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# Forecasts on the Real Income Replacement Rates of Public and Private Pensions by Birth Cohort

## – Focusing on the Annuitization of Retirement Benefits for Stabilizing Old-Age Income

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# Forecasts on the Real Income Replacement Rates of Public and Private Pensions by Birth Cohort

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# Abstract

The demographic changes in Korea compel us to debate and find a new fiscal stabilization policy that can ensure the sustainability of public pension schemes. Growing worries over the prospects of public pensions are also directing more interest toward private pensions. As it is impossible in Korea to ensure adequate old-age income with public pension benefits alone, we need a new pension policy that fosters private retirement pensions. Given the current rate of annuitization of retirement benefits in Korea, retirement benefits can barely serve as a secure source of old-age income for Koreans. It is therefore crucial to forecast the real income replacement rates of public and private pensions in Korea and study the annuitization schemes in other advanced countries so that we can enhance the role and function of Korea's retirement pensions.

# 1 How prepared are Koreans for post-retirement life?

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According to *Pensions at a Glance 2013* published by the Organization for Economic Cooperation and Development (OECD), the effective age at which Koreans retire from the labor market is 71 for men and 70 for women—the second-highest among the OECD member states after Mexico and Chile. Korea is also the fastest-aging country among the OECD member states, with the number of working people per senior (aged 65 or older) expected to drop to 1.2 by 2062, at which time Korea will be the most aged OECD member state. As population aging will inevitably and dramatically affect Korea's ability to fund its pension schemes, the OECD advises that the Korean government adopt a new labor market policy that is more favorable towards old-age workers. There is also a growing demand for the reform of the public and private pension schemes in Korea, so that Koreans can benefit from adequate and steady old-age income under a multi-pillar old-age income security system.

In the Household Finance and Welfare Survey (HFWS) of 2012 in Korea, almost 40 percent of the surveyed answered that they were not prepared at all for post-retirement life. Of the households that were prepared, over 30 percent answered that they

planned to rely on their public pension policies as their main sources of post-retirement income. In particular, almost 78 percent of full-time workers thought of public pensions as the main source of post-retirement income security. Considering that the average income replacement rate of public pension schemes in Korea amounts to a mere 30 percent or so today, a great number of Koreans are risking their post-retirement income security by planning to rely exclusively on public pensions. The survey also reveals the inability or refusal of Koreans to develop a more diversified and effective post-retirement financial portfolio.

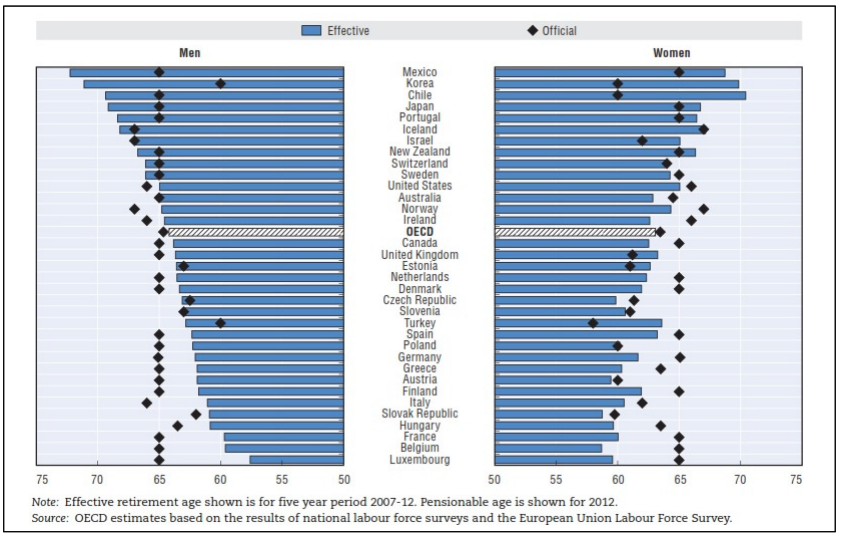
〈Table 1〉 Post-Retirement Preparations: Korea vs. OECD

| | | Korea | OECD |
|---|---|---|---|
| Total income replacement rate[1)] | Average income earners (%) | 39.6 | 54.4 |
| | Low-income earners (%) | 59.2 | 71.0 |
| Public pension spending as a percentage of GDP | | 2.1 | 7.8 |
| Life expectancy | Newborn | 81.3 | 79.9 |
| | At age 65 | 19.5 | 19.1 |
| Ratio of seniors (65+) to working-age population (%) | | 17.9 | 25.5 |
| Average annual income (in KRW 1 million) | | 38.5 | 45.5 |

Note: 1) The income replacement rate refers to the ratio of income from all mandatory post-retirement sources to total personal income. Here the estimated income replacement rates have been based on full-time workers entering the respective labor markets in 2012, with the assumption that low-income earners earn 50 percent of the average income.

Source: OECD (2013), *Pensions at a Glance 2013: OECD and G20 Indices*.

[Figure 1] Effective Retirement Ages in OECD Member States




Source: OECD (2013), *Pensions at a Glance 2013*.

〈Table 2〉 Household Finance and Welfare Survey 2012 on Post-Retirement Preparations

(Unit: %)

| | | Prepared | Public pensions | Private pensions | Personal savings | Real estate | Other[1)] | Not prepared |
|---|---|---|---|---|---|---|---|---|
| All households | | 61.5 | 36.5 | 14.0 | 13.2 | 14.1 | 9.2 | 38.5 |
| | Full-time | 91.4 | 77.6 | 23.1 | 17.4 | 15.6 | 19.0 | 8.6 |
| | Part-time | 44.4 | 20.5 | 11.2 | 9.0 | 7.4 | 2.9 | 55.6 |
| | Self-employed | 73.1 | 45.0 | 18.7 | 15.4 | 20.5 | 5.2 | 26.9 |
| | Unpaid employees (family businesses) | 49.9 | 11.7 | 10.8 | 10.9 | 16.7 | 3.8 | 50.1 |
| | Other (unemployed, etc.) | 40.8 | 10.9 | 6.0 | 10.9 | 11.5 | 7.9 | 59.2 |

Notes: 1) The "Other" category includes investments in stocks, funds, bonds, futures, and other such securities.
2) The respondents were allowed to select more than one option and the total therefore may exceed 100.0.

Source: Statistics Korea, *Household Finance and Welfare Survey 2012*.

Korea already has the highest and fastest-growing old-age poverty rate among all OECD members, which has prompted the OECD to advise the Korean government to make efforts to lower the rate with improved social integration and quality of life. As Table 3 shows, the poverty rates among elderly workers and self-employed people in Korea are as high as 32.4 percent and 32.3 percent, respectively, which are significantly higher than the poverty rates among younger full-time workers and self-employed. The poverty rate was especially pronounced among the very old, forced to work in part-time jobs or in their own businesses without any other employees, as well as those working as unpaid employees of family businesses or in the "other" category (unemployed, etc.). To ensure post-retirement financial stability and improve the quality of life for seniors in Korea, Korean policymakers need to devise new policies that expand employment opportunities for retirees. Programs should also be implemented that provide pre-retirement education on the financial and psychological preparations necessary for post-retirement life.

〈Table 3〉 HFWS on Poverty Rates by Age Group
(Based on Equalized Disposable Income)

(Unit: %)

| | | All | Employment status | | | | | | | Other (unemployed, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Workers | | | Self-employed | | | Unpaid employees of family businesses | |
| | | | | Full-time | Part-time | | With employees | Without employees | | |
| Total | | 16.5 | 10.3 | 4.4 | 24.3 | 13.1 | 2.3 | 16.0 | 17.0 | 21.0 |
| Age group | Under 30 | 10.9 | 7.4 | 4.9 | 14.4 | 4.1 | - | 4.8 | 8.0 | 11.6 |
| | 30-39 | 8.7 | 6.4 | 3.6 | 18.0 | 5.8 | 1.8 | 7.4 | 5.5 | 15.2 |
| | 40-49 | 10.5 | 9.3 | 4.3 | 22.3 | 6.0 | 2.1 | 7.6 | 7.8 | 17.8 |
| | 50-59 | 12.8 | 10.6 | 4.5 | 21.0 | 8.2 | 2.9 | 9.6 | 9.3 | 21.2 |
| | 60+ | 43.1 | 32.4 | 9.1 | 44.6 | 32.3 | 2.5 | 34.5 | 35.3 | 49.1 |
| | Baby boomers | 11.5 | 9.9 | 4.4 | 20.1 | 7.0 | 1.9 | 8.6 | 7.6 | 20.0 |

Source: Statistics Korea, *Household Finance and Welfare Survey(HFWS) 2012*.

# 2 Survey on the post-retirement preparations of retirees in Korea

# 2 Survey on the post-retirement preparations of retirees in Korea

The Ministry of Employment and Labor (MOEL) survey on retirement pensions as of the first quarter of 2014 showed that 98 percent of retirees in Korea opted to collect their retirement benefits in the form of lump-sum retirement allowances, while only two percent opted for annuities. The survey, however, only concerns retirees who collect their retirement benefits immediately after their retirement. However, retirees that collect lump-sum retirement allowances upon retirement may decide to re-invest these allowances into individual retirement pensions or personal pensions under the Employee Retirement Income Security Act (ERISA), opting to annuitize their retirement income. We therefore need a new survey on the actual rate of the annuitization of retirement benefits in Korea.[1] Won, Baek and Son (2014) thus launched a Web-based survey, targeting 500 retirees in their 50s and 60s who retired after at least 10 years of working and who collected lump-sum allowances upon retirement. The survey sought to determine how many of these retirees used their allowances to buy new retirement or personal pension policies, why they chose to collect

1) The retirement annuitization rate is the ratio of retirees who opt to collect their retirement benefits in the form of annuities.

lump-sum allowances, and what other sources of post-retirement income they have secured. Table 4 summarizes the attributes of participants in the survey. Note that the ratio of retirees holding college degrees or higher is quite high (77 percent), as is the ratio of retirees earning KRW 3 million or more per month (79 percent).[2)]

〈Table 4〉 Survey Participants: Overview

| | | | | | |
|---|---|---|---|---|---|
| Pre-retirement line of work | Manufacturing | 210 (42%) | Pre-retirement employment status | SMB owners | 65 (13.0%) |
| | Construction | 46 (9.2%) | | SMB employees | 168 (33.6%) |
| | Wholesale/retail | 34 (6.8%) | | Employees at KOSPI-listed large corporations | 163 (32.6%) |
| | Lodging/restaurants | 3 (0.6%) | | Employees at non-KOSPI listed large corporations | 56 (11.2%) |
| | Service | 56 (11.2%) | | Other | 48 (9.6%) |
| | Agriculture/forestry/fishery | 2 (0.4%) | Total | | 500 (100%) |
| | Electricity/gas/steam/waterworks | 7 (1.4%) | Total household income (KRW) | Less than 2,000,000 | 41 (8.2%) |
| | Transportation/communications | 37 (7.4%) | | 2,000,000 to 2,999,999 | 67 (13.4%) |
| | Financial/real estate services | 71 (14.2%) | | 3,000,000 to 3,999,999 | 91 (18.2%) |
| | Education | 10 (2.0%) | | 4,000,000 to 4,999,999 | 98 (19.6%) |
| | Public corporations | 6 (1.2%) | | 5,000,000 to 5,999,999 | 74 (14.8%) |

