages. By employing both subjective health measures (self-assessment of health, work limitations) and objective health measures (number of health conditions, indexes of activities of daily living, instrumental activities of daily living, and functional limitations (ADL/IADL/FL), information on each individual condition), five representative models were identified. Instrumental variables include parent's health and mortality, health status, respondent's BMI, nights spent in a hospital (hospitalization period), age, and the number of children, but the relevance of the instrumental variables was not discussed. Among five health parameters, statistical reductions in the expected retirement age were seen through dummy variables, comprised of work limitation, health status index, and ADL/IADL/FL. Unlike other studies, the authors found no endogeneity of health variables and in particular no evidence to indicate justification bias. This may have resulted from setting the dependent variable as expected retirement age instead of labor participation.

Also using probitmodels, Kalwij and Vermeulen (2005) estimated the effects of health status on labor market participation by the middle-aged and elderly, with a sample of 12,237 individuals aged from 50 to 64 across 11 European countries. With the Survey of Health, Ageing and Retirement in Europe (SHARE) in 2004, the authors found that endogeneity stemmed from omitted variable bias, which is caused by the failure to account for other important health variables. They asserted that previous studies generally included self-reported health as the sole health indicator in order to control for health status; however, since the self-assessment of health only comprises a single facet in the multiple aspects of health, endogeneity must be controlled through the inclusion of

variables assessing other health-related aspects. For example, while serious illnesses such as cancer or a stroke may force an individual to exit the labor market, the same is not necessarily the case for mild conditions, as an individual with diabetes or high blood pressure may keep working. The point is that the effects of health on labor force participation can be more accurately estimated by including all health variables previously omitted, rather than using instrumental variables that are difficult to identify. Therefore, the authors included relatively objective variables related to an individual's health (severe condition, mild condition, ADLs, maximum grip strength, obesity) and estimated the relationship with a probit model using variables associated with the dummy variables on whether or not an individual participates in labor market. Separate estimations for each of the 11 countries yielded varying results, but the effects of severe condition and grip strength on labor supply decisions showed statistically significant results. Yet the study faced limitations in that the SHARE, whilst containing abundant data on health status, covers no income-related information including public income transfers and household income, therefore being unable to control for these factors.

Kalwij and Vermeulen (2007) added seven health indicators including self-reported health and mental health to their previous study in 2005 by using the same data. The results showed the impact of self-reported health on labor force participation as being the most influential and statistically significant. Although each country may vary in terms of which health variable has a statistically important impact on labor supply decision, the authors included a wide range of health indicators including subjective health status to counteract the endogeneity issues caused by the omitted objective variable bias.

Cai and Kalb (2006) analyzed the relationship between health and labor force participation by using the data drawn in 2001 from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Analysis targeted cohorts of men aged 50 to 64 and women aged 50 to 60. In order to control for endogeneity (reverse causality and unobserved heterogeneity), the authors used two stage least square (2SLS) and simultaneous equation systems such as maximum likelihood (ML) and full-information maximum likelihood (FIML). Since labor force participation and health status are endogenous and mutually interactive, two equations were constructed by using these two indicators as

the dependent variables, including each variable as an explanatory variable, from which the two equations were estimated simultaneously. The variables excluded in the labor force participation equation are overseas birth, birth in non-English speaking countries, children aged under 14, interaction term between married individuals and their children. The variables excluded in the health equation are smoking, heavy drinking, lack of physical activity, health status (chronic diseases), and physical functionality (estimates close to ML and FIML as one of the SF-36 indices). The results showed that better health increased the probability of labor force participation; and while no negative reverse effect from labor force status to health was found for males, the effect was positive for females, with their participation in the labor market leading to better health status. While Cai (2010) shares the general theme of aforementioned studies, it differentiates itself through the use of the first to fourth panel data collected from the HILDA.

Zucchelli *et al.* (2007) investigated the effect of health on retirement with a sample consisting of 1,270 individuals aged 50 and over by using data from the first five (2001-2005) of the HILDA survey. This study featured the use of a discrete-time hazard model and classified changes in health status as two categories: “small” health shocks with gradual effects (self-assessed health, limited mobility) and “large” health shocks with radical effects (year-on-year changes in health status, occurrence of an injury or illness in the previous 12 months). Furthermore, the study used explanatory variables of the previous year (year t-1) in order to avoid problems of simultaneity. The study used pooled ordered probit models and the objective health indicator of physical limitation to estimate the subjective indicator of self-assessed health, in order to control for the endogeneity of the latter. The results showed that health shocks increased the probability of retirement more than gradual health deterioration.

In Korea, the effect of health on the labor market has not been a prominent issue of study. In most cases, health status was controlled in order to investigate other factors that influence the labor market of the elderly. Weon Jong-Hak *et al*. (2009) analyzed the effect of change in pension systems (reduction of income replacement rate from 60 to 40 percent) on thelabor market of the elderly, and the effect on long-term fiscal balance from extended labor force participation among the elderly caused by pension reform. Based on data from KLoSA 2006,

this study estimated the labor supply function and the probability of labor force participation in a sample of 1,416 men aged from 55 to 65; and the results showed that a 10,000-won increase in the public pension income lowered the labor force participation rate by 0.01 percent. Controlling for IADL in this test, an increase by 1 in the IADL index resulted in a decrease in the labor force participation rate by 7.8 to 8.0 percentage points, which indicated that health status exerted much more influence on the rate of labor force participation than public pension or assets. As the focus of the study was on change in public pension systems, however, the endogeneity of health indicators was not corrected.

Hong Baek-eui and Kim Hye-yeon (2011) investigated retirement patterns by employment type and related determinants for the middle-aged and elderly by using the first year data from KLoSA. This study used multinomial logit models, focusing on 1,147 retired men aged 45 and over, and analyzed the determinants of retirement patterns (labor market separation, early retirement, normal retirement from self-employment, normal retirement from employment, continued work in self-employment, continued work in employment, long-term continued work in employment). Main explanatory variables include age, income, educational attainment, marital/partner status, type of occupation, health status (subjective health status, ADL, IADL), and birth cohorts. The study results showed health status was not statistically significant to retirement patterns.

In the meantime, Lim Jae-yeong and Lee Seok-won (2008) studied the effect of labor force participation on health, specifically the effect of the reduction in medical expenses caused by the elderly job creation program. Among the elderly population aged 65 and over, the study focused on 1,055 previous participants in the elderly employment programs (2004 – September 2006), using the data from a survey on the living conditions of the participants, which was conducted in September 2006 by the Korea Labor Force Development Institute for the Aged, as well as data on usage patterns of health insurance and medical services (2001-2006). The result showed that participation in the senior employment program resulted in health improvements, thereby contributing to the reduction in medical expenses.

Lastly, this paper explores previous policy studies on employment promotion among the elderly population. Lee Cheol-seon (2012) suggested various measures for promoting the employment of the elderly including specific

measures for raising the retirement age; enhancement of job quality for the elderly, in response to their difficulty in regaining employment and increasing tendency to work as temporary employees; increase in the coverage rate for occupational health and safety insurance. Lee Cheol-seon (2011) divided employment policies for middle-aged and elderly employees into two: maintaining employment and creating employment. For the former, the author suggested employment extension by raising the retirement age and implementing wage peak systems; for the latter, support for job transition, provision of job placement services, portal services for job offers, and vocational training. Jeong Yong-hwan (2007) suggested several measures such as the establishment of an organization dedicated to elderly workforce management; mandatory enforcement of the elderly employment quota; introduction and enhancement of systems to extend the retirement age and working period; expansion of support systems to promote the employment of older workers; expansion of social job creation; promotion of elderly-friendly industries; and establishment of vocational training systems. The National Assembly Research Service (2010) presented several ideas such as the improvement of wage peak systems, extension of retirement ages, job-sharing policies, reform for seniority-friendly workplace culture, curtailment of working hours, establishment of productive and flexible labor-management relationships, identification of jobs suitable for the elderly, and quality enhancement of jobs for the elderly. The National Assembly Budget Office (2012) suggested the consolidation of policies for elderly self-employed people, legislation for the retirement age extension, and expansion of measures to provide post-retirement income security. In addition, particular emphasis was placed on policies for the self-employed, since self-employment constitutes the largest proportion of jobs among the elderly population, especially in farming, forestry and fishery, while the probability of transitioning into self-employment after retirement is also high. As a means to guarantee old-age income after retirement, it was also suggested to increase job opportunities for older workers by expending government funding and to reinforce employment support services for older workers.

Ⅳ

Empirical Analysis

This study aims to achieve three goals: first, to test whether the population has been ageing in a healthy way as the life expectancy gets longer; second, to analyze whether improvement in health status increases the labor supply; and finally, to estimate how the participation of the elderly in labor market will affect Korea's national finance.

1 Healthy Ageing (correlation between life expectancy and healthy life expectancy)

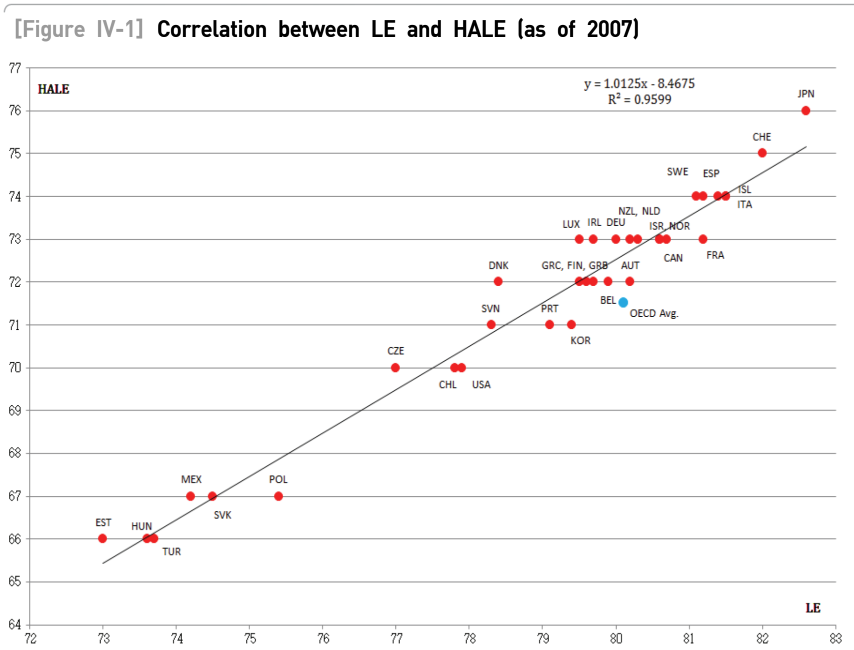
This study proposes the promotion of elderly employment as a fundamental measure to reduce the burden on national finance, which is caused by the ageing of the population. However, this proposition assumes that an increase in the general life expectancy would result in a corresponding increase in healthy life expectancy. The fact that the health level of the elderly population has improved can be used as the logical basis of extending the retirement age and other measures to prolong the elderly population's economic participation.

Life expectancy (LE) refers to the expected number of years of life remaining at birth. Healthy life expectancy (HALE) refers to the period without major illnesses in an individual's life, which can be calculated by subtracting morbidity years, as the period spent in poor health condition, from the overall life expectancy. In order to test whether Korea has been experiencing healthy

ageing, this study examined the correlation between LE and HALE by referring to the World Health Organization's healthy life expectancy data (2010), which was introduced in Chapter 2, and life expectancy data presented by the OECD Health Data. Featuring cross-sectional data by country from 2007, [Figure IV-1]'s horizontal axis represents each country's LE and the vertical axis represents each country's HALE. As expected, LE and HALE yielded a close positive correlation at the significance of 0.96, which means when LE increases by one year, so does HALE. Therefore, it is expected that if a country's LE is set to rise in the future, so will the HALE.

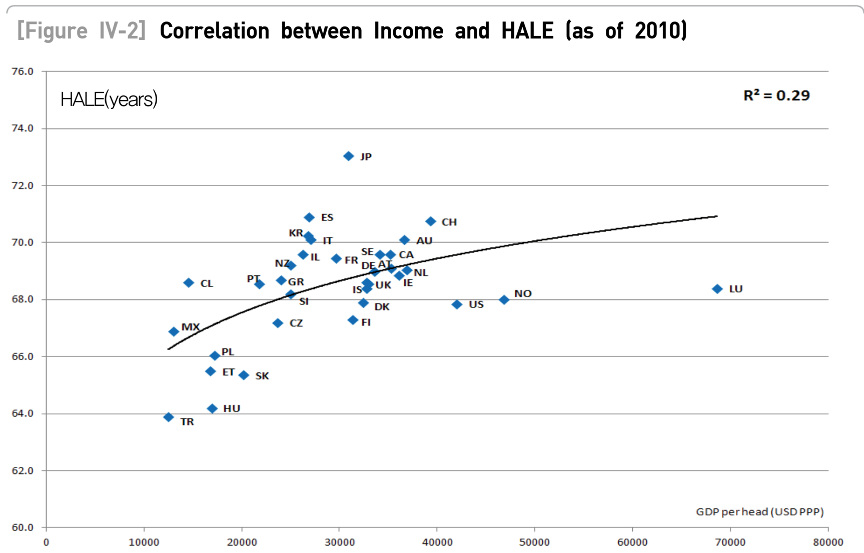
Another way to prove the trend of healthy ageing is to look into the correlation between increases in income and HALE over time. [Figure IV-2] shows the correlation between the two in OECD countries as of 2010. OECD data was used for per capita income, while data from 2010 presented by Solomon

[Figure IV-1] **Correlation between LE and HALE (as of 2007)**



Source: LE (horizontal axis) is extracted from the OECD Health Data (2007)
HALE (vertical axis) is extracted from 2007 data of the World Health Statistics (2010)

[Figure IV-2] Correlation between Income and HALE (as of 2010)



Source: Per capita GDP is extracted from the OECD Statistics, HALE is extracted from data presented by Solomon *et al.* (2012)

et al. (2012) was used for HALE. It is observed that HALE increases as the per capita GDP grows. If Korea continues to see a gradual growth in income as it did for the past 10 years, it is expected that the HALE will rise accordingly.

2 Healthy Ageing and Labor Participation

Previous studies revealed income (assets) and health condition as two important factors affecting middle-aged and elderly participation in the labor market. The former has a negative correlation with the participation while the latter holds a positive correlation. This study will focus on the influence of health status on the participation of the middle-aged and elderly population in the labor market.

The data from the second wave of KLoSA (conducted in 2008) was utilized in order to analyze the influence of health condition on the labor market

participation. The advantage of this survey is that it specifically targets middle-aged and elderly over 45 and that it includes various variables to measure health status. However, this study narrowed its scope to those aged 50 to 64; ranging from the 50s as the point of origin for the rise of early retirement and drop in the employment rate, up to the age of 65 as the point of highest prevalence for retirement and pension collection.

The dependent variable (Y) is a dummy variable indicating current participation in economic activities, while the main explanatory variable represents health status. Two estimation models are used, including the probit model, which reflects the dependent variable's non-linear characteristics, and the IV-probit model, which controls for the endogeneity of health conditions. With the estimation of the IV-probit model, it is difficult to verify the appropriateness of an IV. Therefore, this study aims to first evaluate the appropriateness of IVs by turning to the ordinary least squares (OLS) model and two-stage least-squares (2SLS) method to adjust for endogeneity.

First, the OLS model is a linear probability model shown in the equation [1] below. The dependent variable represents the status of participation in economic activities: if positive, Y is given as 1; and if negative, Y is given as 0. The major variable of interest regarding health includes subjective health condition, ADL, IADL, and the number of chronic diseases. The explanatory variables controlled for factors such as age, gender (female =1), marital status (married = 1), education level (middle school graduate = 1, high school graduate = 1, college or above = 1), household income and assets, and public pension subscription status (subscribed =1).

$$[1]\ Yi = a + b_1 \cdot Health + b_2 X_i + u_i$$

In order to control for health status as the variable of interest, subjective self-rated health status, consisting of 5 stages from very good to very bad, was reclassified and given a binary range of either 1 or 0, whereby the former is the equivalent of "Good" or "Very Good" while the latter equates to "Average," "Bad," or "Very Bad." The ADL index is presented on a scale of 0 to 7, which represents the number of activities out of seven for which the respondent requires assistance: dressing; personal hygiene (face washing/brushing teeth/washing

hair); bathing and showering; eating; functional mobility (getting up from bed, leaving the bedroom); use of bathroom; and urinating and defecating. The IADL index is on a scale of 0 to 10, representing the number of activities the individual requires help for among 10 daily activities: grooming; housekeeping; food preparation; laundry; short distance travel; use of transportation; shopping; handling finances; use of telephone; and handling personal medications. Lastly, the number of chronic diseases refers to those among nine major diseases that the respondent has been diagnosed with, including hypertension, diabetes, cancer, cardiovascular diseases, cerebrovascular illness, lung conditions, liver conditions, mental illnesses, and arthritis.

<Table IV-1> shows the descriptive statistics of the KLoSA (2008). The survey's sample size comprises 3,307 individuals from the middle-aged and elderly demographic from 50 to 64, which showed a considerably high tendency to participate in economic activities at 60 percent. Forty six percent of them responded subjectively in assessing their health condition as good or very good. Presented through the aforementioned method, the average ADL measured at 0.05; IADL, 0.22; and the number of chronic diseases, 0.13. Among the sample group, the average age was 56, female respondents and the married accounted for 56 percent and 89 percent, respectively. As for educational attainment, those with at least middle school diplomas comprised 22 percent; high school diploma, 36 percent; and college or above, 11 percent. Public pension subscribers comprised 39 percent, while the average annual household income and the average household assets recorded 31.67 million won and 243.15 million won, respectively.

<Table IV-2> presents the OLS-based estimation for analyzing the effect of health status on labor force participation among the middle-aged and elderly population. Those who are optimistic about their health status are more likely by a coefficient between 0.08 and 0.11 to participate in the labor market than those who are not. This result is consistent when factoring in regional dummies, or other health related variables like ADL index, IADL index, and the number of chronic diseases. As expected, ADL, IADL, and the number of chronic diseases shows a negative correlation with labor force participation. A closer look at columns (5) and (6), which encompass all three health variables, reveals that good or better subjective health status has a positive correlation of 0.08

to 0.09 with labor participation; IADL index or the number of chronic diseases, on the other hand, has a negative correlation of 0.05 with labor market participation.

〈Table IV-1〉 **Descriptive Statistics**

Variable	Description	Obser-vations	Mean	Standard deviation	Minimum value	Maximum value
work	Affirmative = 1	3307	0.60	0.49	0	1
health_ good	Subjective health condition: good or very good = 1	3307	0.46	0.50	0	1
ADL	Activities of daily living	3307	0.05	0.49	0	7
IADL	Instrumental activities of daily living	3307	0.22	1.07	0	10
num_NCD	Number of chronic diseases	3307	0.13	0.38	0	3
age	Age	3307	56.22	4.18	50	64
female	Female = 1	3307	0.56	0.50	0	1
married	Married = 1	3307	0.89	0.31	0	1
edu_mid	Middle school graduate = 1	3307	0.22	0.41	0	1
edu_high	High school graduate = 1	3307	0.36	0.48	0	1
edu_univ	College or above = 1	3307	0.11	0.31	0	1
Hh_inc	Household income (100 mil.)	3307	0.3167	0.34	0.0001	9.136
hh_asset	Household assets (1 bil.)	3307	0.24316	0.39	0	6.458
pubpen	Public pension subscription = 1	3307	0.39	0.49	0	1
grip	Grip index	3118	26.47	7.88	5	55.75
normal_ weight	Within normal weight range = 1	3118	0.74	0.44	0	1

Labor force participation consistently shows a negative correlation with age or gender variables, while showing a positive correlation with household income and public pension subscription status. Income and assets are statistically significant, showing a positive and negative correlation, respectively. This would signify that elderly participation in economic activities is positively influenced if the employer sponsors public pension subscriptions or provides higher wages. On the other hand, the possession of sizeable assets hinders the incentive to participate in the labor market, although the significance of this factor is negligible.

A matter of note is the statistically significant tendency that a higher education level results in a lower likelihood of participation in economic activities, which is contrary to our previous assumption that there would be a positive correlation between educational level and economic participation. This tendency is consistently observed even when the endogeneity of health related variables is controlled for, or other data such as the Korean Labor & Income Panel Study (KLIPS) are used. Therefore further study on this matter is required. It can be inferred that highly educated people are likely to generate higher income, which in turn decreases labor market participation in later years due to their likelihood to have accumulated comfortable degree of wealth. On this matter, previous studies provide inconsistent results, as well: some suggest that education level does not have any significant influence on labor force participation; but others show that the two have a negative correlation (Romeu Gordo, 2011; Mete & Schultz, 2011).