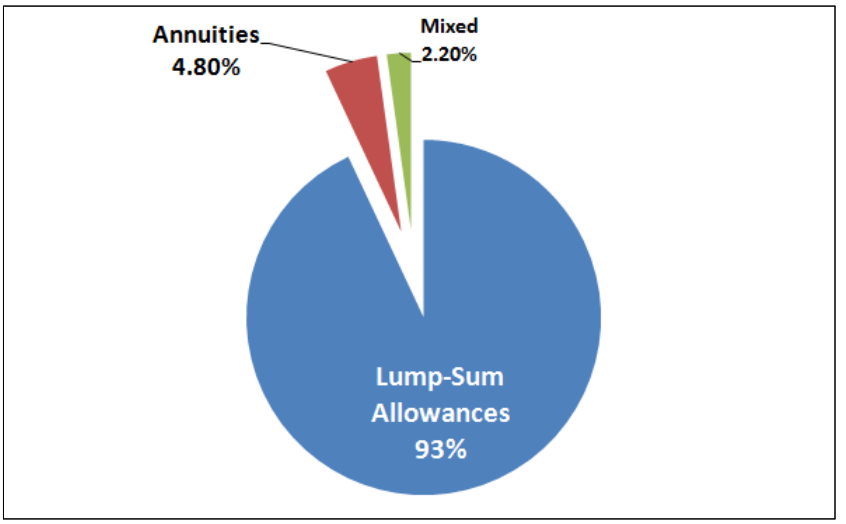
2) The reason that the participant pool includes such high ratios of well-educated and high-earning retirees is that the survey was conducted via a specialized panel polling agency with its own limited pool of respondents. The target participants of the survey were retirees who had worked for a long time in their last jobs. However, a limited number of retirees meet this criterion in Korea because of frequent turnovers and growing employment insecurity on the Korean job market. Also, panel polling agencies tend to possess databases on individuals who participated in previous panel studies and can search this data to meet the criteria of the survey with greater ease than individual researchers without existing databases. Thus, the participant pool for the current survey likely reflects the characteristics of existing panel participants at the chosen polling agency.

| | | | | | |
|---|---|---|---|---|---|
| | Religion | 2 (0.4%) | | 6,000,000 to 6,999,999 | 48 (9.6%) |
| | Broadcasting/journalism | 4 (0.8%) | | 7,000,000 or more | 81 (16.2%) |
| | Law | 2 (0.4%) | Total | | 500 (100%) |
| | Medicine | 5 (1.0%) | Educational attainments | High school or less | 114 (22.8%) |
| | IT | 5 (1.0%) | | Bachelor's degree | 326 (65.2%) |
| | | | | Graduate degree | 60 (12.0%) |
| Total | | 500 (100%) | Total | | 500 (100%) |

Source: Won, Baek, and Son (2014). *Demographic Changes and Their Implications on the Forecasts and Operating Strategy of Public and Private Pension Assets*, KIHASA.

As with retirees participating in the MOEL survey from the first quarter of 2014, an overwhelming majority—93 percent—also collected their retirement benefits in the form of lump-sum allowances, while only 4.8 percent opted for annuities and 2.2 percent for a combination of allowances and annuities. The fact that the vast majority of retirees collect their retirement benefits in the form of lump-sum allowances suggests that retirement benefits in Korea fail to serve as a secure source of post-retirement income. The average amount of lump-sum allowances collected by retirees was KRW 63.5 million each. The greatest proportion (13.5 percent) of retirees collected from KRW 10 million to KRW 20 million each in allowances.

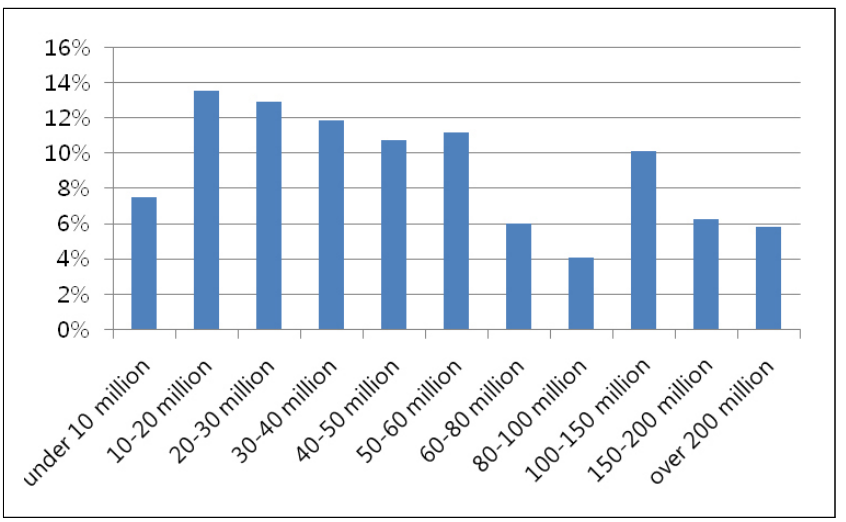
[Figure 2] Favored Modes of Collecting Retirement Benefits




Source: Won, Son and Baek (2014).

[Figure 3] Amounts of Lump-Sum Retirement Allowances Collected by Retirees

(Unit: KRW)




Source: Won, Baek and Son (2014).

As of 2013, according to MOEL's Survey on Current Status of Working by Employment Status (for commercial enterprises hiring at least five persons each), retirees had worked 6.4 years on average. It was therefore difficult to find retirees with at least 10 years of work experience prior to retirement. While the ratio of retirees in our survey that chose retirement annuities was similar to that reported in the MOEL's survey, our survey was limited to 500 retirees. Interpreting Table 5 therefore requires some caution.

〈Table 5〉 Choice over Forms of Retirement Benefits and Household Income

(Units: KRW, %, number of persons)

| Chosen form of retirement benefits | Average monthly household income | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | Under 2 million | 2 ~ 3 million | 3 ~ 4 million | 4 ~ 5 million | 5 ~ 6 million | 6 ~ 7 million | Over 7 million | |
| Lump-sum | 17.8<br>(83) | 22.6<br>(105) | 20.0<br>(93) | 15.1<br>(70) | 10.3<br>(48) | 3.9<br>(18) | 10.3<br>(48) | 100<br>(465) |
| Annuities | 8.3<br>(2) | 25.0<br>(6) | 16.7<br>(4) | 16.7<br>(4) | 8.3<br>(2) | 16.7<br>(4) | 8.3<br>(2) | 100<br>(24) |
| Mixed | 9.1<br>(1) | 9.1<br>(1) | 27.3<br>(3) | 0.0<br>(0) | 27.3<br>(3) | 18.2<br>(2) | 9.1<br>(1) | 100<br>(11) |
| Total | 17.2<br>(86) | 22.4<br>(112) | 20.0<br>(100) | 14.8<br>(74) | 10.6<br>(53) | 4.8<br>(24) | 10.2<br>(51) | 100<br>(500) |

Source: Won, Baek and Son (2014).

Figure 4 divides retirement benefits collected into more specific types. Of the 500 retirees, 85 percent or 425 stated that they collected lump-sum retirement allowances, with nine of them also holding individual retirement pensions (IRPs). Only 6.4 percent or 32 of the retirees chose retirement pension

plans with defined benefits (DB-type plans), and 4.2 percent or 21 of the retirees chose retirement pension plans with defined contributions (DC-type plans).

[Figure 4] Types of Retirement Benefits


Source: Won, Baek and Son (2014)

The lump-sum retirement allowances and mixed retirement benefits collected by retirees together translate into an average monthly income of KRW 1.23 million per retiree.[3] The income replacement rate of these retirement benefits—the ratio of retirement benefits to average monthly household income—was 39.76 percent for households with average monthly income of less than KRW 2 million; 28.63 percent for households with average monthly income ranging from KRW 2,000,000 to KRW 2,999,999; 26.97 percent for households with average monthly

3) As of 2014, the minimum amount of monthly income a four-person household needs to survive was KRW 1.6382 million (or KRW 1.319089 million in cash).

income ranging from KRW 3,000,000 to KRW 3,999,999; 15.40 percent for households with average monthly income ranging from KRW 4,000,000 to 4,999,999; 18.44 percent for households with average monthly income ranging from KRW 5,000,000 to 5,999,999; 21.56 percent for households with average monthly income ranging from KRW 6,000,000 to 6,999,999; and 7.21 percent for households with average monthly income of KRW 7,000,000 or more. Citing a World Bank report on the income replacement rate trend worldwide that shows the income replacement rates of public pensions and of personal retirement pensions to be 30 percent or so each, Ryu et al. (2009) argues that the income replacement rate of the first-tier National Pension in Korea amounts to 35 percent, while the income replacement rates of the second-tier retirement pension and the third-tier private pensions amount to 12.5 percent and 7.5 percent, respectively. Our survey shows similar results.

〈Table 6〉 Monthly Retirement Benefit Distribution and Household Income

(Unit: %)

| Average monthly household income (KRW) | Monthly retirement benefits (KRW) | | | | Total |
|---|---|---|---|---|---|
| | Under 500 thousand | 500 thousand ~ 1 million | 1 ~ 2 million | Over 2 million | |
| Under 2 million | 50.0 | 25.0 | 25.0 | 0 | 100 |
| 2 ~ 3 million | 42.80 | 28.6 | 28.6 | 0 | 100 |
| 3 ~ 4 million | 0 | 66.7 | 33.3 | 0 | 100 |
| 4 ~ 5 million | 0 | 33.3 | 33.3 | 33.30 | 100 |
| 5 ~ 6 million | 0 | 66.7 | 33.3 | 0 | 100 |
| 6 ~ 7 million | 0 | 0 | 50.0 | 50.0 | 100 |
| Over 7 million | 14.3 | 85.7 | 0 | 0 | 100 |

Source: Won, Baek and Son (2014).

Of the retirees who opted for either lump-sum retirement allowances or mixed retirement benefits, 34 percent chose annuities certain (i.e., with retirement benefits continually granted over a fixed period of time), and the remaining 66 percent chose lifetime annuities (i.e., granted throughout the remainder of the retiree's lifetime). Given the particular characteristics and the limited size of our survey's retiree pool, we need to be cautious in interpreting this result. Nevertheless, we can see from our survey that the ratio of retirees who choose to collect their retirement benefits over longer stretches of time instead of at once or over short terms continues to increase. As retirees with DB-type plans have no choice over the form of retirement benefits they can collect (as these plans are determined by retirement pension providers and employers), we limited our focus to holders of DC-type plans and IRPs and examined the distribution of their investment between principal-guaranteed plans and performance-based products. At all levels of household income, more retirees chose principal-guaranteed plans than performance-based products, with a ratio as large as 4 to 1 at certain income levels. This once again reveals a key problem with the way retirement pension assets are administered in Korea. Individual employees in Korea often do not have the systematic knowledge and expertise to choose what to invest in for their post-retirement income. It is crucial, then, to educate employees in Korea on the need to devise long-term invest-

ment strategies that angle for returns above the wage growth rate. Korean policymakers also need to provide default options and other such institutional safety nets to rescue employees from the consequences of any uninformed choices.

〈Table 7〉 Distribution of Retirees by Retirement Plan Type

| Duration of retirement benefits granted | | Ratio (%) |
|---|---|---|
| Annuities certain | 10 to 20 years | 11.43 |
| | 20 to 30 years | 20.00 |
| | Over 30 years (but not lifetime) | 2.86 |
| Lifetime annuities | Lifetime | 65.71 |
| Total | | 100 |

Source: Won, Baek and Son (2014).

〈Table 8〉 Distribution of Retirement Pension Plans by Household Income Level

(Unit: %)

| Holders of DC-type plans and IRPs | Average monthly household income (KRW) | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | Under 2 million | 2 ~ 3 million | 3 ~ 4 million | 4 ~ 5 million | 5 ~ 6 million | 6 ~ 7 million | Over 7 million | |
| Principal-guaranteed | 72.5 | 80 | 56.67 | 80 | 44 | 38.33 | 65.5 | 100 |
| Performance-based | 27.5 | 20 | 43.33 | 20 | 56 | 61.67 | 34.5 | 100 |

Source: Won, Baek and Son (2014).

Now we need to turn our attention to the 93 percent of retirees who chose to collect their retirement benefits in lump-sum allowances. In an effort to mitigate growing public concerns over the financial sustainability of retirement allowance schemes, the Korean government introduced retirement pen-

sion plans in 2005. As our survey shows, however, the vast majority of businesses in Korea have retained their retirement allowance schemes, with an overwhelming majority of employees preferring lump-sum retirement allowances to retirement pension plans. Policymakers' initial goal in introducing retirement pensions was to diversify the old-age income security system by adding private retirement pension plans to the existing public ones, such as the National Pension, to ensure secure and steady sources of post-retirement income. But as the preference for lump-sum retirement allowances persists in Korea, we need to understand its causes. Retirees are likely to invest at least part of their lump-sum allowances in other retirement pensions or financial assets. Our survey therefore asked participants to identify the categories of spending items into which they apportioned their lump-sum retirement allowances. The four major categories of spending items included Consumption (e.g., expenses on various items of living and medicine); Real Property Investment (e.g., investment in real estate or one's own business); Finance (e.g., savings and insurances); and other. The retirees were also asked to indicate the percentage of their lump-sum allowances they spent on each of these categories. Of all spending items under these major categories, debt redemption (17.15 percent), savings (16.54 percent), and living expenses (16.01 percent) claimed the greatest portions of retirement allowances. Only 1.12 percent and 2.21 percent, re-

spectively, were spent on IRPs and savings-type insurances.

In particular, the lower the household income level, the greater proportion of retirement allowances was spent on living expenses. By contrast, the higher the household income, the greater the proportion of spending went on savings or debt redemption. Savings-type insurances and IRPs, on the other hand, showed no significant correlations to household income levels. As our survey took place not in one-on-one interviews, but on the Web, we were unable to investigate and identify in detail when our retirees spent their lump-sum retirement allowances and on what specific items or purposes. Only a fraction of retirees converted their retirement allowances into personal pensions, but their presence was enough to indicate that there are retirees who seriously consider retirement pensions as possible sources of post-retirement income.

〈Table 9〉 How Retirees Spend Their Lump-Sum Retirement Allowances

(Unit: %)

| Spending items | | Ratio | Average monthly household income (KRW) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Under 2 million | 2 ~ 3 million | 3 ~ 4 million | 4 ~ 5 million | 5 ~ 6 million | 6 ~ 7 million | Over 7 million |
| Consumption | Living expenses | 16.01 | 23.55 | 14.53 | 17.03 | 15.23 | 14.61 | 15.75 | 6.94 |
| | Debt redemption | 17.15 | 9.99 | 17.89 | 21.59 | 19.71 | 19.12 | 20.75 | 11.94 |
| | Housing (mortgage/rents) | 11.44 | 15.35 | 16.35 | 9.30 | 10.50 | 9.61 | 6.95 | 3.37 |
| | Transfer to children/family members | 1.53 | 1.67 | 3.23 | 0.44 | 1.09 | 1.18 | 1.25 | 0.92 |
| | Education and marriage of children | 6.44 | 9.40 | 5.09 | 6.25 | 5.00 | 4.65 | 7.25 | 8.27 |
| | Medical expenses | 2.05 | 3.90 | 2.67 | 1.02 | 1.30 | 1.86 | 2.75 | 0.51 |
| Real property investment | One's own business | 12.52 | 14.64 | 14.25 | 11.90 | 10.57 | 11.37 | 0.75 | 15.18 |
| | Real estate | 6.48 | 1.31 | 3.95 | 6.69 | 6.21 | 7.80 | 9.75 | 18.06 |
| Finance | Savings | 16.54 | 14.19 | 14.99 | 17.34 | 18.39 | 15.20 | 19.50 | 19.88 |
| | Direct/indirect investment in stocks, funds, etc. | 5.03 | 1.27 | 2.41 | 4.88 | 7.24 | 9.94 | 8.50 | 7.76 |
| | IRPs | 1.12 | 0.06 | 0.66 | 0.16 | 1.67 | 2.71 | 1.50 | 3.27 |
| | Savings-type insurances | 2.21 | 2.68 | 2.08 | 2.21 | 1.81 | 0.88 | 5.00 | 2.55 |
| | Guaranteed insurances | 1.13 | 1.61 | 1.42 | 1.09 | 0.96 | 0.69 | 0.00 | 0.92 |
| Other | Travel expenses/ donations/reserve funds | 0.35 | 0.38 | 0.50 | 0.10 | 0.31 | 0.39 | 0.30 | 0.45 |
| Total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: Won, Baek and Son (2014).

〈Table 10〉 Structure of Multi-Pillar Old-Age Income Security System

(Unit: KRW)

| Income source (number of beneficiaries) | Average monthly benefits | Income source (number of beneficiaries) | Average monthly benefits |
|---|---|---|---|
| National Pension (NPS) or Special Occupational Pensions (SOPs) (329 persons) | 929,498 | NPS + RPs (42 persons) | 1,686,429 |
| Retirement Pensions (RPs) (49 persons) | 786,327 | NPS+ PPs (90 persons) | 1,967,933 |
| Lump-Sum Retirement Benefits (102 persons) | 29,607,843 (lump-sum) | RPs + PPs (20 persons) | 1,372,500 |
| Private Pensions(PPs) (111 persons) | 881,748 | NPS + RPs +PPs (18 persons) | 2,483,333 |
| Housing Pension (4 persons) | 635,000 | | |

Source: Won, Baek and Son (2014).

Approximately 66 percent of the 500 surveyed benefitted from monthly annuities provided by either the National Pension or the special occupational pensions, receiving KRW 930,000 each per month on average. Only 8.4 percent of the retirees benefitted from both the first-tier (public) pensions and retirement pensions under the current multi-pillar old-age income security system, receiving KRW 1.69 million each per month on average. A smaller fraction, or 3.6 percent benefitted from all the three tiers of the current pension system (i.e., public pensions, retirement pensions, and private pensions altogether), receiving KRW 2.48 million each per month on average. In other words, retirees with access to at least two tiers of retirement benefits under the current system received

about 1.8 times more benefits per month than retirees with access to only a single tier. Retirees with access to all three tiers of retirement benefits earned 2.7 times more on average. Retirees-to-be, therefore, need to make full use of the current multi-pillar old-age income security system if they wish to maintain their current standard of living even after retirement. In the following section, we shall look into the income replacement rate of retirement annuities and the real income replacement rate of public and private retirement pension benefits combined.

# 3 Retirement Pension Systems in Korea and Abroad

A. Retirement benefits system in Korea: current status and issues
B. Annuitization rate in Korea
C. Literature on the income replacement rates of retirement pensions
D. Comparison of annuitization scheme policies in other countries

# 3 Retirement Pension Systems in Korea and Abroad

In August 2014, the Korean government announced its Plan to Promote Private Pensions, requiring workers to purchase retirement pension policies to enhance their financial prospects for post-retirement life. The main change entailed by the Plan is the duty it imposes on workers to purchase retirement pension policies, with a view to promoting the annuitization of retirement benefits. In addition, the Plan expanded the range of workers eligible for retirement benefits and introduced various retirement-friendly measures, including the deregulation of assets underlying the investments made by retirement pension funds, greater tax exemptions and benefits, and stronger guarantees of retirement benefits. The range of businesses required to provide retirement pensions for their employees will gradually expand in phases, starting in companies hiring 300 employees or more in 2016 and proceeding to companies hiring 100 to 300 persons, companies hiring 30 to 100 persons, companies hiring 10 to 30 persons, and companies hiring fewer than 10 persons in 2017, 2018, 2019, and 2022, respectively. Prior to the Plan, workers were only able to deduct 12 percent of the sums of the premiums they paid into IRPs and other retirement pension plans or up to KRW 4 million each per year.

Under the Plan, workers can now deduct an additional 12 percent of up to KRW3 million they might pay into their respective retirement pension policies.

Moreover, to encourage workers to annuitize their retirement pension benefits, retirees who opt to receive their retirement benefits in annuities need only pay up to 70 percent of the taxes that retirees collecting lump-sum retirement allowances have to pay. In the interest of the equity of taxation on retirement income, well-paid retirees will be required to pay even higher taxes should they opt to collect lump-sum allowances. The Plan lifted investment ceilings on individual assets of investment, leaving intact only the ceilings on risky investments. Starting in early 2015, financial institutions are required to guarantee up to KRW 50 million per depositor with respect to deposits under DC-type plans or IRPs. As these and other measures raise expectations of a significant improvement of the multi-pillar old-age income security system in Korea, this study surveys issues plaguing current public and private retirement pension schemes and analyzes the income replacement rates of the National Pension, basic old-age pensions, and retirement pensions, before forecasting post-retirement income levels for future generations.

## A. Retirement benefits system in Korea: current status and issues

Since its introduction in 2005, retirement pension, along with the National Pension, has played important roles as part of Korea's growing multi-pillar old-age income security system and the country's social security network. Financial institutions were major players at the time the retirement pensions' introduction, but they are increasingly failing to ensure adequate income for old-age retirees as originally intended. In this section, we shall survey the issues concerning the administration of assets for retirement pensions and the ways in which retirees collect their benefits.

The retirement benefit system in Korea consists of three main plan or scheme types: retirement allowance schemes, DB-type pension plans, and DC-type pension plans. Because DB-type plans are required to provide predefined amounts of benefits after workers retire, they compel employers to bear the risks associated with the administration of the underlying assets. Under DC-type plans, on the other hand, employers are only obligated to pay predefined contributions and workers themselves bear the responsibilities for any risks associated with administering the underlying assets.

Despite policymakers' intent behind introducing retirement pensions, the overwhelming majority of retirees still opt to col-

lect their retirement benefits as lump-sum allowances instead of annuities. At present, therefore, the only difference between retirement pensions and retirement allowance schemes is that the funds for the former are deposited with institutions independent of the companies that provide retirement benefits. As over 95 percent of the funds deposited with such external institutions are invested in principal-guaranteed plans, the extremely conservative streak in retirement pension providers' investment strategies adds to the increasing financial burdens on companies in the long term.

〈Table 11〉 Retirement Pension Funds

(Units: KRW 100 million, %)

| Type | Total | DB-type | DC-type | Corporate IRPs | Personal IRPs |
|---|---|---|---|---|---|
| Deposit (ratio) | 890,338 (100) | 606,338 (68.1) | 204,622 (23.0) | 6,997 (0.8) | 72,381 (8.1) |

Source: MOEL (2014), Third-Quarter Retirement Pension Statistics 2014.

〈Table 12〉 Different Types of Retirement Pensions

(Units: KRW 100 million, %)

| Type | DB-type | | DC-type | | Corporate IRPs | | Personal IRPs | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Amount | Ratio | Amount | Ratio | Amount | Ratio | Amount | Ratio | Amount | Ratio |
| Principal-guaranteed | 595,222 | 98.2 | 162,152 | 79.3 | 6,336 | 90.6 | 59,196 | 81.8 | 822,905 | 92.4 |
| Performance-based | 8,964 | 1.5 | 39,507 | 19.3 | 632 | 9.0 | 7,587 | 10.5 | 56,690 | 6.4 |
| Other | 2,151 | 0.3 | 2,964 | 1.4 | 29 | 0.4 | 5,598 | 7.7 | 10,743 | 1.2 |
| Total | 606,338 | 100 | 204,622 | 100 | 6,997 | 100 | 72,381 | 100 | 890,338 | 100 |

Source: MOEL (2014).