The OLS model yielded estimates mostly in keeping with our hypothesis, but the model does not control for the endogeneity of health-related variables. The most important source of endogeneity is reverse causality. This is because labor force participation can also affect one’s health conditions. For instance, active labor may exacerbate the health of those in physically strenuous professions, while for those whose employment is also a means of social engagement, labor can become a source of vitality and the perception of improved health. Other causes for endogeneity include omitted variable bias, justification bias and measurement error. Omitted variable bias occurs in the absence of control for factors that are unobserved but nonetheless influence health and the labor supply. Diligent persons, for example, are more likely to be in

〈Table IV-2〉 **OLS Regression Estimates**

Y=work	(1)	(2)	(3)	(4)	(5)	(6)
Health_good	0.10***	0.11***	0.08***	0.09***	0.08***	0.09***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
ADL			–0.02	–0.03*	–0.02	–0.02
			(0.015)	(0.014)	(0.015)	(0.015)
IADL			–0.06***	–0.05***	–0.06***	–0.05***
			(0.007)	(0.007)	(0.007)	(0.007)
Num_NCD					–0.05***	–0.05***
					(0.018)	(0.018)
Age	–0.01***	–0.01***	–0.01***	–0.01***	–0.01***	–0.01***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Female	–0.30***	–0.30***	–0.33***	–0.33***	–0.33***	–0.33***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Married	0.02	0.01	0.01	0.01	0.01	0.01
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Edu_mid	–0.03	–0.02	–0.03	–0.02	–0.03	–0.02
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Edu_high	–0.06***	–0.04*	–0.06***	–0.04**	–0.06***	–0.04**
	(0.021)	(0.021)	(0.020)	(0.021)	(0.020)	(0.021)
Edu_univ	–0.10***	–0.09***	–0.10***	–0.09***	–0.10***	–0.09***
	(0.027)	(0.028)	(0.027)	(0.028)	(0.027)	(0.028)
hh_income	0.08***	0.07***	0.07***	0.07***	0.07***	0.07***
(100 mil.)	(0.022)	(0.023)	(0.021)	(0.022)	(0.021)	(0.022)
hh_asset	–0.04**	–0.04*	–0.05**	–0.04**	–0.05**	–0.04**
(1bil.)	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)
pubpen	0.24***	0.23***	0.23***	0.22***	0.23***	0.22***
	(0.018)	(0.018)	(0.017)	(0.018)	(0.017)	(0.018)
Constant	1.47***	1.40***	1.52***	1.46***	1.53***	1.47***
Regional dummy	(0.120)	(0.123)	(0.117)	(0.121)	(0.117)	(0.121)
Regional dummy	NO	YES	NO	YES	NO	YES
Observations	3,307	3,307	3,307	3,307	3,307	3,307
Adj. R2	0.26	0.27	0.28	0.29	0.28	0.29
F test	166.17	72.88	163.77	78.39	154.14	76.94
Prob 〉 F	0	0	0	0	0	0

good health and to participate in economic activities due to their higher self-discipline in comparison to others. As a result, the coefficient produced by the OLS model may suffer from an upward bias. Justification bias occurs when respondents give a distorted answer in order to justify their decision on whether or not to participate in the labor market. For instance, those who want retirement might give a more negative assessment of their health than the reality; meanwhile, those who want to remain in the labor market would give a more positive response. This can be referred to as self-reporting bias or state-dependent reporting bias (Bond, 1991). The presence of such a bias would result in an upward bias on the influence of health conditions on labor force participation. The prevention or mitigation of such a bias requires the use of objective health indexes that cannot be distorted by the respondents, such as blood pressure and cholesterol level. Lastly, measurement error is caused by the use of subjective health variables. Although this study aims to assess labor capacity or work-related health conditions, such information cannot be extracted directly from the survey data, which only provides subjective information based on the respondent’s self-perception. Measurement errors tend to cause the impact of health variables on labor market participation to be downwardly biased.

The next step taken to control for the endogeneity of health variables is to estimate 2SLS models with the use of an instrumental variable. An appropriate instrumental variable (Z) for an explanatory variable with endogeneity must satisfy the following conditions. First, it must have a correlation with health indexes ($Corr(X, Z)\neq 0$). And second, it does not have a direct influence on labor market participation ($Corr(Z, u)=0$). In fact, finding appropriate instrumental variables is an important and difficult task for a researcher to achieve, requiring the selection of an instrumental variable based on economic theory or common sense and to test whether the variable satisfies the above two conditions. Instrumental variables that in theory only affect the individual’s health status and bear no relation to labor market participation include the health status and lifespan of the parents, as well as factors that directly affect the individual’s accumulation of health capital, such as medical history, nutritional conditions, or regional variables affecting the health environment. However, the KLoSA does not provide the health status during an individual’s childhood, and despite asking whether the respondents’ parents were currently

alive, only 20 percent of the participants answered on the matter, which renders the results unusable for analysis. Therefore, the study sets its instrumental variables as the grip index and the normal weight status (18.5≦BMI<25), which seem directly related to one's health status but unrelated to labor market participation.

The grip strength refers to the maximum isometric strength of the hand measured by a hand grip dynamometer. This study views grip strength as a measurement of physical functionality to be directly related to subjective health conditions while unrelated to labor force participation directly. This factor is frequently used as a general measurement of health status in medical studies, but it is not widely utilized in the field of social sciences (Kalwij and Vermeulen, 2005). Especially in medical journals, hand grip has been generally perceived as an indicator to show an individual's future health conditions, regarding functional limitation, disability, and mortality (Ling *et al.*, 2010; Rantane *et al.*, 1999; Giampaoli *et al.*, 1999). Among the previous studies introduced in Chapter III, Kalwij and Vermeulen (2007) includes hand grip in the estimation formula, regarding the hand grip index as an objective health indicator. However, some studies use objective indexes such as a certain health condition or physical functioning limitation to serve as instrumental variables for subjective health indicators (Disney *et al.*, 2006; Campolieti, 2002; Dwyer and Mitchell, 1999; Bound *et al.*, 1996). A theoretical ground for selecting objective indexes as instrumental variables of subjective indicators is provided by Grossman's human capital theory (1972). According to this theory, health is a form of human capital, and therefore physical functionality limitation directly affects the accumulation of health capital, while labor supply is only indirectly affected by the accumulation of human capital. As in Sayer *et al.* (2006), this study considers the factor of grip strength to have a close correlation with subjective health conditions, whereby respondents with stronger grip strength are more likely to assess their health as good or better), but it does not directly affect one's decision on whether to participate in the labor market.

Normal weight refers to the range of 18.5 to 25 on the body mass index (BMI), as the bodyweight divided by the height squared. Individuals in the normal weight range as opposed to being under or over weight are more likely to be in good health. However, bodyweight does not directly influence the

decision as to whether to remain in the labor market, or whether for an employer to retain an employee. Smoking and drinking are also related to health, but they do not pose a direct impact on labor market participation. Lastly, residents may possess better health in a region with high standards in terms of the average health status, ratio of green areas, income level, and accessibility to medical services, but these factors would not directly affect the decision to participate in the labor market.

There are two ways to confirm whether these potential instrumental variables, which are chosen theoretically, satisfy the first condition to be appropriate as instrumental variables, which is direct correlation with the health variable. The first method is to test whether there is a correlation between the two variables; and second is to estimate the instrumental variable's model and to utilize the first stage estimates for testing whether the two variables Z and X have a statistically significant correlation; that is, test whether the F value for Z (excluded variables) exceeds 10. This study initially confirmed whether a correlation exists between these instrumental variables and the subjective health condition variable (health_good) as the explanatory variable, and found that the two potential instrumental variables have a positive correlation with the health variable, where the grip strength has a correlation of 0.21, compared to 0.08 for normal weight.

<Table IV-3> shows the result of the 2SLS estimation, in which the endogeneity of subjective health condition is controlled by using instrumental variables. Labor force participation was higher by 0.55 to 0.63 among respondents of the middle-aged and elderly group from 50 to 64 who assessed their health condition as good or very good. Columns (1) and (2) include subjective health variables alone, and columns (3) to (6) contain both subjective and objective variables, but there were no significant differences in the results yielded. A comparison between IV-probit and probit estimates reveals a six-fold increase in the influence of health condition on labor force participation, which confirms the occurrence of endogeneity such as measurement errors with regards to variables representing subjective health conditions.

As for the influence of objective health variables on the labor market, the result of the 2SLS estimation differed from that of the OLS estimation. While IADL and the number of chronic diseases showed a statistically significant

〈Table IV-3〉 **2SLS Model Estimates**

IV: grip, normal weight	(1)	(2)	(3)	(4)	(5)	(6)
Health_good	0.59***	0.63***	0.55***	0.60***	0.59***	0.63***
	(0.155)	(0.162)	(0.164)	(0.174)	(0.189)	(0.201)
ADL			−0.08***	−0.08***	−0.08***	−0.08***
			(0.022)	(0.021)	(0.022)	(0.022)
IADL			−0.01	0	−0.01	0
			(0.017)	(0.019)	(0.019)	(0.021)
num_NCD					0.06	0.07
					(0.048)	(0.050)
age	−0.01*	−0.01	−0.01**	−0.01*	−0.01*	−0.01
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
female	−0.28***	−0.28***	−0.29***	−0.28***	−0.29***	−0.28***
	(0.024)	(0.025)	(0.026)	(0.027)	(0.028)	(0.029)
married	−0.03	−0.03	−0.03	−0.03	−0.03	−0.03
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)
edu_mid	−0.09***	−0.08**	−0.08***	−0.07**	−0.09***	−0.08**
	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)	(0.032)
edu_high	−0.15***	−0.13***	−0.14***	−0.13***	−0.15***	−0.13***
	(0.034)	(0.034)	(0.035)	(0.035)	(0.037)	(0.037)
edu_univ	−0.18***	−0.18***	−0.18***	−0.17***	−0.18***	−0.18***
	(0.041)	(0.042)	(0.041)	(0.042)	(0.042)	(0.044)
hh_income (100 mil.)	0.04	0.03	0.04*	0.04*	0.04*	0.03
	(0.022)	(0.022)	(0.022)	(0.022)	(0.023)	(0.023)
hh_asset (1 bil.)	−0.06***	−0.07***	−0.06***	−0.07***	−0.07***	−0.07***
	(0.024)	(0.025)	(0.024)	(0.025)	(0.024)	(0.025)
pubpen	0.18***	0.17***	0.18***	0.17***	0.18***	0.17***
	(0.025)	(0.025)	(0.024)	(0.025)	(0.025)	(0.026)
Constant	0.93***	0.81***	0.99***	0.86***	0.94***	0.80***
	(0.245)	(0.260)	(0.255)	(0.275)	(0.285)	(0.309)
Regional dummies	NO	YES	NO	YES	NO	YES
Observations	3,118	3,118	3,118	3,118	3,118	3,118
Wald chi2	1037	1051	1255	1281	1231	1252
Prob 〉 chi2	0	0	0	0	0	0

〈Table IV-4〉 **First-Stage Estimates from 2SLS Model**

Y = health_good	1st stage
age	−0.01*** (0.002)
female	0.05 (0.030)
married	0.03 (0.027)
edu_mid	0.10*** (0.025)
edu_high	0.15*** (0.023)
edu_univ	0.15*** (0.034)
hh_income	0.059 (0.038)
hh_asset	0.004 (0.003)
pubpen	0.083*** (0.020)
grip	0.010*** (0.002)
normal_weight	0.070*** (0.019)
observations	3,118
Adj. R2	0.1104
F(11, 3106)	43.52
Prob 〉 F	0

negative correlation towards the labor market participation among the middle-aged and elderly group, the same correlations were not shown in the 2SLS model, which controlled for endogeneity. However, it was found that a higher ADL index contributed to a decrease of 0.08 in the labor market

〈Table IV-5〉 **First Conditional Test of Instrumental Variable**

Variable	R2	Adj. R2	Robust F (2, 3106)	Prob 〉 F
health_good	0.1104	0.1072	20.9061	0.0000

〈Table IV-6〉 **Endogeneity Test for Health Variable**

Ho: Health variables are exogenous
Robust score chi2(1) = 13.6733 (p=0.0002)
Robust regression F(1, 3106) = 13.8339 (p=0.0002)

participation. Corroborating the OLS model, the 2SLS model also showed a negative correlation between labor market participation and factors such as gender (female), educational attainment (high), and assets (large-scale), while subscription to public pensions had a positive correlation. However, both models showed the wealth effect as being negligible, while the impact of health variables was considerably larger.