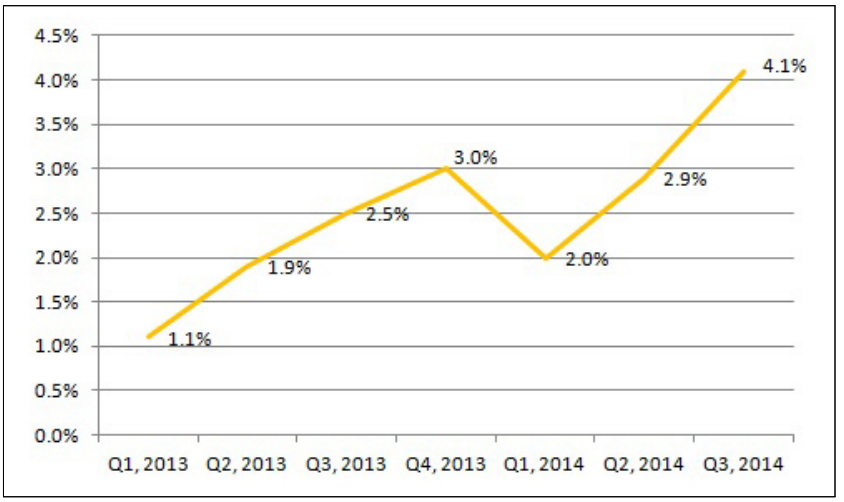
## B. Annuitization rate in Korea

The “annuity puzzle” refers to the phenomenon in which retirees, intent on minimizing their longevity risk, opt to collect their retirement benefits in the form of lump-sum allowances, despite the obvious advantages of lifetime annuities, so they can invest those allowances in other sources of possible steady income. Seong et al. (2014) characterizes the annuity puzzle as financial behavior that reflects consumers’ tendency to underestimate the true value of lifetime annuities. The majority of retirees in Korea opt to collect their accumulated retirement pension premiums in lump sums instead of annuities to pay for their immediate living expenses. However, the failure to generate adequate returns on the re-invested portions of their lump-sum allowances hinders their financial security into old age.

In Korea, both the amount of accumulated retirement pension premiums and the ratio of workers purchasing retirement pension policies are on the rise, but the annuity puzzle persists. Figure 5 charts the changing annuitization rate in Korea. The annuitization rate refers to the ratio of eligible retirees who choose to collect their retirement benefits in the form of annuities. It also includes the ratio of retirees who convert their accumulated retirement benefits into annuities. As Figure 5 shows, the annuitization rate is on a clear ascent over time, but it remains below 10 percent, indicating that over 90 percent of

retirees in Korea still refuse to collect their retirement benefits in forms other than lump-sum allowances. Lump-sum allowances, however, are a precarious means upon which to base one's old-age financial security. Annuities under mandatory retirement pension schemes provide far greater levels of stability for old-age income.

[Figure 5] Annuitization Rate in Korea




Source: Financial Supervisory Service (FSS, 2014), **Report on the Operating Performance of Retirement Pensions** (as of September 2014).

## C. Literature on the income replacement rates of retirement pensions

The majority of existing studies in Korea estimate and compare the income replacement rates of the three main pillars of

Korea's multi-pillar old-age income security system—the National Pension, the retirement pensions and the personal pensions—rather than only estimating and analyzing the income replacement rate of retirement pensions alone. With regard to retirement pensions, these studies do not take into account the differences among income quantiles and tend to focus their attention on the income replacement rate of DC-type plans.

Han et al. (2013) provides an actuarial pension model for estimating the income replacement rate of the National, retirement, and personal pensions. The authors estimate the income of pension policyholders based on the income of workplace-based participants in the National Pension. They also estimate the lifetime duration of participation in the pension schemes based on the transfer rate of participants. Han et al. (2013) concludes that men and women participate in the National Pension for an average of 22.16 years and 16.82 years, respectively, before they begin to collect their benefits. The period of participation in retirement pensions differs from the period of participation in the National Pension by 5.04 to 5.86 years. The reason people were found to participate in retirement pensions for shorter periods than they do in the National Pension can be explained by these authors only considering workplace-based National Pension participants. Estimating the income replacement rate as a ratio of the average monthly

amount of retirement benefits that a beneficiary collects in the first year of his or her retirement to his or her lifetime income, these authors conclude that the income replacement rates of the retirement pensions range between eight and 11.5 percent for men and 4.4 and 7.5 percent for women.

In estimating the income replacement rates of the National, retirement and personal pensions based on lifetime income, Kang (2011) and Lim et al. (2005) base pension contributions on the reported amounts of income of workplace-based National Pension participants. Their studies divide the participants between those who participate in the pension schemes for 20 years and those who participate for 40 years, with the assumption that the individuals in both groups will collect their retirement benefits for 20 years, given the average life expectancy in Korea. Kang (2011) thus estimates that the income replacement rates of retirement pensions for beneficiaries collecting benefits would be 14.2 and 28.3 percent, respectively, for the 20-year and 40-year groups.

The focus of Ryu et al. (2008) is on the income replacement rate of private pensions. In estimating pre-retirement income, these authors refer to the average wage income of workplaces hiring at least five persons each (MOEL statistics) and the average wage-growth rate of 4.7 percent. They thus estimate that the average amount of pre-retirement earned income amounts to KRW 6.95 million, assuming 28 years of work for each pen-

sion policyholder. The authors then provide their analyses for different scenarios involving different wage growth rates, ranging from one percent to the average of 4.7 percent and involving different periods of participation (20 years, 25 years, 28 years, 30 years, and 35 years). Assuming a wage growth rate of 4.7 percent and a return-on-investment (ROI) rate of 3.79 percent, the income replacement rates of private pensions range from 11.5 to 13.6 percent depending on the duration of participation in the pension schemes.

Focusing exclusively on retirement pensions, Eoh et al. (2009) assume that an average worker in Korea becomes a new retirement pension policyholder at age 20 and remains a participant for 40 years until retiring at age 60. The authors divide pension participants into five groups according to monthly income levels throughout a lifetime—KRW 0.5 million, KRW 1 million, KRW 1.73 million (the average monthly income level of National Pension participants as of 2008), KRW 2.5 million, and KRW 3.6 million—and appropriate the economic and demographic assumptions used in the National Pension Actuarial Valuation Committee's report. For the average income group (earning KRW 1.73 million a month) participating in retirement pensions for 40 years, the estimated income replacement rate is 24 percent. The authors also analyze three different scenarios on the annuitization rates of retirement pensions. Given that the annuitization rate rose from three percent to 10 per-

cent over the three years from 2006 through 2008, the authors assume that the annuitization rate grows by 3.3 percent each year. They then describe the three scenarios. The optimistic one assumes that the annuitization rate would reach 100 percent by 2035. The neutral one assumes that the rate would rise to a maximum of 50 percent and remain at that level. The pessimistic one assumes that the rate would rise to a maximum of 30 percent and remain at that level. The authors estimate that the ratio of annuity beneficiaries at age 60 or older to the total population would range from seven to 17 percent by 2050. In the neutral scenario assuming an average of 15 years of participation in retirement pensions, the income replacement rate ranges between six and seven percent.

## D. Comparison of annuitization scheme policies in other countries

Governments worldwide, like the one in Korea, are struggling to raise the pension annuitization rates through diverse policy means and incentives. The general pattern is that annuitization rates tend to be higher in countries that enforce mandatory annuitization schemes.

Lee (2011) explains mandatory and default (non-mandatory) annuitization schemes as follows. The mandatory annuitization

schemes popular in Western Europe require providers of all retirement pensions that receive tax benefits from the state to pay retirement benefits in the form of annuities. The United Kingdom is a good example in this regard. The mandatory schemes pass on the longevity and investment risks of individuals to financial institutions, thus allowing retirees to secure certain levels of income until death. The remaining balances in pension policyholders' accounts after their death are then transferred onto other accounts and paid out in annuities to other retirees, thereby raising the income level of retirees overall. Moreover, these mandatory schemes minimize the risk of reverse choice facing insurance providers and thereby enable them to enhance the competitiveness of the insurance policies they offer. With the mandatory retirement pension schemes enlarging the pension market, more and more insurance providers are able to enter the market and offer consumers a greater range of choices. Mandatory schemes, on the other hand, limit individuals' choices of underlying investment assets, take away their control over investment assets, and still carry the risk of pension providers defaulting on payment obligations.

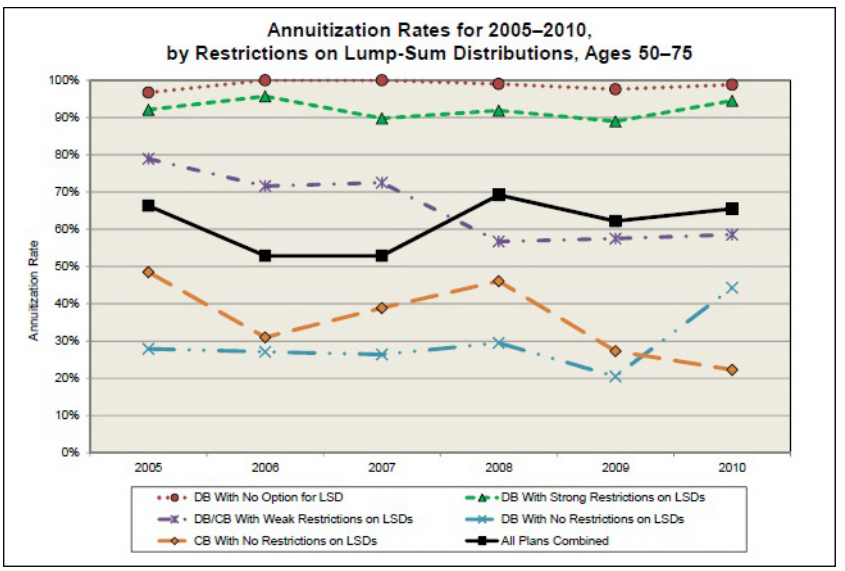
The default pension schemes strive to induce individuals to annuitize their retirement income without limiting their choices. These schemes present participants with initial default options, which are retained if participants choose to keep

them or do not explicitly cancel them during their participation in the schemes. For example, if the default option of a given retirement pension scheme is annuitization, the retiree will collect his or her retirement benefits in the form of annuities so long as he or she has not explicitly revoked that option. The default annuitization policy enjoys growing popularity in the United States. These schemes pay respect to individuals' right to choose retirement benefit options and are cost-effective. However, these schemes may not be as effective as intended. With little perceived risk, participants are likely to make reverse choices, thus causing policies to lose price competitiveness and ultimately lowering the annuitization rate.

As Figure 6 shows, there is a sizable gap between the DB-type plans and the DC-type plans in the United States in terms of annuitization rates. The annuitization rate of all types of retirement pension plans in the United States was 65.5 percent as of 2010. The rate, however, was as high as 98.8 percent with respect to DB-type pension plans. Nevertheless, the annuitization rates of DB-type plans that allow retirees to collect benefits in lump sums and of DB-type plans with cash balance options were 44.3 percent and 22.3 percent, respectively. The annuitization rate in the United States differs significantly depending on whether pension providers allow retirees to collect their benefits in lump sums. Under the ERISA, the US federal government allows DB-type plan providers to present joint and

survivorship annuities as default options. DC-type plans in the United States, on the other hand, do not provide annuitization schemes, leaving the matter up to the voluntary choice of individual participants. As of 2007, 52 percent of DC-type retirees collected their benefits in lump sums, while only 18 percent collected lifetime annuities. Six percent collected annuities certain. In sum, DC-type plans carry far lower annuitization rates than DB-types in the United States.

[Figure 6] Annuitization Rates of Different Pension Plans in the United States[1)]




Note: 1) Based on retirees, aged 50 to 75, who chose in 2005 through 2010 to collect their retirement benefits in the form of other lifetime annuities or annuities certain. The amounts of annuities were estimated on the basis of whether or not the given plan included restrictions on lump-sum distributions in the contract.

Source: Employee Benefit Research Institute estimates from the data provided by Aon Hewitt.