<Table IV-4> presents the first-stage estimates in order to assess the accuracy of the 2SLS estimation, which used instrumental variables. As shown in <Table IV-4>, grip and normal_weight, which are included in the instrumental variables, are statistically significant and in positive correlation with subjective health conditions (health_good). Respondents with strong hand grip were more likely by a coefficient of 0.01 to assess their health condition as good; and when an individual weighs in the range of his normal weight, the figure increases by a coefficient of 0.07.

As shown in <Table IV-5>, the F-value for the two excluded variables is 20.91, which exceeds 10 to satisfy the first condition for an instrumental variable (Corr (X, Z) $\neq$0). Therefore, there is a statistically significant correlation between health variables and instrumental variables.

<Table IV-6> presents the results of the Durbin-Wu-Hausman test to verify whether endogeneity is present in the health variables. The null hypothesis

〈Table IV-7〉 **Validity Test for Instrumental Variables**

Test of over-identifying restrictions:
Score chi2(1) = 0.209354 (p=0.6473)

(H_0) stated that the health variable (health_good) is not an endogenous variable, whereas the test yielded a p-value smaller than 0.01, dismissing the null hypothesis at a statistically significant level and concluding that the health variable is indeed endogenous.

Finally, <Table IV-7> shows the test results for the validity of instrumental variables, as the second required condition. This entailed a test to confirm whether grip index and normal_weight status does not have a direct influence on the economic participation. The null hypothesis (H_0) states that Corr (Z, u)=0, which the test was unable to dismiss. Based on this, this study concludes that the instrumental variables satisfy the second condition by having no direct influence on the labor market participation.

This study has so far examined the influence of the health conditions of the middle-aged and elderly on their labor force participation by relying on the two regression models of OLS and 2SLS. Furthermore, tests have confirmed that the chosen instrumental variables satisfy the two conditions for instrumental variables: first, the correlation between the instrumental variables and the endogenous variable of subjective health conditions is not weak; and second, the designated instrumental variables have no direct impact on labor market participation. The aforementioned linear models are used as basic starting modelsdue to their aptitude for the validity test of instrumental variables. However, if a dependent variable is a binary variable (e.g. whether an individual works or not), the error term goes against the assumption of homoscedasticity and of normality, which could cause bias in the estimates. Therefore, we conduct a test to verify the consistency in the results of the above empirical analysis by relying on the probit and IV-probit models as main estimation models.

Based on the probit model, <Table IV-8> estimates the marginal effects of the influence of health conditions on the labor market participation of the middle-aged and elderly. Consistent with the result of OLS estimation, subjective

health condition (health_good) increases the participation by approximately 10 percent (between 9 to 14 percent). Other objective health indicators such as the ADL/IADL indexes and chronic diseases have a negative correlation with labor market participation. Among the three, the most significant is the ADL index, whereby an increase in the index by one resulted in the economic participation decreasing by 18 percent to 19 percent. In relation to the labor market participation of the middle-aged and elderly, the marginal effect of the IADL index is -0.08, and that of chronic diseases, -0.06. Other explanatory variables are consistent with the OLS coefficient estimates.

<Table IV-9> shows the results of IV-probit model estimation, which uses two instrumental variables of grip strength and normal weight status in order to control for the endogeneity of subjective health condition. In the IV-probit model, the marginal effect of health condition ranges from 0.54 to 0.59, which is consistent with the results of 2SLS estimation, in which if the health status is good, the labor market participation increases by 0.55 to 0.63 with the endogeneity of health variables controlled for. Other explanatory variables are consistent in terms of the coefficient's size and sign and statistical significance. However, an exception is that ADL estimate is -0.08 in the 2SLS model, but it ranges from -0.35 to 0.40 in the IV-probit model, five times larger than that of the 2SLS model. This means that, as ADL index increases, the labor market participation of the middle-aged and elderly decreases by 35 to 40 percent. Also, the number of chronic diseases has a statistically significant positive relationship in the IV-probit model, which is contrary to the previous assumption that it would have a negative correlation with labor force participation.

The empirical analysis conducted in this study holds the following limitations. First, the analysis does not take advantage of the characteristics of the panel and uses only cross-sectional data from one year (2008). Therefore, it is impossible to control for heterogeneity among individuals. Second, the analysis relies on a relatively strong assumption that the grip strength and normal weight status, used as instrumental variables, affect only subjective health status with no direct influence on the decision to participate in the labor market. Even though this assumption is based on Grossman's theory (1972), bias may exist in the coefficients if the second condition for an instrumental variable does not completely satisfy.

〈Table IV-8〉 **Results of Probit Model (marginal effects)**

Y=work	(1)	(2)	(3)	(4)	(5)	(6)
health_good	0.13***	0.14***	0.10***	0.12***	0.09***	0.11***
	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)
ADL			−0.19**	−0.18**	−0.19**	−0.18**
			(0.086)	(0.078)	(0.087)	(0.079)
IADL			−0.08***	−0.08***	−0.08***	−0.08***
			(0.012)	(0.012)	(0.012)	(0.012)
num_NCD					−0.06***	−0.06***
					(0.024)	(0.025)
age	−0.02***	−0.02***	−0.02***	−0.02***	−0.02***	−0.02***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
female	−0.33***	−0.34***	−0.37***	−0.38***	−0.37***	−0.38***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
married	0.02	0.01	0.02	0.01	0.02	0.01
	(0.030)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
edu_mid	−0.04	−0.03	−0.05*	−0.03	−0.05*	−0.04
	(0.026)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
edu_high	−0.07***	−0.05**	−0.08***	−0.06**	−0.08***	−0.06**
	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
edu_univ	−0.13***	−0.12***	−0.15***	−0.14***	−0.15***	−0.14***
	(0.041)	(0.042)	(0.042)	(0.043)	(0.042)	(0.043)
hh_income	0.14***	0.14***	0.13***	0.13**	0.13***	0.13**
(100 mil)	(0.049)	(0.052)	(0.049)	(0.052)	(0.048)	(0.051)
hh_asset	−0.07**	−0.06**	−0.07**	−0.06**	−0.07**	−0.06**
(1 bil)	(0.029)	(0.030)	(0.028)	(0.030)	(0.028)	(0.029)
pubpen	0.27***	0.27***	0.27***	0.26***	0.27***	0.26***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)
Constant	1.47***	1.40***	1.52***	1.46	1.53***	1.47***
	(0.120)	(0.123)	(0.117)	(0.121)	(0.117)	(0.121)
Regional dummies	NO	YES	NO	YES	NO	YES
Observations	3,307	3,307	3,307	3,307	3,307	3,307
Log Likelihood	−1728.5	−1703.7	−1680.78	−1658.47	−1677.71	−1655.41
Wald test	845.19	823.35	828.16	810.88	834.4	816.71
Prob 〉 chi2	0	0	0	0	0	0

〈Table IV-9〉 **Results of IV-probit Model (marginal effects)**

IV: grip, normal weight	(1)	(2)	(3)	(4)	(5)	(6)
health_good	0.55***	0.57***	0.54***	0.57***	0.56***	0.59***
	(0.065)	(0.061)	(0.076)	(0.071)	(0.078)	(0.071)
ADL			−0.40***	−0.36**	−0.38***	−0.35**
			(0.153)	(0.152)	(0.145)	(0.144)
IADL			−0.01	0	−0.01	0
			(0.020)	(0.020)	(0.021)	(0.021)
num_NCD					0.07*	0.08**
					(0.040)	(0.039)
age	−0.01	0	−0.01	0	−0.01	0
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
female	−0.24***	−0.24***	−0.26***	−0.25***	−0.25***	−0.24***
	(0.041)	(0.043)	(0.049)	(0.051)	(0.054)	(0.056)
married	−0.03	−0.03	−0.02	−0.02	−0.02	−0.02
	(0.027)	(0.027)	(0.028)	(0.028)	(0.027)	(0.027)
edu_mid	−0.09***	−0.08***	−0.09***	−0.08***	−0.09***	−0.08***
	(0.026)	(0.027)	(0.026)	(0.027)	(0.026)	(0.026)
edu_high	−0.15***	−0.13***	−0.16***	−0.14***	−0.16***	−0.14***
	(0.025)	(0.025)	(0.025)	(0.026)	(0.025)	(0.025)
edu_univ	−0.20***	−0.19***	−0.20***	−0.19***	−0.20***	−0.19***
	(0.037)	(0.037)	(0.037)	(0.038)	(0.036)	(0.037)
hh_inc	0.06	0.06	0.06	0.06	0.06	0.05
	(0.040)	(0.040)	(0.040)	(0.041)	(0.040)	(0.040)
hh_asset	−0.07***	−0.08***	−0.07***	−0.07***	−0.07***	−0.07***
	(0.025)	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)
pubpen	0.16***	0.15***	0.17***	0.16***	0.16***	0.15***
	(0.037)	(0.037)	(0.039)	(0.039)	(0.042)	(0.042)
Regional dummies	NO	YES	NO	YES	NO	YES
Observations	3,118	3,118	3,118	3,118	3,118	3,118
Log Likelihood	−3683	−3629	−3640	−3585	−3595	−3540
Wald chi2	1768	1876	1692	1821	1831	1996
Prob 〉 chi2	0	0	0	0	0	0

<Robustness Test>

The next aim is to test whether the influence of the health status of the middle-aged and elderly on the labor market participation is consistent even when factoring in several other elements such as age, occupation, size of assets, and reemployment status. Because the validity of the instrumental variables is confirmed in the previous OLS model and there is no big difference from the results of the probit estimation, we decided to use the probit model, which reflects the discontinuity of dependent variables, as our main estimation model for the remaining processes.

Respectively targeting male and female respondents, <Tables IV-10> and <Table IV-11> each shows estimations from both the probit and IV-probit models. In the probit model, the common health variables affecting labor force participation by the elderly across both genders are subjective health status (health_good) and the IADL. Men and women are both more likely to participate in the labor market when their health condition is good, with the marginal effects for males at 7 to 10 percent while those for females were slightly higher at 10 to 12 percent.

As expected, the larger the IADL index, the lower the labor market participation of the middle-aged and elderly. The marginal effect of the IADL variable is 4 percent among men, which is below half of the same figure for women (10 percent). As for the ADL index and the number of chronic diseases, a degree of gender difference was observed. When the ADL index increases by one, male labor force participation rate decreases by 9 percent. But among women, an increase in the number of chronic diseases reduces labor force participation by 6 percent. Compiling all results, this study concludes that the health status has a marginally greater influence on labor force participation by women compared to men.