# 4 Total Income Replacement Rate Estimates of Public and Private Pensions for Different Generations

A. National Pension and other basic pensions: amounts of benefits and income replacement rates

B. Income replacement rate of retirement pensions

C. Total income replacement rate of public and private pensions in Korea

# 4 Total Income Replacement Rate Estimates of Public and Private Pensions for Different Generations

## A. National Pension and other basic pensions: amounts of benefits and income replacement rates

In July 2014, the Korean government began providing basic old-age pension benefits for 70 percent of seniors, aged 65 or older, in lower-income groups. Although Won et al. (2014) has already estimated the total income replacement rate of the National and basic pension benefits for the current and future generations, our study adds retirement pensions to the list and estimates the total income replacement rate of all public and private pension plans for different birth cohorts. To this end, we calculate the income replacement rate of the National Pension income first and base our estimates of the basic pension income on that. We thus project and trace changes in pension income levels for National Pension beneficiaries who additionally collect basic pension benefits.

The model for estimating the basic amount of National Pension benefits is shown below:

$$BPA_t = \begin{cases} \left[\sum_{j=1}^{t-1} \frac{1}{\sum_{k=1}^{t-1} I_k} \times c_j \times (\alpha_j \cdot A + \beta_j \cdot B) \times I_j\right], \sum_{k=1}^{t-1} I_k \leq 20 \\ \left[\sum_{j=1}^{t-1} \frac{1}{\sum_{k=1}^{t-1} I_k} \times c_j \times (\alpha_j \cdot A + \beta_j \cdot B) \times I_j\right], \sum_{k=1}^{t-1} I_k > 20 \\ \times \left[1 + 0.05 \times \left\{\left(\sum_{k=1}^{t-1} I_k\right) - 20\right\}\right] \end{cases}$$

In the equation above, designed to estimate the basic pension amount ($BPA_t$) at time $t$, $A$ and $B$ respectively represent the current average income and the lifetime average income of National Pension participants. To estimate $B$, we re-valuated the past income of participants throughout the period of participation using the rate of increase in the value of $A$ and calculated its average. $c$ stands for the wage coefficient, while $\alpha$ and $\beta$ provide coefficients determining income redistribution, which vary year to year as shown in Table 13.

〈Table 13〉 Wage Coefficients for Estimating the Basic Pension Amount under the National Pension

| | 1988-1998 | 1999-2007 | 2008-2027* | 2028 and afterward |
|---|---|---|---|---|
| Wage coefficient $c_i$ | 2.4 | 1.8 | 1.5* (Decreasing by 0.015 yearly) | 1.2 |
| $\alpha_i$ | 1 | 1 | 1 | 1 |
| $\beta_i$ | 0.75 | 1 | 1 | 1 |
| Nominal income replacement rate | 70% | 60% | 50% | 40% |

$I_j$, an indicator variable, equals one (1) in the case of participants that paid their contributions in year $t$ and equals zero (0) in the case of participants that did not pay such contributions. The period of participation in the National Pension before beginning to collect retirement benefits therefore equals $\sum_{k=1}^{t-1} I_k$. The equation for estimating the income replacement rate of the National Pension is shown below:

$$IRR_t = \frac{BPA_t/12}{B_{t-1}}$$

We borrowed the analysis model from Choi and Han (2013) to estimate the expected periods of participation in the National Pension for different age groups. Choi and Han, however, tend to overestimate the periods of participation in comparison to the National Pension's estimates based on its own database. Therefore, in order to estimate the periods of participation in the National Pension, we multiply Choi and Han's formula by the participation rates from the National Pension's database.

$$n_{x+t} = \sum_{j=1}^{t} \frac{l_{x+j}}{l_x} \times LF_{x+j} \times (1 - U_{x+j})$$

- $n_{x+t}$: the expected period of participation for participants at time $x+t$, who began participating in the National

Pension at age $x$,

$l_{x+j}$: number of participants at age $(x+j)$ on the National Life Table,

$LF_{x+j}$: economic activity rate of survivors at age $(x+j)$,

$U_{x+j}$: unemployment rate,

$(1-U_{x+j})$: employment rate

This study analyzes MOEL's estimates on the monthly amounts of pension benefits, made in the Wage Structure Statistics Surveys, to estimate the amounts of National Pension and basic pension benefits. The Surveys, however, do not provide information on when workers begin participating in the National Pension or on how long they remain participants. We thus had to estimate the periods of participation in the National Pension and the lifetime average income of workers using the economic activity rates, employment rates, and wage growth rates for groups with different levels of education. We also estimate the amounts of retirement benefits based on the assumption that workers participate in these retirement pensions for the same length of time they participate in the National Pension. Figures 7 and 8 chart the economic activity and employment rates we used in this estimation process, based on Statistics Korea's data and the National Pension Fiscal Calculations Report (2013).

[Figure 7] Economic Activity Rates of Different Income Groups (College Graduates and Above)

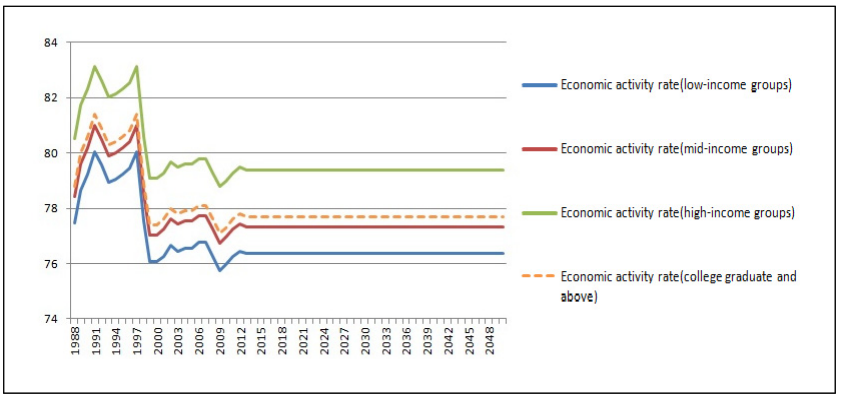
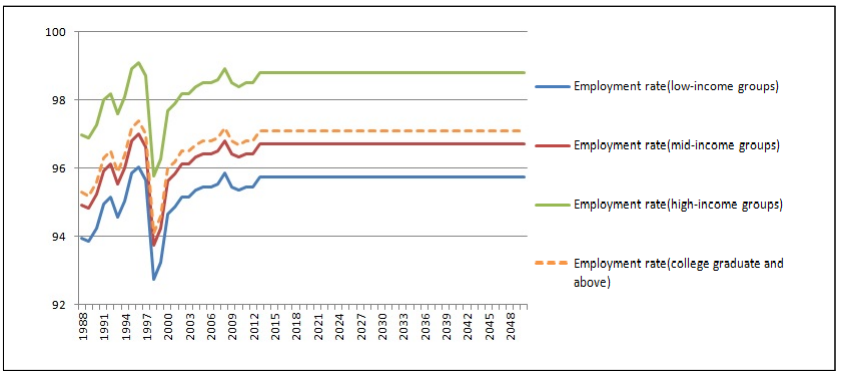



Table 14 lists the periods of participation in the National Pension we estimated using Statistics Korea's data on the economic activity and unemployment rates of groups with different levels of education and income. In addition to assuming that the periods of participation in retirement pensions are identical to those in the National Pension, we assume that the income groups as defined on the past Wage Structure Statistics Survey would remain intact into the future. Then we estimated the amounts of pension benefits and the income replacement rates of public and private pensions for different birth cohorts, as shown in Table 15.[4)]

4) In this analysis, the income replacement rate is defined as the ratio of the monthly amount of pension benefits to lifetime average income ($B$).

[Figure 8] Employment Rates of Different Income Groups (College Graduates and Above)




〈Table 14〉 Periods of Participation in the National Pension by Birth Cohort and Educational Attainment Level

(Unit: years)

| | Middle-school graduates and below | | | High-school graduates | | | College graduates and above | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low-income | Middle-income | High-income | Low-income | Middle-income | High-income | Low-income | Middle-income | High-income |
| Born in 1955 | 10.43 | 11.00 | 11.58 | 15.05 | 15.42 | 16.11 | 18.33 | 18.75 | 19.66 |
| Born in 1959 | 11.83 | 12.46 | 13.12 | 17.27 | 17.70 | 18.49 | 21.07 | 21.55 | 22.60 |
| Born in 1964 | 13.59 | 14.30 | 15.06 | 20.05 | 20.55 | 21.46 | 24.49 | 25.05 | 26.28 |
| Born in 1969 | 15.34 | 16.13 | 16.98 | 22.82 | 23.39 | 24.43 | 27.91 | 28.55 | 29.94 |
| Born in 1974 | 15.51 | 16.29 | 17.14 | 23.39 | 23.98 | 25.04 | 28.64 | 29.30 | 30.72 |
| Born in 1979 | 15.21 | 15.95 | 16.77 | 23.34 | 23.93 | 24.99 | 28.61 | 29.27 | 30.70 |
| Born in 1984 | 14.98 | 15.69 | 16.49 | 23.34 | 23.93 | 24.99 | 28.65 | 29.31 | 30.73 |
| Born in 1989 | 14.75 | 15.43 | 16.21 | 23.27 | 23.87 | 24.93 | 28.67 | 29.33 | 30.76 |
| Born in 1994 | 14.71 | 15.39 | 16.17 | 23.26 | 23.86 | 24.92 | 28.71 | 29.37 | 30.81 |

Note: The low, middle, and high-income groups correspond to the bottom 30 percent, the middle 40 percent, and the top 30 percent of income earners, respectively.
Source: Won, Baek, Kim and Choi (2014). *Analysis of the Post-Retirement Life Stabilization Effect of Basic Pension Benefits*, KIHASA.

The basic pension is another public pension, other than the National Pension, that is a subject of this study. The Korean government began providing basic pension benefits for seniors aged 65 or older in the lower 70 percent of income groups in July 2014. Assuming that the current basic pension amount, KRW 200,000 per month, will be readjusted every five years according to the inflation rate, we also estimated the amounts of basic pension benefits for different birth cohorts. Instead of actually identifying the lower 70 percent of income groups eligible for basic pension benefits, we estimated the lifetime average income ($B$) and the amounts of National Pension benefits for different birth cohorts first, and then we based our estimates of basic pension amounts on them. As of 2014, Korean law requires that National Pension beneficiaries paid less than KRW 300,000 per month (readjusted periodically according to the inflation rates) should receive the entire amount of the monthly basic pension of KRW 200,000, while National Pension beneficiaries who receive KRW 300,000 to KRW 500,000 a month should receive the amount of the basic pension that brings their total public pension income up to the minimum KRW 500,000 a month. We took this law into account and used the equation below to estimate the amounts of basic pension benefits for National Pension beneficiaries.

Basic pension benefit=max[200,000 won − (2/3) * (A-benefit), 0]
+ 200,000 won * 50%
If a≥b, then max(a, b)=a.
If a<b, then max(a, b)=b.

For National Pension beneficiaries, we excluded *B*—decided according to beneficiaries' own income—and took into account *A*—the basic pension part of the National Pension benefits—in estimating the amounts of basic pension benefits. We therefore need to determine the size of the *A*-benefit first, using the equation for estimating the basic pension amount under the National Pension. $I_i$, an indicator variable, equals one (1) in the case of participants that paid their contributions in year t and equals zero (0) in the case of participants that did not pay such contributions.

$$A-benefit_t = \begin{cases} \left[\sum_{j=1}^{t-1} \frac{1}{\sum_{k=1}^{t-1} I_k} \times c_j \times (\alpha_j \cdot A) \times I_j\right], \sum_{k=1}^{t-1} I_k \leq 20 \\ \left[\sum_{j=1}^{t-1} \frac{1}{\sum_{k=1}^{t-1} I_k} \times c_j \times (\alpha_j \cdot A) \times I_j\right], \sum_{k=1}^{t-1} I_k > 20 \\ \times \left[1 + 0.05 \times \left\{\left(\sum_{k=1}^{t-1} I_k\right) - 20\right\}\right] \end{cases}$$

〈Table 15〉 Amounts of B-Income and National Pension Benefits and the Income Replacement Rate by Birth Cohort (College Graduates and Above)[1)]

| Year of birth | Low-income groups | | | Middle-income groups | | | High-income groups | | |
|---|---|---|---|---|---|---|---|---|---|
| | B-income (KRW) | National Pension (KRW) | Income Replacement Rate (%) | B-income (KRW) | National Pension (KRW) | Income Replacement Rate (%) | B-income (KRW) | National Pension (KRW) | Income Replacement Rate (%) |
| 1955 | 1,517,454 | 512,921 | 33.80 | 2,901,177 | 709,579 | 24.45 | 3,980,000 | 895,381 | 22.49 |
| 1959 | 1,541,793 | 573,240 | 37.18 | 2,880,522 | 786,727 | 27.31 | 3,980,000 | 997,670 | 25.06 |
| 1964 | 1,558,212 | 643,865 | 41.32 | 2,844,784 | 875,679 | 30.78 | 3,980,000 | 1,119,254 | 28.12 |
| 1969 | 1,481,076 | 694,092 | 46.86 | 2,642,878 | 926,872 | 35.07 | 3,893,550 | 1,216,936 | 31.25 |
| 1974 | 1,451,466 | 663,354 | 45.70 | 2,585,424 | 886,642 | 34.29 | 3,805,976 | 1,164,775 | 30.60 |
| 1979 | 1,451,407 | 614,173 | 42.31 | 2,587,217 | 826,632 | 31.95 | 3,808,149 | 1,090,520 | 28.63 |
| 1984 | 1,451,760 | 577,385 | 39.77 | 2,587,345 | 779,282 | 30.11 | 3,808,443 | 1,029,994 | 27.04 |
| 1989 | 1,452,254 | 547,860 | 37.72 | 2,587,941 | 739,422 | 28.57 | 3,809,785 | 977,410 | 25.65 |
| 1994 | 1,451,244 | 531,158 | 36.60 | 2,585,416 | 716,689 | 27.72 | 3,805,994 | 947,263 | 24.88 |

Note: 1) The figures shown here are present values based on the real values as of 2014. The discount rate used was the revaluation rate of the A-value.
Source: Won, Baek, Kim and Choi (2014).

## B. Income replacement rate of retirement pensions

Now, let us estimate the income replacement rates of retirement pensions according to various assumptions. The basic assumptions are as follows. First, the base income is the monthly amount of benefits that National Pension participants would receive after retirement, which we estimated using the monthly income information in MOEL's Wage Structure Statistics Survey. In this process, we applied the National Pension's existing ceiling on the monthly amount of benefits. Second, we assumed that beneficiaries would begin to collect benefits at

age 60, based on their respective periods of participation in the National Pension. We also assumed that beneficiaries would collect their benefits as lifetime annuities throughout the remainder of their lives. Thus, we estimated the total amount of retirement pension benefits that beneficiaries would collect from age 60 until death as follows:

$$B = \frac{1}{12} \times \left[ \left\{ \sum_{t=e}^{r-1} \left( 12 \times \frac{W_t}{12} \right) \times I_t \times (1+i)^{b-t} \right\} \div APV\ of\ life\ annuity \right]$$

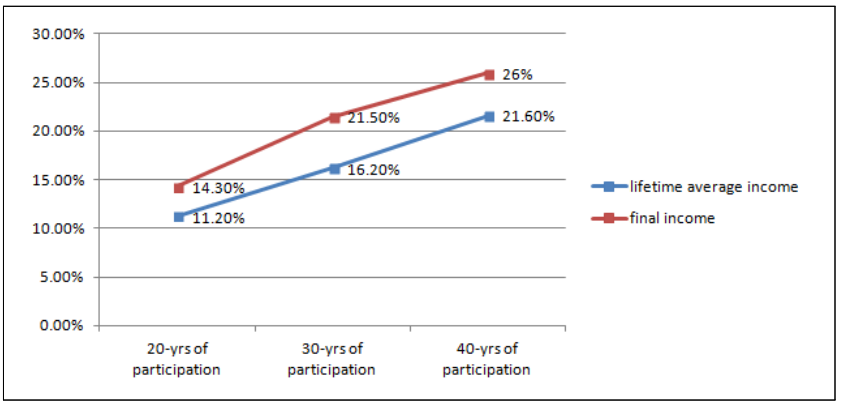
$$APV\ of\ life\ annuity = \sum_{j=0}^{w-b-1} v^j\, {}_jp_b$$

- $W_t$: monthly amount of benefits at time $t$,
  $r$: retirement age, $e$: age at which one began working,
  $b$: age at which one begins to collect retirement benefits,
  $i$: interest rate, $v = 1/(1+i)$,
  ${}_jp_b$: probability of surviving from age $b$ for $j$ years,
  $w$: limiting age (age at which no survivor is left),
  $I_t$: an indicator variable, equals one (1) in the case of participants that paid their contributions in year $t$ and equals zero (0) in the case of participants that did not pay such contributions.

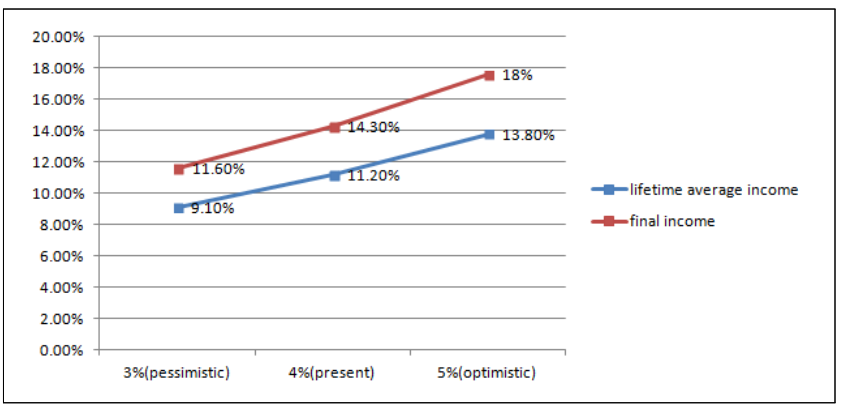
Before estimating the total income replacement rate of the National Pension, the basic pension, and the retirement pension, we first need to estimate the income replacement rate of the retirement pension only. Earlier, in estimating the income

replacement rate of the National Pension, we calculated the ratio of monthly benefits to the lifetime average income. In the present case, however, we also calculate the ratio of monthly benefits to the final average income. The main factors that decide the income replacement rate of retirement pensions are the length of period of participation in the pension scheme, the wage growth rate, and the ROI rate. We therefore posit diverse scenarios involving different periods of participation, wage growth rates, and ROI rates to estimate income replacement rates. In general, the final income is smaller than the lifetime average income, and the income replacement rate based on the latter is therefore smaller than the income replacement rate based on the former. If we estimate the changing income replacement rates by converting retirement pension benefits into lifetime annuities, using different periods of participation and ROI rates, the income replacement rate of retirement pensions, on average, range from 11 to 14 percent after 20 years of participation. Under a pessimistic scenario involving a low ROI rate (three percent), the income replacement rate drops to a range of nine to 11 percent after 20 years of participation.

[Figure 9] Income Replacement Rates for Different Periods of Participation
(Assuming a Wage Growth Rate of 4% and a ROI Rate of 4%)



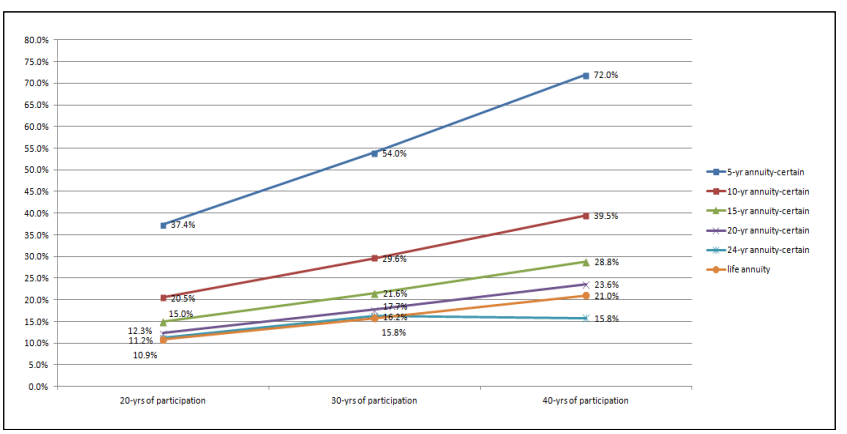

[Figure 10] Income Replacement Rates for Different ROI Rates
(Assuming a Wage Growth Rate of 4% and 20 Years of Participation)



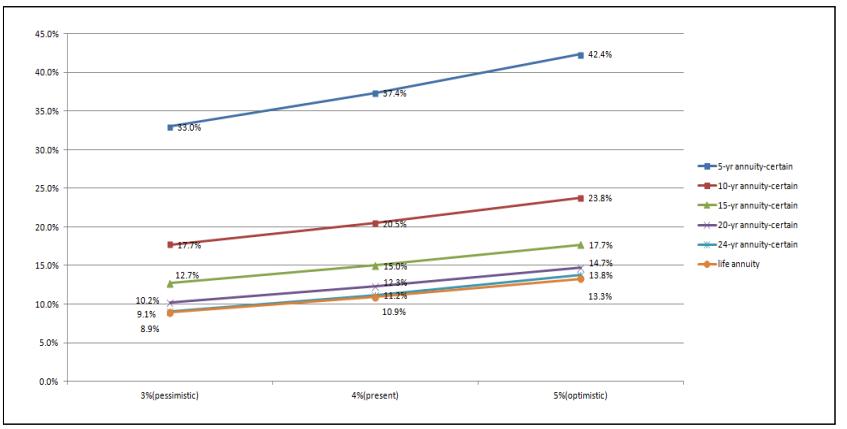

Figures 11 and 12 are the changes in the estimated income replacement rates depending on the different periods of participation and ROI rates and based on the lifetime average income. The income replacement rates of 10-year-long an-

nuities certain range from 20.5 to 39.5 percent depending on the period of participation, and they range from 17.7 to 23.8 percent depending on the ROI rate. Following a similar pattern, the income replacement rates of 20-year-long annuities certain range from 12.3 to 23.6 percent and from 10.2 to 14.7 percent, respectively. In other words, the longer the period of participation and the higher the ROI rate, the higher the income replacement rate. This is just as our intuition had predicted, since the period of participation and the return on investment directly determine the amounts of pension funds.

[Figure 11] Income Replacement Rates of Different Types of Retirement Pensions for Different Periods of Participation
(Assuming a Wage Growth Rate of 4% and a ROI Rate of 4%)



[Figure 12] Income Replacement Rates of Different Types of Retirement Pensions for Different ROI Rates
(Assuming a Wage Growth Rate of 4% and 20 Years of Participation)




On the other hand, as the wage growth rate rises, the income replacement rate begins to drop. Figure 13 charts the changes in the income replacement rate of lifetime annuities according to changes in the wage growth rate. The graph shows that the income replacement rate drops from 13.7 percent to 9.3 percent when the wage growth rate increases.

Figure 14 charts the changing income replacement rates of different retirement pension types, based on the lifetime average income, according to changes in the wage growth rate. As the wage growth rate rises, the income replacement rate of 10-year-long annuities certain, for instance, drops from 25.1 to 17 percent, while that of 20-year-long annuities certain drops

from 15 to 10.2 percent. The rise in the wage growth rate increases the amount of contributions participants have to pay and thereby enlarges the pension fund. However, it also affects the lifetime average income and the final income, thus ultimately serving to decrease the income replacement rate.