The observation of other explanatory variables beside health variables also demonstrates a degree of influence on labor market participation: married men are 10 to 12 percent more likely to participate in the labor market; greater possession of assets decreases the participation rate by 6 percent; and the education variable has a statistically significant influence only with regards to men with education at college graduate level or above. On the other hand, despite

bearing inconclusive statistical significance, married females are 4 to 5 percent less likely to participate in the labor market while the scale of wealth had no noticeable impact on female labor market participation; and those with educational attainment at levels of high school, college or above are considerably less likely to engage in economic activities. In addition, whether a workplace provides a public pension subscription influences women twice as much or more than men. Based on this, it can be concluded that the female middle-aged and elderly are more likely to work either when in a secure job providing a public pension subscription or when facing the need to generate income with a low education level.

Each respectively providing estimates for men and women, <Table IV-10> and <Table IV-11> demonstrate that the marginal effects shown in the IV-probit model are 4 to 10 times larger than those shown in the probit-model estimation. Consistent with the result of probit model estimation, the labor force participation of men increases when the subjective health condition is given as good or better, and when the ADL index decreases. The marginal effect of the former is 63 to 67 percent, while that of the latter is 18 to 20 percent. Meanwhile, the influence of the IADL index on male elderly labor force participation is statistically insignificant while the number of chronic diseases has a statistically significant positive correlation. Likewise, for women, a better subjective health status and a lower score in the ADL index exhibited a statistically significant influence on labor market participation. The marginal effects of the former are 57 to 58 percent, and those of the latter range from 1.56 to 1.62. On the other hand, the IADL index and chronic diseases did not yield a statistically significant influence on the labor market participation of middle-aged and elderly females. For both genders, labor market participation decreases with a greater size of assets and higher educational level (attainment of education from high school, college or above). Contrary to the probit model estimation, the marital status showed no significant influence on the labor force participation of middle-aged and elderly males, while married females of the same age group are seven percent less likely to engage in economic activities than unmarried females. As for public pension subscription, no significant effect was found among men, while subscription to public pensions boosts the female economic activity by 19 to 20 percent.

The second test aimed to verify the hypothesis that the influence of health status on labor market participation differs according to the occupation type. First, dummy variables for 10 professions[3] were included in the test to control for occupational influence; for example, day laborers doing physically strenuous work are more affected by a deterioration of health conditions than office or managerial workers. Therefore, occupations are largely divided into white-collar[4] and blue-collar jobs, while including the interaction term of the dummy variables (health_goodwhite_collar), which represents subjective health status and white collar jobs. If our assumption is vindicated to prove that middle-aged and elderly white-collar workers are less affected by changes in health status than blue-collar laborers of the same age group, the interaction term would carry a negative sign (-). As shown in Table 12, the interaction term (health_goodwhite_collar) does not hold a significant influence in the probit model. However, the IV-probit model, which controls for endogeneity, shows that individuals in white-collar occupations are less likely to be influenced by health conditions in relation to labor force participation. Among middle-aged and elderly white-collar workers, the subjective health condition (health_good) increases participation in the labor market by 5 to 6 percent, while the figure is 74 to 76 percent among blue-collar laborers.

The third test aimed to confirm whether the influence of health on labor force participation differs depending on the size of wealth among the middle-aged and elderly group. For example, the larger the scale of income and assets possessed by an individual, the greater the likelihood to participate in economic activities for self-satisfaction and self-realization. On the other hand, individuals with a low level of income are more likely to work as a living necessity.

3) ① Administrator (legislator, public administrator or management administrator, general manager), ② (semi) professionals (science, computer, engineering, public health, education, administration, business management, legal practice, social service, religion, culture art, media), ③ office workers (general office work, customer service), ④ service workers (interactive service, cooking and serving, tourism and transportation service, security service), ⑤ sales persons (retail or wholesales, telecommunications, model and PR), ⑥ skilled workers in agriculture, forestry, and fishery industries, ⑦ skilled workers and related workers (extraction and construction, metal, mechines and related skills), ⑧ device, machine manipulation and assembling (fixed machinery devices and system controller, machine adjustments, assembling, and driving), ⑨ simple labor workers, ⑩ professional soldier.

4) White collar occupations: ①–⑤, blue collar occupations: ⑥–⑩

〈Table IV-10〉 **Probit & IV-probit Model Estimates (male, marginal effects)**

Y=work	Probit model			IV-Probit model		
health_good	0.10***	0.07***	0.07***	0.63***	0.64***	0.67***
	(0.019)	(0.019)	(0.020)	(0.091)	(0.121)	(0.105)
ADL		-0.09**	-0.09*		-0.20**	-0.18**
		(0.048)	(0.048)		(0.093)	(0.090)
IADL		-0.04***	-0.04***		0.03	0.03
		(0.007)	(0.007)		(0.030)	(0.031)
num_NCD			-0.03			0.17**
			(0.022)			(0.075)
age	-0.01***	-0.01***	-0.01***	0	0	0
	(0.002)	(0.002)	(0.002)	(0.005)	(0.006)	(0.007)
married	0.10**	0.12**	0.12**	0.07	0.07	0.07
	(0.048)	(0.050)	(0.050)	(0.049)	(0.055)	(0.056)
edu_mid	0.01	-0.01	-0.01	-0.03	-0.03	-0.03
	(0.024)	(0.027)	(0.027)	(0.038)	(0.038)	(0.037)
edu_high	0.01	0	0	-0.08*	-0.08*	-0.09**
	(0.023)	(0.025)	(0.024)	(0.042)	(0.045)	(0.044)
edu_univ	-0.07*	-0.08**	-0.08**	-0.15***	-0.15***	-0.15***
	(0.040)	(0.043)	(0.043)	(0.047)	(0.047)	(0.046)
hh_income	0.31***	0.30***	0.30***	0.18	0.18	0.15
(100 mil)	(0.091)	(0.093)	(0.094)	(0.119)	(0.135)	(0.145)
hh_asset	-0.06**	-0.06***	-0.06**	-0.08***	-0.08**	-0.08**
(1 bil)	(0.027)	(0.024)	(0.025)	(0.031)	(0.033)	(0.032)
pubpen	0.13***	0.13***	0.13***	0.03	0.03	0.02
	(0.023)	(0.024)	(0.024)	(0.045)	(0.055)	(0.057)
Regional dummies	YES	YES	YES	YES	YES	YES
Observations	1,439	1,439	1,439	1,350	1,350	1,350
Log Likelihood	-509.85	-475.74	-474.88	-1358	-1324	-1294
Wald Test	204.03	228.57	227.73	1,487	1,557	2,062
Prob 〉 chi2	0	0	0	0	0	0

〈Table IV-11〉 **Probit & IV-probit Model Estimates (female, marginal effects)**

Y=work	Probit model			IV–Probit model		
health_good	0.12***	0.11***	0.10***	0.57***	0.57***	0.58***
	(0.026)	(0.026)	(0.026)	(0.078)	(0.084)	(0.086)
ADL		–0.06	–0.06		–1.62***	–1.56***
		(0.079)	(0.083)		(0.261)	(0.283)
IADL		–0.10**	–0.10**		–0.08	–0.07
		(0.045)	(0.044)		(0.053)	(0.052)
num_NCD			–0.06**			0.05
			(0.031)			(0.045)
age	–0.02***	–0.02***	–0.02***	0	0	0
	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)	(0.006)
married	–0.04	–0.05	–0.04	–0.07**	–0.07**	–0.07**
	(0.036)	(0.036)	(0.036)	(0.033)	(0.033)	(0.033)
edu_mid	–0.01	–0.01	–0.01	–0.08**	–0.07**	–0.08**
	(0.032)	(0.032)	(0.032)	(0.033)	(0.033)	(0.033)
edu_high	–0.08***	–0.09***	–0.09***	–0.15***	–0.16***	–0.15***
	(0.032)	(0.032)	(0.032)	(0.030)	(0.029)	(0.029)
edu_univ	–0.15***	–0.15***	–0.15***	–0.19***	–0.19***	–0.19***
	(0.053)	(0.052)	(0.052)	(0.050)	(0.049)	(0.049)
hh_income	0.04	0.04	0.03	0.01	0.01	0.02
(100 mil)	(0.043)	(0.043)	(0.043)	(0.033)	(0.033)	(0.033)
hh_asset	–0.04	–0.04	–0.04	–0.06*	–0.06*	–0.06*
(1 bil)	(0.040)	(0.041)	(0.041)	(0.035)	(0.035)	(0.035)
pubpen	0.30***	0.31***	0.31***	0.20***	0.20***	0.19***
	(0.029)	(0.029)	(0.029)	(0.051)	(0.053)	(0.056)
Regional dummies	YES	YES	YES	YES	YES	YES
Observations	1,868	1,868	1,868	1,768	1,768	1,768
Log Likelihood	–1136.66	–1127.45	–1125.51	–2208	–2198	–2179
Wald Test	239.89	240.13	245.11	518.5	2379	2451
Prob 〉 chi2	0	0	0	0	0	0

〈Table IV-12〉 **Probit & IV-Probit Model Estimates: Controlling for Occupation (marginal effects)**

	Probit			IV-probit		
	(1)	(2)	(3)	(4)	(5)	(6)
health_good	0.14*** (0.027)	0.11*** (0.028)	0.10*** (0.028)	0.75*** (0.060)	0.74*** (0.070)	0.76*** (0.069)
health_good white_collar	–0.01 (0.038)	0 (0.039)	0 (0.039)	–0.70*** (0.053)	–0.69*** (0.060)	–0.70*** (0.056)
ADL		–0.20** (0.097)	–0.20** (0.098)		–0.37** (0.158)	–0.35** (0.153)
IADL		–0.07*** (0.012)	–0.07*** (0.012)		0 (0.021)	0.01 (0.022)
num_NCD			–0.05** (0.024)			0.08** (0.035)
age	–0.02*** (0.002)	–0.02*** (0.003)	–0.02*** (0.003)	–0.01** (0.004)	–0.01* (0.004)	–0.01* (0.004)
female	–0.34*** (0.020)	–0.38*** (0.020)	–0.38*** (0.020)	–0.22*** (0.052)	–0.22*** (0.063)	–0.21*** (0.069)
married	0.01 (0.031)	0.01 (0.031)	0.01 (0.031)	–0.04 (0.026)	–0.03 (0.027)	–0.03 (0.026)
edu_mid	–0.02 (0.026)	–0.03 (0.027)	–0.03 (0.027)	–0.10*** (0.028)	–0.10*** (0.028)	–0.10*** (0.028)
edu_high	–0.03 (0.027)	–0.03 (0.027)	–0.03 (0.027)	–0.13*** (0.027)	–0.13*** (0.027)	–0.13*** (0.027)
edu_univ	–0.07 (0.045)	–0.08* (0.046)	–0.09* (0.046)	–0.14*** (0.038)	–0.15*** (0.038)	–0.14*** (0.037)
hh_inc	0.15*** (0.052)	0.14*** (0.052)	0.14*** (0.051)	0.06 (0.038)	0.05 (0.039)	0.05 (0.039)
hh_asset	–0.07** (0.029)	–0.07** (0.029)	–0.07** (0.029)	–0.06** (0.024)	–0.05** (0.024)	–0.06** (0.024)
pubpen	0.27*** (0.019)	0.27*** (0.020)	0.27*** (0.020)	0.14*** (0.042)	0.14*** (0.046)	0.13*** (0.049)
occupational dummy	YES	YES	YES	YES	YES	YES
observations	3,280	3,280	3,280	3,092	3,092	3,092
Log Likelihood	–1656.08	–1608.75	–1606.63	–2625	–2585	–2556
Wald test	848.57	832.03	834.69	2281	2231	2414
Prob 〉 chi2	0	0	0	0	0	0

Therefore, we predicted that the influence of changes in health status on labor force participation would be small fo r individuals in the low-income bracket.