〈Table 16〉 Income Replacement Rate of Retirement Pensions (Based on the Lifetime Average Income)

| Income Replacement Rate (%) | | Annuities period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 years | | | | 20 years | | | | Lifetime | | | |
| Period of participation | 20 years | WGR[1] \ ROI[2] | 3% | 4% | 5% | WGR \ ROI | 3% | 4% | 5% | WGR \ ROI | 3% | 4% | 5% |
| | | 3% | 19.5 | 22.7 | - | 3% | 11.2 | 13.5 | - | 3% | 10.0 | 12.4 | - |
| | | 4% | 17.7 | 20.5 | 23.8 | 4% | 10.2 | 12.3 | 14.7 | 4% | 9.1 | 11.2 | 13.8 |
| | | 5% | - | 18.7 | 21.6 | 5% | - | 11.1 | 13.4 | 5% | - | 9.3 | 12.5 |
| | 30 years | WGR \ ROI | 3% | 4% | 5% | WGR \ ROI | 3% | 4% | 5% | WGR \ ROI | 3% | 4% | 5% |
| | | 3% | 28.4 | 34.4 | - | 3% | 16.3 | 20.6 | - | 3% | 14.6 | 18.8 | - |
| | | 4% | 24.6 | 29.6 | 35.8 | 4% | 14.1 | 17.7 | 22.2 | 4% | 12.6 | 16.2 | 20.7 |
| | | 5% | - | 25.7 | 30.8 | 5% | - | 15.3 | 19.1 | 5% | - | 14.0 | 17.8 |
| | 40 years | WGR \ ROI | 3% | 4% | 5% | WGR \ ROI | 3% | 4% | 5% | WGR \ ROI | 3% | 4% | 5% |
| | | 3% | 37.9 | 47.4 | - | 3% | 21.7 | 28.3 | - | 3% | 19.4 | 25.9 | - |
| | | 4% | 31.9 | 39.5 | 49.3 | 4% | 18.3 | 23.6 | 30.5 | 4% | 16.3 | 21.6 | 28.5 |
| | | 5% | - | 33.3 | 41.4 | 5% | - | 19.9 | 25.5 | 5% | - | 18.2 | 23.8 |

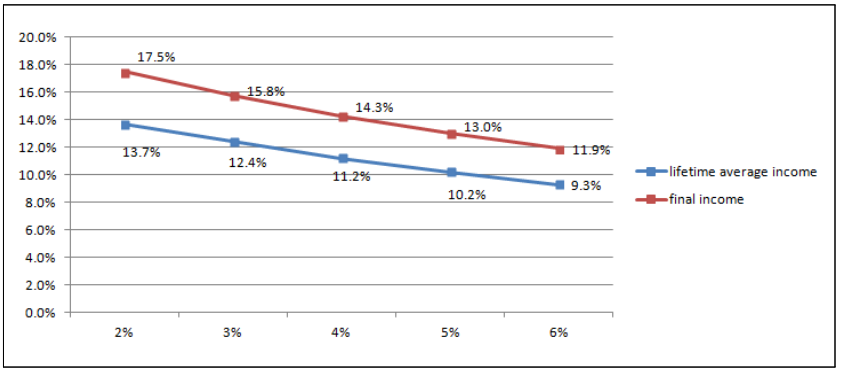
Not: 1) WGR: wage growth rate, 2) ROI: return on investment

〈Table 17〉 Income Replacement Rate of Retirement Pensions (Based on the Final Income)

| Income Replacement Rate (%) | | Annuities period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 years | | | | 20 years | | | | Lifetime | | | |
| Period of participation | 20 years | ROI[2] / WGR[1] | 3% | 4% | 5% | ROI / WGR | 3% | 4% | 5% | ROI / WGR | 3% | 4% | 5% |
| | | 3% | 25.0 | 29.0 | - | 3% | 14.3 | 17.3 | - | 3% | 12.8 | 15.8 | - |
| | | 4% | 22.7 | 26.3 | 30.4 | 4% | 13.0 | 15.7 | 18.8 | 4% | 11.6 | 14.3 | 17.6 |
| | | 5% | - | 23.9 | 27.6 | 5% | - | 14.2 | 17.1 | 5% | - | 13.0 | 15.9 |
| | 30 years | ROI / WGR | 3% | 4% | 5% | ROI / WGR | 3% | 4% | 5% | ROI / WGR | 3% | 4% | 5% |
| | | 3% | 37.8 | 45.8 | - | 3% | 21.7 | 27.3 | - | 3% | 19.3 | 25.0 | - |
| | | 4% | 32.7 | 39.4 | 47.5 | 4% | 18.8 | 23.5 | 29.5 | 4% | 16.7 | 21.5 | 27.5 |
| | | 5% | - | 34.1 | 41.0 | 5% | - | 20.4 | 25.4 | 5% | - | 18.6 | 23.7 |
| | 40 years | ROI / WGR | 3% | 4% | 5% | ROI / WGR | 3% | 4% | 5% | ROI / WGR | 3% | 4% | 5% |
| | | 3% | 45.8 | 57.3 | - | 3% | 26.3 | 34.2 | - | 3% | 23.4 | 31.3 | - |
| | | 4% | 38.5 | 47.7 | 59.6 | 4% | 22.1 | 28.5 | 36.9 | 4% | 19.7 | 26.0 | 34.4 |
| | | 5% | - | 40.2 | 49.7 | 5% | - | 24.0 | 30.8 | 5% | - | 21.9 | 28.7 |

Not: 1) WGR: wage growth rate, 2) ROI: return on investment

[Figure 13] Income Replacement Rates of Different Retirement Pensions according to Different Wage Growth Rates (Assuming a ROI Rate of 4% and 20 Years of Participation)



[Figure 14] Income Replacement Rates of Different Retirement Pensions according to Different Wage Growth Rates
(Assuming a ROI Rate of 4% and 20 Years of Participation)

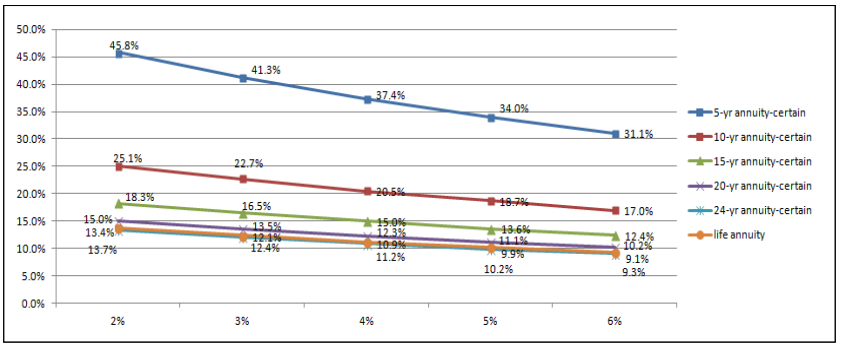
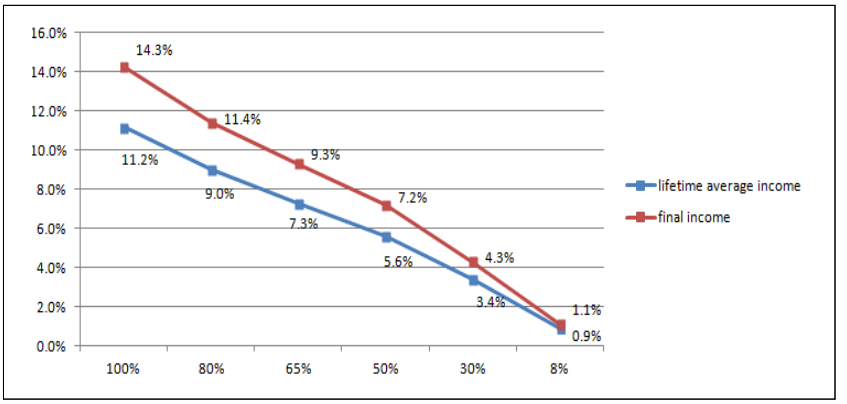



Figure 15 charts differing income replacement rates corresponding to differing annuitization rates. At an annuitization rate of 100 percent, the income replacement rate for all pension beneficiaries would amount to 14.3 percent in terms of final income or 11.2 percent in terms of lifetime average income. Considering the current annuitization rate of eight percent, however, the income replacement rate would drastically drop to one percent, as indicated by the point on the farthest right corner of Figure 15. The annuitization rate of eight percent does not distinguish between annuities certain and lifetime annuities. If we were to confine our interest to the latter, the rate would drop even further. In other words, the income replacement rate of retirement pensions for all workers in Korea remains around a dismal one percent. Policymakers therefore need to find ways to increase the annuitization rate

to make retirement pensions a more substantial source of post-retirement income for Koreans.

[Figure 15] Income Replacement Rates Corresponding to Annuitization Rates (Assuming a Wage Growth Rate of 4%, a ROI Rate of 4%, and 20 Years of Participation)

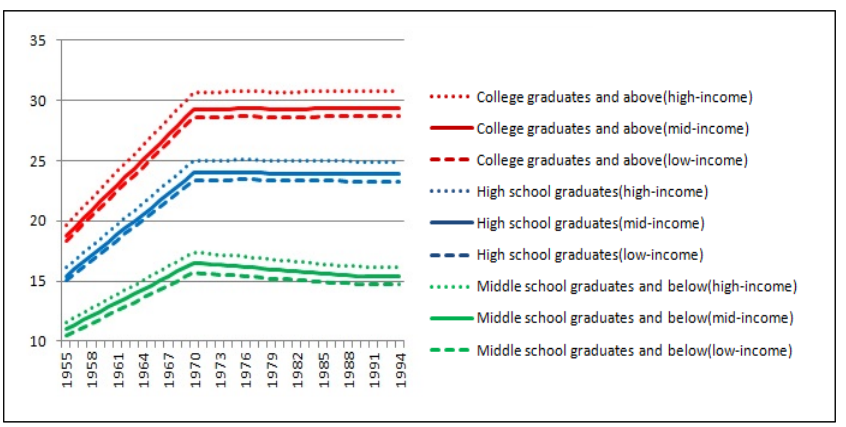



## C. Total income replacement rate of public and private pensions in Korea

Now we can estimate the total income replacement rate of public and private pensions in Korea, holding onto the assumption that retirement pension annuities serve as a crucial component of Korea's multi-pillar system for old-age income security. For the base income levels and periods of participation used in estimating the amounts of benefits under the National Pension, the basic pension, and the retirement pen-

sions, we used the same statistics. Figure 11 shows the different periods of participation in the National Pension by birth cohort and level of education. Persons born in 1955, holding college degrees or more and belonging to middle-income groups are estimated to participate in the National Pension for 18 years on average. The periods extend to 25 years and 29 years for those born in 1964 and 1974, respectively.

[Figure 16] Estimated Periods of Participation in the National Participation for Different Birth Cohorts: By Education and Income Level




Notes: 1) We assumed that each birth cohort's period of participation was identical for all types of public and private pensions.
2) The lifetime average income group of each education group was divided into 10 deciles, with the first three classified as the low-income groups, the fourth to seventh classified as the middle-income groups, and the top three classified as the high-income groups.

Source: Won, Baek, Kim and Choi (2014).