To verify this assumption, this study included the interaction term of health status and asset level (health_good×asset). If the above hypothesis is correct—the smaller the size of assets, the smaller the influence of health status on labor market participation—the interaction term should have a positive sign (+). According to <Table IV-13>, the interaction term has a positive sign (+) in the IV-probit model for which endogeneity is controlled. This indicates that a larger scale of assets connotes a larger influence of health status on labor force participation.

Finally, we discuss the effects of reemployment among the middle-aged and elderly on the results of estimation models. More often than not, middle-aged and elderly retirees continue their engagement in the labor market through reemployment upon leaving their main workplace at or before the set retirement age. According to the Seoul Welfare Foundation (2012), the average retirement age of Seoul citizens is 52.6, and the average reemployment rate is 24 percent. If an individual voluntarily retires in his early 50s, and seeks reemployment, health status is largely irrelevant with this temporary discontinuity of economic activity, which connotes a state of frictional unemployment. If the health status is good among the elderly seeking reemployment, it is possible that the inclusion of such individuals in the estimation model may result in downward bias. However, it is difficult to discern those engaged in job-seeking activities among retirees who are currently not participating in economic activities. Therefore the 50-55 age bracket was excluded in repeating the estimation, which is assumed to be the period in which reemployment occurs most frequently, based on the fact that the average reemployment age is 52. A comparison between <Table IV-14>, which presents the re-estimation results covering the ages of 56 to 64, and <Table IV-2> and <Table IV-3>, covering ages 50 to 64, shows that the influence of subjective self-assessed health status on labor market participation is similar in both cases while the impact of ADL decreases considerably. On the other hand, the probit model showed a stronger negative correlation between the number of chronic diseases and labor force participation in the re-estimation, thereby confirming that when excluding the age bracket of most frequent reemployment, the health indicators of subjective health status and the number

〈Table IV-13〉 **Probit & IV-Probit Model Estimates: Controlling for Differences by Asset (marginal effects)**

	Probit			IV–probit		
	(1)	(2)	(3)	(4)	(5)	(6)
health_good	0.11*** (0.020)	0.09*** (0.021)	0.08*** (0.021)	0.59*** (0.067)	0.59*** (0.078)	0.60*** (0.080)
health_good×asset	–0.04** (0.022)	–0.04** (0.021)	–0.04* (0.022)	0.19** (0.077)	0.18** (0.080)	0.19** (0.080)
ADL		–0.19** (0.085)	–0.19** (0.087)		–0.37** (0.144)	–0.36** (0.139)
IADL		–0.08*** (0.012)	–0.08*** (0.012)		–0.01 (0.020)	0 (0.021)
num_NCD			–0.06** (0.024)			0.07* (0.038)
age	–0.02*** (0.002)	–0.02*** (0.002)	–0.02*** (0.002)	0 (0.004)	–0.01 (0.005)	0 (0.005)
female	–0.33*** (0.019)	–0.37*** (0.019)	–0.37*** (0.019)	–0.23*** (0.046)	–0.25*** (0.055)	–0.24*** (0.060)
married	0.02 (0.030)	0.02 (0.031)	0.02 (0.031)	–0.03 (0.027)	–0.03 (0.028)	–0.03 (0.028)
edu_mid	–0.04 (0.026)	–0.05* (0.027)	–0.05* (0.027)	–0.09*** (0.026)	–0.10*** (0.026)	–0.09*** (0.025)
edu_high	–0.08*** (0.025)	–0.08*** (0.026)	–0.08*** (0.026)	–0.15*** (0.024)	–0.15*** (0.025)	–0.15*** (0.024)
edu_univ	–0.14*** (0.041)	–0.15*** (0.042)	–0.16*** (0.041)	–0.18*** (0.039)	–0.19*** (0.040)	–0.18*** (0.040)
hh_inc	0.15*** (0.049)	0.15*** (0.049)	0.15*** (0.048)	0.05 (0.058)	0.05 (0.059)	0.04 (0.060)
hh_asset	0.04 (0.059)	0.04 (0.058)	0.04 (0.059)	–0.54*** (0.198)	–0.53*** (0.203)	–0.55*** (0.204)
pubpen	0.27*** (0.019)	0.27*** (0.019)	0.27*** (0.019)	0.15*** (0.040)	0.16*** (0.042)	0.15*** (0.045)
O	3,307	3,307	3,307	3,118	3,118	3,118
Log Likelihood	–1726.31	–1678.68	–1675.77	–3478	–3436	–3402
Wald test	840.7	822.73	829.36	2048	1958	2127
Prob 〉 chi2	0	0	0	0	0	0

〈Table Ⅳ-14〉 **Probit & IV-Probit Model Estimates: excluding Reemployment Effect (marginal effects)**

(ages of 55 to 64)	Probit			IV−probit		
	(1)	(2)	(3)	(4)	(5)	(6)
health_good	0.17***	0.15***	0.14***	0.56***	0.54***	0.54***
	(0.027)	(0.027)	(0.028)	(0.085)	(0.111)	(0.126)
ADL		−0.14**	−0.14**		−0.26***	−0.27***
		(0.063)	(0.065)		(0.089)	(0.095)
IADL		−0.08***	−0.08***		−0.02	−0.02
		(0.016)	(0.016)		(0.027)	(0.029)
num_NCD			−0.09***			0.01
			(0.033)			(0.059)
age	−0.02***	−0.02***	−0.02***	0	0	0
	(0.005)	(0.005)	(0.005)	(0.007)	(0.008)	(0.008)
female	−0.33***	−0.37***	−0.37***	−0.22***	−0.24***	−0.25***
	(0.027)	(0.027)	(0.028)	(0.061)	(0.078)	(0.085)
married	0.01	0.02	0.02	−0.02	−0.01	−0.01
	(0.041)	(0.041)	(0.041)	(0.038)	(0.039)	(0.039)
edu_mid	−0.05	−0.05	−0.05	−0.07**	−0.07**	−0.07**
	(0.034)	(0.035)	(0.035)	(0.033)	(0.034)	(0.034)
edu_high	−0.05	−0.04	−0.04	−0.10***	−0.10***	−0.10**
	(0.035)	(0.036)	(0.036)	(0.036)	(0.038)	(0.039)
edu_univ	−0.16***	−0.17***	−0.17***	−0.19***	−0.19***	−0.19***
	(0.056)	(0.057)	(0.056)	(0.050)	(0.051)	(0.051)
hh_inc	0.25**	0.23**	0.23**	0.13	0.14	0.14
	(0.098)	(0.098)	(0.094)	(0.082)	(0.087)	(0.089)
hh_asset	−0.08*	−0.09*	−0.09*	−0.10***	−0.10***	−0.11***
	(0.047)	(0.048)	(0.047)	(0.040)	(0.040)	(0.040)
pubpen	0.24***	0.23***	0.23***	0.14***	0.15***	0.15***
	(0.028)	(0.029)	(0.029)	(0.048)	(0.053)	(0.057)
Observations	1,778	1,778	1,778	1,662	1,662	1,662
Log Likelihood	−988.1	−962.4	−958.9	−1998	−1974	−1957
Wald test	412.4	421.9	429.9	817.2	791.2	796.5
Prob>chi2	0	0	0	0	0	0

of chronic diseases exert a greater influence on the labor force participation of the middle-aged and elderly.

3 Influence of Employing Aged Population on the National Finance

The third analysis aims at estimating the national finance effects of greater labor force participation among the elderly population through extended duration of employment for senior workers. Passed in April 2013, the Act on Prohibition of Age Discrimination in Employment and Elderly Employment Promotion (hereinafter referred to as the Act on Extension of Retirement Age) was examined to produce an estimation for the influence of the extended retirement age on national finance. Under the Act on Extension of Retirement Age, the legal retirement age will be extended to 60 in public organizations and large business operations with a workforce of 300 or more from 2016, followed by governmental agencies, local governments, and all businesses with a workforce of fewer than 300 from 2017. According to the Ministry of Employment and Labor, the average retirement age in Korea is 57.3, and this Act is expected to increase the labor participation period by three years.

A. Benefits of greater elderly employment on the national finance

When the enforcement of the Act on Extension of Retirement Age lengthens the legal retirement age to 60, the income-generating period will become longer for the elderly, thereby resulting in a diversity of additional revenues including the increased earned income tax, pensions, and national health insurance premiums. A longer period of employment also means greater income among the elderly, which would boost consumption and revenue from consumption tax and other taxes. <Table IV-15> features calculations for the expected changes in the national finances; more specifically in the earned income taxes, pension, and National Health Insurance premiums.

The increment in income tax revenues from the enforcement of the Act is calculated by multiplying the number of potential beneficiaries with their incomes and the income tax rate. The base year was set as 2012. The estimate

for the number of beneficiaries is produced as follows: First, isolate the population aged 50 to 60 from the population projection data by Statistics Korea (column 1 of <Table IV-15>), and then multiply the number by the employment rate (column 2) extracted from the economically active population survey, which is then finally multiplied by the number of people in employment (column 3). Although the average retirement age is currently 57, those over 50 often decide to retire early. Therefore this study limits the age of beneficiaries to range from 50 to 60. The employment rate of 2012 was surveyed over five years, according to which the ages 50 to 54 recorded 75.4 percent, ages 55 to 59 recorded 68.1 percent, and age 60 recorded 56.1 percent.

As the next step, this study estimates the total number of retirees (column 6), followed by the number of those retiring at the normal retirement age (column 8). In order to estimate the number of retirees, the retirement rate (column 4) is used to calculate the number of employees before retirement (column 5), from which the current number of employees (column 3) is subtracted. Retirement rates by age are calculated based on the data from the first and second waves of the KLoSA: Researchers calculated by age the proportion of those whose employment status changed from "employed" to "retired" between the first and second surveys (conducted in 2006 and 2008, respectively). The average retirement rate for the age group of 50 to 60 is around 9 percent, which increases with higher age. However, there are many other reasons for retirement besides age, including health status or family members' health condition, sufficiency of income, and preference of leisure, which renders it difficult to assess that all retirees would benefit from the Act. Therefore, the number of beneficiaries was estimated by considering the proportion of those who choose the retirement age as the reason for their retirement. Among those aged from 50 to 54, few retire due to the retirement age, and therefore the age group was collated as a range of five years; on the other hand, the age group of 55 and above applied the proportion of those who retired due to the retirement age (column 7). As expected, the proportion increased with age. The number of those who would benefit from the Act on Extension of Retirement Age is estimated in column 8; the number of those who would retire at the current retirement age of 57. The total beneficiaries are estimated at 72,169, comprising mostly of those aged from 58 to 60. Although the Ministry of Employment and Labor presented its

〈Table IV-15〉 **Calculation of the Potential Beneficiaries of the Retirement Extension Act**

Age	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total population (as of 2016) (unit: 1 person)	Employment rate (%)	Number of employees (unit:1 person)	Retirement rate (%)	Number of employees before retirement (3)/(1-(4)	Number of retirees (5)-(3)	Retired due to retirement age (%)	Number of beneficiaries (unit: 1 person): (6)X(7)
50	819,191	75.4	617,670	4.65	647,792	30,122	1.88	566
51	829,707	75.4	625,599	8.11	680,813	55,214	1.88	1,038
52	835,985	75.4	630,333	11.83	714,906	84,573	1.88	1,590
53	851,832	75.4	642,281	5.29	678,156	35,874	1.88	674
54	868,099	75.4	654,547	6	696,326	41,780	1.88	785
55	865,245	68.1	589,232	7.94	640,052	50,820	7.69	3,908
56	842,538	68.1	573,768	12.2	653,495	79,726	9.09	7,247
57	806,668	68.1	549,341	8.7	601,688	52,347	14.29	7,480
58	770,514	68.1	524,720	10.94	589,176	64,456	20.37	13,130
59	733,532	68.1	499,535	16.67	599,466	99,931	23.61	23,594
60	694,429	56.1	389,575	10.66	436,059	46,484	26.15	12,156
Total								72,169

conservative estimation of beneficiaries at 78,000, this study's estimate was seven percent smaller than that of the Ministry.

Next, we calculate the additional income tax revenue per person by factoring in the number of beneficiaries and earned income by age and tax rate. Earned income by age presented in the column 1 of <Table IV-16> is based on the Employment and Labor Ministry's Survey Report on Labor Conditions (2011), calculated by multiplying the average monthly salary by 12 and adding annual performance bonuses and incentives. In order to convert the average income by age from 2011 into that of 2012, this study proposed two assumptions: first, income increases according to the consumer price index (Statistics Korea);

〈Table IV-16〉 **Aged Beneficiaries' Income Information**

(Unit: 10 thousand won)

Age	Annual Income from Survey Report on Labor Conditions (2011)	Scenario 1: Converted into 2012 income by adjusting for consumer price inflation1)	Scenario 2: Converted into 2012 income by adjusting for nominal GDP growth rate2)
50	4505	4604	4641
51	4465	4563	4600
52	4434	4532	4568
53	4434	4532	4568
54	4373	4469	4505
55	4142	4233	4267
56	4052	4141	4174
57	3900	3986	4018
58	3586	3665	3694
59	3194	3264	3290
60	2845	2908	2931

Note: 1) 2008: 4.7%, 2009: 2.8%, 2010: 3%, 2011: 4%, 2012: 2.2%
2) 2008: 5.28%, 2009: 3.76%, 2010: 10.16%, 2011: 5.27%, 2012: 3.02%

and the second scenario is that it grows according to the nominal GDP growth rate (Bank of Korea), which is the same approach taken by Weon Jong-Hak *et al.*

Subsequently, the additional earned tax revenues are calculated by multiplying the average income by age and income tax rate. And other revenues from increased pension and health insurance premiums are also estimated by multiplying the average income with rates for the national pension and health insurance premiums. The income tax rates presented in <Table IV-17> are determined by the total earned income (total wages), which is extracted from the National Tax Service's Statistical Yearbook of National Tax (2012). The average effective income tax rate for all taxpayers is 4.58 percent, but as shown

〈Table IV-17〉 **Eared Income Tax Rate by Income Range**

	Average effective tax rate (%)
Overall tax payers	4.58
Less than 20 million won	0.54
Less than 30 million won	0.85
Less than 40 million won	1.47
Less than 45 million won	2.07
Less than 60 million won	2.99

Source: Statistical Yearbook of National Tax (2012) (Table 4-2-4)

in <Table IV-16>, the elderly make an annual income of 20 million to 50 million won with a relatively low effective tax rate ranging from 0.85 percent to 2.99 percent. The premium rate for the national pension is 9 percent as of 2012, the burden of which is halved between the employer and the employee. This study applies a pension premium rate of 4.5 percent, paid by the employee to calculate additional pension revenues from the extra earned incomes. As for the National Health Insurance, the premium rate is 5.8 percent (2012), and the study uses 2.9 percent which is paid by the employee to estimate additional health insurance revenues.

<Table IV-18> presents increments in revenues from additional income taxes, pension and health insurance premiums under the two aforementioned scenarios. The additional tax revenues by age in column 1 of <Table IV-18> are calculated by multiplying together the number of beneficiaries (column 8 of <Table IV-15>), the average earned income (column 2 of Table 16), and the corresponding income tax rate (<Table IV-17>). Under the first scenario, the total additional revenue amounts to 232.3 billion won (0.018 percent of the 2012 GDP), comprised of 41.4 billion won, 116 billion won and 74.8 billion won from extra income taxes, pension premiums and health insurance premiums,

〈Table IV-18〉 **Additional National Revenues under Two Scenarios**

(Unit: 10 thousand won)

Age	(1)	(2)	(3)	(4)	(5)	(6)
	Scenario 1			Scenario 2		
	Earned income revenue	Pension revenue	Health insurance revenue	Earned income revenue	Pension revenue	Health insurance revenue
50	77,992	117,329	75,612	78,617	118,270	76,218
51	141,688	213,153	137,365	142,825	214,863	138,467
52	215,523	324,228	208,947	217,252	326,829	210,623
53	91,421	137,531	88,631	92,154	138,635	89,342
54	72,836	157,966	101,801	105,847	159,233	102,617
55	343,254	744,450	479,757	346,008	750,421	483,605
56	622,700	1,350,513	870,330	627,695	1,361,345	877,311
57	438,407	1,341,685	864,642	623,592	1,352,447	871,577
58	707,545	2,165,344	1,395,444	713,221	2,182,713	1,406,637
59	1,132,457	3,465,730	2,233,470	1,141,541	3,493,529	2,251,386
60	299,250	1,590,448	1,024,955	301,650	1,603,205	1,033,176
Sub total	4,143,074	11,608,378	7,480,955	4,390,401	11,701,491	7,540,961
Total	23,232,406			23,632,853		

respectively. Under the second scenario, the data is converted using nominal GDP growth rate as opposed to consumer price inflation, which is why the converted incomes are larger than those under the first scenario. The additional national revenues are estimated at 236.3 billion won (0.019 percent of the 2012 GDP).

If the effect of increased elderly employment (or the Act on Extension of Retirement Age) on the national finance was largely examined thus far through a conservative calculation of total additional revenues combining the increments in earned income and social insurance revenues, it is also possible to estimate

the influence from a more comprehensive view by factoring in the public tax burden, which excludes corporate taxes. If given the availability of data on individual consumption amount and itemized income, the total amount of taxes and individual burden of social insurance premiums could be calculated by multiplying the public's tax burden rate (including income tax, individual consumption tax, general consumption tax, property tax, and social insurance premiums, with corporate taxes excluded). However, since the available income-related data is limited to earned incomes, which is currently unavailable on an itemized basis, it is difficult to calculate the impact of the extension of retirement on the national finance from a more comprehensive perspective. At best, this study re-estimated the additional national revenues (income and social insurance revenues) accrued from higher elderly employment, which multiplied income by the sum of income tax and social insurance.

Presented by An Jongseok in his 2013 study, the 2010 public tax burden rate is 25 percent, with income tax and social insurance premiums accounting for 3.6 percent and 5.7 percent respectively, to comprise 9.3 percent in total. This would suggest that if the extension of the retirement age generates additional incomes through greater elderly employment, at least 9.3 percent of the increment is expected to go to the state coffers. <Table IV-19> shows the result of re-estimation of total additional revenues by multiplying 9.3 percent of the public tax burden and the income by age to calculate additional revenues by age, and adding all revenues by age to aggregate the extra revenues. The re-estimation based on the public's tax burden rate suggests a total additional revenue of 239.9 billion won for the first scenario, and 241.8 billion won for the second scenario. These figures do not show a big difference from the results shown in <Table IV-18>, which factors in the income by age, and income tax rate.

〈Table IV-19〉 **Additional National Revenues Calculated based on the Tax Burden Rate**

(Unit: 10 thousand won)

	Scenario1	Scenario 2
Additional revenues	23,990,647	24,183,082

The aforementioned static calculation method has its limitations. In fact, an accurate calculation of increments in national revenues would require a more specific structure of average effective tax rate by age and income. But for the sake of convenience, this study does not consider age but only factors in the average effective tax rates by income, presented in the Statistical Yearbook of National Tax. It is inevitable that there is a difference between the real increments in revenues and the estimated incremental amounts, due to the application of average income by age and average effective tax rates instead of the individual's income data. If the beneficiaries of the Act on Extension of Retirement Age are polarized and significantly deviate into those with extremely high income and those with extremely low income, as opposed to being concentrated on the average income, this study would have underestimated the additional revenues. This is because the effective income tax rate increases progressively; for example, the rate for those with an annual income of more than 300 million won is set at over 20 percent.

Also, additional revenues could be created not only through increased income taxes but also in increased consumption as the elderly population continues to participate in economic activities for longer. If other tax revenues rise while spending on the elderly decreases, the extended retirement age would induce greater benefits in terms of national finances. The Act would benefit the workers whose workplace has a retirement age of less than 60, but it is also possible that the Act encourages corporate entities that already have a retirement age of 60 or older to further extend the retirement age to 62 or 65. If the Act can create positive externalities not only in the entities with a retirement age of 60 or younger but also in companies with a retirement age of 60 or older, the influence of the extension on national finance is likely to grow further.

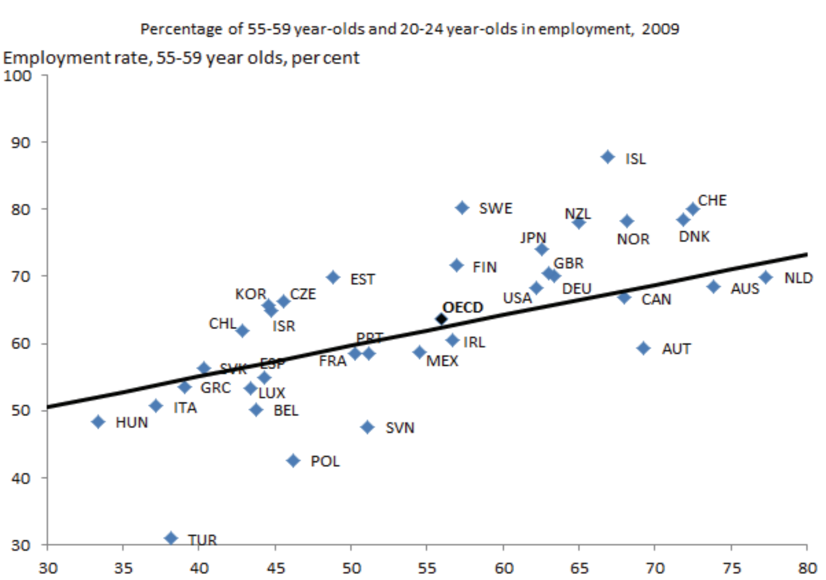
B. Negative effects of greater elderly employment on the national finances (costs)

The aforementioned Act on Extension of Retirement Age, which guarantees the employee a legal retirement age of 60, does not entail extra fiscal spending. An individual becomes entitled to the benefits for the elderly only upon turning 65 while no age-related benefits are available to those under the

age of 60. This means the extension of retirement age does not cause any considerable changes in terms of the country's welfare spending. As for corporate entities, there arises a need to cut costs due to decreased productivity or increased personnel expenses caused by a higher proportion of elderly employees. In order to cut costs, businesses may be forced to introduce policies such as a wage peak system or flexible working hours. From a broader perspective, however, as opposed to focusing on the single policy of retirement age extension, the promotion of employing the elderly not only raises national revenues by increasing earned incomes but also creates costs. For example, if the government turns to fiscal expenditure or tax benefits to promote elderly employment, it would result in fiscal costs. Also, if greater elderly employment entails fewer jobs for the youth, that would decrease the positive effects from the promotion of employing elderly persons, because the additional revenues from the former would be offset in the form of opportunity costs caused by lower youth employment.

The topic of whether the youth and the elderly compete for jobs is a subject of such importance to deserve separate study, but we will discuss it only briefly below. According to the Pension at a Glance 2011 published by the OECD, the logic that late retirement of the elderly hinders the employment of the youth is referred to as "lump-labor fallacy," which supposes that the total number of jobs available is fixed and split between all age groups. However, the youth employment rate (aged 20 to 24) and the elderly employment rate (aged 55 to 59) show a positive correlation among OECD countries ([Figure IV-3]). Despite this, a fallacy exists in certain countries and individuals of certain characteristics (female, educational level, etc.) that the increases in jobs for the elderly correspond to decreases in youth employment. For example, in countries with low employment such as Italy and Hungary, there is a perception among the public that a boosted elderly employment diminishes job opportunities for the youth, which is more likely to be believed by women and those with lower education levels. France introduced early retirement policies to address youth unemployment, but the measure ultimately failed to bring about any positive effect in solving the problem of youth unemployment, while exacerbating the fiscal burden (Jang Sin-cheol, 2009). Therefore, it is likely that youth unemployment is caused not by the elderly occupying an excessive proportion

[Figure Ⅳ-3] **Employment Rates: Younger and Older Workers**



Source: OECD, Pension at a Glance 2011 (p.76, Figure 4.6)

of jobs, but more by other factors such as structural issues in supply-demand mismatch.

In Korea, no consensus has been made on whether elderly and youth employment are mutually obtrusive or complementary. However, according to the National Assembly Budget Office (2012), the dominant trend in Korea would suggest that the two are closer to being complementary rather than being at odds (Ahn Ju-yeop, 2011; Kim Jun-yeong, 2011; Hyundai Research Institute, 2010, etc.). The reason that greater employment of the elderly would not hinder the employment of younger workers is because the two groups prefer different workplaces (industry or trade) and duties. But the issue of contestability between the two could change depending on the occupation and duties, because the retention of aged regular workers would connote a smaller number of young workers being newly recruited in public organizations such as state-owned

companies with rigid policies for changes in the number of employees (KDI, 2013). However, the scale of recruiting old workers is smaller in the public sector than in the private sector. Therefore, the extent of hindrance to youth employment caused by greater elderly employment would be negligible.

V

Conclusion and Policy Implications

South Korea has already entered the ageing society, and is rapidly progressing towards becoming an aged and super-aged society. The rise in the elderly population reduces fiscal revenues and increases fiscal expenditure, thereby placing a significant burden upon public finance on a national scale. The decline in fiscal revenues stems from a decline in the economically active population and an ageing labor force. A reduction in the economically active population or an increase in the retired population indicates a reduced rate of income-earning activities, and consequently leads to a decline in tax revenues collected from individual earned income, business income, consumption, and assets. Fiscal expenditure caused by the ageing population will increase mainly in the area of elderly welfare including pension and health insurance. According to the Future Population Projection (2011) published by Statistics Korea, the proportion of the elderly in the entire population is expected to increase from 10 percent at present up to 40 percent in 2060. Along with the absolute increase in the number of elderly people, life expectancy will also increase, in turn leading to an increase in the period over which the elderly as the largest demographic will be dependent on pensions. Furthermore, when it is taken into consideration that 30 percent of the total medical expenditure is currently spent on the elderly, which currently comprises 10 percent of the entire population, an increase up to 40 percent will provide an excessive burden in terms of medical expenses.

This paper suggested an extension of the labor participation period of the elderly as a means to alleviate an increased fiscal burden caused by an ageing

society. In an effort to provide grounds for the suggestion to encourage the elderly to participate in labor force activities, this study first identified healthy ageing trends, demonstrated the relationship of better health resulting in an increase in the elderly labor supply, and then estimated the effect of the extended period of the elderly labor participation on public finances. Healthy ageing is used as grounds for the assertion that improved health among the elderly would allow them to remain in employment for longer. Cross-sectional data by country also demonstrated the trend that the healthy lifespan increases along with the life expectancy and overall income levels. At present, as the life expectancy and income among the Korean population have increased gradually as a trend that is expected to continue, their healthy life expectancy is also anticipated to increase. Following on, this paper demonstrated that improved health status among the elderly also increased labor supply, by using the second wave of the KLoSA 2008. While it is true that the healthy aged are the main target of encouragement for participation in economic activity, since the current system generally sets the retirement age at 65, this study instead targeted the middle-aged and elderly population aged 50 to 64. Primary explanatory variables to represent health status included subjective health, ADL, IADL, and the number of chronic diseases, while dummy variables that represent labor force participation were used as dependent variables. Primary models employed in this paper are probit models and IV-probit models: the former did not control for endogeneity of health variables, whereas the latter did control for endogeneity. The probit model results showed that middle-aged and elderly respondents evaluating their self-assessed health as good or excellent were 10 percent more likely to participate in the labor market, while the size of the effect rose to 60 percent when using the IV-probit model. Lastly, in order to estimate the effect of elderly labor participation on fiscal status, this paper examined the impact of the Act on Extension of Retirement Age, passed in April 2013. As this Act guarantees the retirement age at 60, most middle-aged and elderly workers will benefit from the extended labor participation, considering the reality that employees are generally influenced to retire at a relatively lower age of 57. Estimates of the increased fiscal revenue (fiscal income from labor earnings, pension and health insurance) as a result of the implementation of the Act on Extension of Retirement Age were calculated at 230-250 billion won (0.02 percent in

relation to GDP in 2012). However, while the Elderly Friendly Employment Policy may increase fiscal revenue, it may also incur additional costs. The government's fiscal expenditure or tax benefits for this policy causes direct costs, and if the increased employment of the elderly working people hinders youth employment, indirect costs will be added. Based on data from Statistics Korea's Economically Active Population Survey, this paper found no evidence to indicate that increased employment of the elderly would hinder youth employment. Therefore we conclude that the Elderly Friendly Employment Policy exerts a more positive impact on the fiscal status than the negative.

The current administration under President Park Geun-hye is aiming to achieve an employment rate of 70 percent. Employment expansion is the most aggressive and ambitious strategy in response to a demographic change, as it improves national fiscal soundness and alleviates the intergenerational burden of family support. In order to meet the target employment rate offset by the government and to fundamentally resolve the fiscal burden created by demographic changes, the most appropriate course of action is to fully utilize the potential of the elderly workforce in the labor market. The elderly participation in the labor force can lead to the enhancement of economic growth and delay their transition to dependent status, which will allow the government to secure tax revenue from the income earned through their economic activity. In relation to social security systems including health insurance and pension, longer labor market participation by elderly people would result in greater improvements in the fiscal soundness of social security funds. The extension of senior labor force participation can raise the age of pension collection and shorten the period of dependence. Although a consensus has yet to be reached, based on the study result suggesting that labor enhances individual health, it can be concluded that the promotion of elderly employment would result in more positive effect on the finance for national health insurance.

As discussed above, as healthy ageing progresses, the improvement of the elderly population's health status would increase the labor supply. Therefore, the government must formulate policies and measures to encourage the employment of elderly people, which requires both demand-side and supply-side considerations. From the demand side, companies that hire elderly people may be granted subsidies or tax benefits/exemptions, while from the supply side,

tax benefits may be expanded for elderly workers' income. Furthermore, as pointed out in many previous studies, policies such as retirement age extension and the direct government provision of job opportunities for the elderly leads to an overall increase in senior employment. In addition to economic incentives and systems, investment in senior health is necessary to allow active elderly participation in the labor market. As shown in this paper through empirical analysis, health serves as a crucial factor in influencing labor force participation by the elderly. Consequently, institutional improvement is required in a number of aspects such as preventive and check-up measures for improving elderly health and flexible working schemes to allow for adjustments of workload.

Starting with the enactment of the Act on Extension of Retirement Age, which legislated the retirement age at 60, the retirement age must gradually rise further to compensate for the deepening trend of population ageing. Countries with a lower life expectancy than Korea, such as Germany, Denmark, the U.K. and Finland plan to raise the retirement age closer towards 70. As the current healthy life expectancy among the Korean population has risen to 71 through advancements in combating old-age dementia and other disorders, it may be desirable to gradually move the retirement age into the latter half of 60s. Naturally, as policies for elderly employment promotion such as extending the retirement age may cause undesirable side-effects in the labor market such as a conflict of interest with youth employment and a decline in corporate productivity, additional measures must follow, including wage peak systems and reduction of working hours.

To reduce the national fiscal burden caused by the demographic change of population ageing, the government must encourage the elderly population to join the workforce and thereby stimulate income-generating activities, and promote the trend of active ageing to postpone their dependence on welfare expenditure. Hence, the elderly population must be encouraged to become a supporting pillar of society, not only as consumers, but as producers as well. Facing the prospect of deeper population ageing, this is a time of urgency that requires concerted efforts to change social perception and establish the necessary systems and policies in order to vitalize workforce participation by the elderly. In particular, disseminating a positive outlook towards elderly workers and creating a social atmosphere conducive for all age groups to work together is

likely to require a significant timeframe, and therefore the formulation of responses to population ageing must begin at the soonest possible juncture.

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