〈Table 18〉 Total Income Replacement Rate Estimates by Birth Cohort (for College Graduates and Above)

| Year of birth | Low-income | | | Middle-income | | | High-income | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1[1] | 2[2] | 3[3] | 1 | 2 | 3 | 1 | 2 | 3 |
| 1955 | 33.80 (18.33 years)[4] | 41.32 | 51.20 | 24.45 (18.75 years) | 28.39 | 38.50 | 22.49 (19.66 years) | 25.36 | 35.96 |
| 1959 | 37.18 (21.07 years) | 43.08 | 54.44 | 27.31 (21.55 years) | 30.47 | 42.09 | 25.06 (22.66 years) | 27.35 | 39.54 |
| 1964 | 41.32 (24.49 years) | 45.92 | 59.12 | 30.78 (25.05 years) | 33.30 | 46.81 | 28.12 (26.28 years) | 29.92 | 44.09 |
| 1969 | 46.86 (27.91 years) | 50.59 | 65.64 | 35.07 (28.55 years) | 37.16 | 52.55 | 31.25 (29.94 years) | 32.67 | 48.81 |
| 1974 | 45.70 (28.64 years) | 49.07 | 64.51 | 34.29 (29.30 years) | 36.19 | 51.98 | 30.60 (30.72 years) | 31.89 | 48.45 |
| 1979 | 42.31 (28.61 years) | 45.35 | 60.77 | 31.95 (29.27 years) | 33.65 | 49.43 | 28.63 (30.70 years) | 29.79 | 46.34 |
| 1984 | 39.77 (28.65 years ) | 42.51 | 57.95 | 30.11 (29.31 years) | 31.65 | 47.45 | 27.04 (30.73 years) | 28.09 | 44.65 |
| 1989 | 37.72 (28.67 years ) | 40.21 | 55.67 | 28.57 (29.33 years) | 29.97 | 45.78 | 25.65 (30.76 years) | 26.60 | 43.19 |

Notes: 1) National Pension; 2) National Pension + basic pension; 3) National Pension + basic pension + retirement pension (lifetime annuities); 4) period of participation.

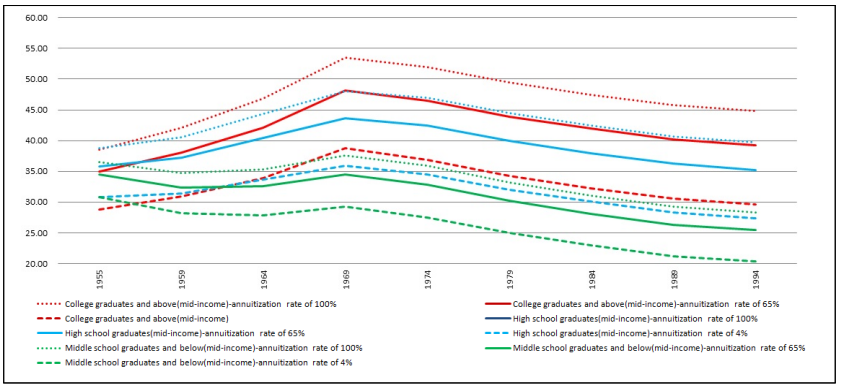
The estimated total income replacement rates of public and private pensions for groups of all education and income levels continue rise for birth cohorts born in the years up to 1970, but begin to decline with respect to birth cohorts born afterward. This is because the income replacement rate of the National Pension benefits is expected to decrease to 40 percent for participants who are participating in the scheme in 2028 and after and will pay contributions for 40 years. In the meantime, the total income replacement rates of the public and private pen-

sions drop in proportion to the rise in the income level of each education group. This is because the income replacement rate of the National Pension is significantly higher for low-income groups than upper ones. For the birth cohorts in each education and income group with the highest income replacement rate estimates, the total income replacement rate of all the three pensions ranges from 40 to 60 percent. Most advanced economies worldwide maintain the total income replacement rate of their public and private pensions from 60 to 70 percent. According to Ryu et al. (2009), the income replacement rate of personal pensions ranges from 6.3 to 7.5 percent depending on the period of participation. Even if we were to add the income replacement rate of personal pensions to the total income replacement rate estimates shown in Table 18, we would still lag behind the more appropriate OECD-recommended income replacement rate.

As of 2014, the annuitization rate in Korea barely reached four percent. In other words, only four percent of persons eligible to collect retirement pension benefits receive their benefits in the form of either annuities certain or lifetime annuities. So long as this rate remains the same, Korean retirees will never be able to earn income from their public and private pensions at the levels of the total income replacement rate estimates listed in Table 18. In order to estimate and compare different income replacement rates in relation to different annui-

tization rates, we need to use a number of different scenarios. In one, we assume the current annuitization rate of four percent persists long into the future. In another, we assume the average American annuitization rate of 65 percent (as of 2010) under the default-option annuitization scheme. In the last, we assume an annuitization rate of 100 percent, i.e., that all beneficiaries will opt to receive lifetime annuities. Then we again estimate and compare the income replacement rates of different education and income groups. For persons born in 1970, holding college degrees or more, and belonging to the middle-income groups, the income replacement rate would amount to 37.77 percent at the annuitization rate of four percent, rise to 48.39 percent at the annuitization rate of 65 percent, and rise further to 53.91 percent at the annuitization rate of 100 percent. The implication is that to increase pension income substantially under the current multi-pillar old-age income security system in Korea, policymakers not only need to reform and improve certain public or private pensions, but also need to devise a comprehensive plan for enhancing all the pensions at concern and thereby increase the total income replacement rate for Korean retirees.

[Figure 17] Comparison of Total Income Replacement Rate Estimates by Birth Cohort: For All Education Groups of Middle-Income Level, at Different Annuitization Rates




〈Table 19〉 Total Income Replacement Rate Estimates by Birth Cohort and Education Group (at Middle-Income Level)

| Year of birth | Middle-school graduates and below | | | High-school graduates | | | College graduates and above | | |
|---|---|---|---|---|---|---|---|---|---|
| | Scenario 1[1)] | Scenario 2 | Scenario 3 | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 1 | Scenario 2 | Scenario 3 |
| 1955 | 30.87 (38.37)[2)] | 34.49 (41.99) | 36.56 (44.06) | 30.78 (38.28) | 35.86 (43.36) | 38.77 (45.27) | 28.79 (36.29) | 34.96 (42.46) | 38.50 (46.00) |
| 1959 | 28.22 (35.72) | 32.32 (39.82) | 34.68 (42.18) | 31.35 (38.85) | 37.17 (44.67) | 40.51 (48.01) | 30.93 (38.43) | 38.02 (45.52) | 42.09 (49.59) |
| 1964 | 27.90 (35.40) | 32.60 (40.10) | 35.30 (42.80) | 33.66 (41.16) | 40.42 (47.92) | 44.30 (51.80) | 33.84 (41.34) | 42.08 (49.58) | 46.81 (54.31) |
| 1969 | 29.22 (36.72) | 34.52 (42.02) | 37.57 (45.07) | 35.95 (43.45) | 43.64 (51.14) | 48.05 (55.55) | 38.75 (46.25) | 48.14 (55.64) | 53.53 (61.03) |
| 1974 | 27.53 (35.03) | 32.89 (40.39) | 35.96 (43.46) | 34.54 (41.04) | 42.42 (49.92) | 46.95 (54.45) | 36.82 (44.32) | 46.45 (53.95) | 51.98 (59.48) |
| 1979 | 24.93 (32.43) | 30.18 (37.68) | 33.19 (40.69) | 32.04 (39.54) | 39.91 (47.41) | 44.42 (51.92) | 34.28 (41.98) | 43.91 (51.41) | 49.43 (56.93) |
| 1984 | 22.94 (30.44) | 28.10 (35.60) | 31.06 (38.56) | 30.08 (37.58) | 37.95 (45.45) | 42.46 (49.96) | 32.29 (39.79) | 41.92 (49.42) | 47.45 (54.95) |
| 1989 | 21.23 (28.73) | 26.31 (33.81) | 29.22 (36.72) | 28.38 (35.88) | 36.23 (43.73) | 40.73 (48.23) | 30.60 (38.10) | 40.24 (47.74) | 45.78 (53.28) |

Notes: 1) Scenario 1 assumes the annuitization rate of 4 percent; Scenario 2, the annuitization rate of 65 percent; and Scenario 3, the annuitization rate of 100 percent.

2) The income replacement rate of personal pensions, estimated to be 7.5 percent in Ryu et al. (2009), was added to the total income replacement rate estimates of all education and income groups.

# 5 Conclusion

# 5 Conclusion

The theoretical replacement rate of the National Pension will continue to decrease in the future to around 40 percent, making it impossible for Korean retirees to rely solely on the National Pension for old-age income. Our estimates also show that the total theoretical replacement rate of the National Pension, the basic pension, and retirement pensions would range from 40 to 60 percent for most Korean retirees, far below the OECD-recommended 60-to-70-percent range that has empirically been proven as more appropriate. As our analyses of different scenarios show, we may be able to enhance the capability of the current multi-pillar old-age income security system in Korea first by reforming the more pliable private pension schemes before proceeding to reform the public ones.

Today, Korean retirees can choose to collect their retirement benefits under either retirement allowance schemes or retirement pension schemes. Beginning in 2022, however, all Korean workers will be forced to convert to retirement pension schemes. This change will significantly raise the theoretical replacement rate of public and private pensions alike. However, given that the old-age income security system in Korea necessarily involves both public and private pensions, policymakers

will need to go further and enact laws and tax incentives that compel more beneficiaries to convert to long-term retirement annuities and make greater contributions to pension funds. As the increasing failure and bankruptcy of self-employed and small businesses continue to raise the debt burdens on Korean households, the Korean government needs to find ways to stop retirees from collecting their retirement income in the form of lump-sum allowances.

A ban on the collection of lump-sum retirement benefits is an option as a last resort, but given the rising level of uncertainty over the Korean job market and economy, policymakers may find it impossible to garner enough social support for a ban. In addition, solutions to other more pressing economic and labor issues need to be debated and settled before such a drastic action. Considering these circumstances, the default annuitization policy, with its greater flexibility, may be more suited to Korea than a mandatory annuitization scheme. The default scheme respects individuals' right to choose, while also increasing the annuitization rate on the whole. Such a scheme would help individuals by passing on their longevity and investment risks to financial institutions, while securing steady streams of income until death. The Korean government thus needs to strengthen its annuitization policy in phases, along with improving the job market and the overall economy, and thus ensure greater stability of income for old-age retirees into the future.

## References


Kang Seong-ho (2011), "Lifetime-Based Public and Private Pension Income Estimates," *Korea Journal of Insurance Studies*, 88, 51-87.

Ryu Geon-shik and Lee, Bong-ju (2008), "Analysis of the Old-age Income Securing Effective of Private Pension Schemes," *Korea Journal of Corporate Management Studies*, 28, 189-205.

Seong Ju-ho, Choi Yun-ho and Park, Jun-beom (2014), *Actuarial Analysis of the Annuity Puzzle and an Alternative Pension Design*, Korea Risk Management Society.

Eoh Gi-gu, Kim Won-seob and Lee Seung-hyeob (2009), *Old-age Income Security Systems and Roles of Retirement Pensions in Major Economies*, FKTU Research Center.

Won Jong-uk, Baek Hye-yeon, Kim Tae-eun and Choi Yo-han (2014), *Analysis of the Post-Retirement Life Stabilization Effect of Basic Pension Benefits*, KIHASA.

Won Jong-uk, Baek Hye-yeon, and Son Ji-hun (2014), *Demographic Changes and Their Implications on the Forecasts and Operating Strategy of Public and Private Pension Assets*, KIHASA.

Lee Gyeong-hee (2011), *Suggestions for Increasing the Annuitization of Retirement Pension Benefits*, Korea Insurance Research Institute.

Lim Byeong-in and Kang Seong-ho (2005), "Old-age Income Securing Effects of the National Pension, Retirement Pensions and Personal Pensions for Different Income Groups," *Korea Journal of Insurance Finance*, 16(3), 89-121.

Choi Gi-hong and Han Jeong-lim (2013), *Analysis of the National*

*Pension Burden Structures for Different Income Groups*, National Pension Research Institute.

Han Jeong-lim and Lee Hang-seok (2013), "An Actuarial Pension Model for Estimating the Income Replacement Rate of the National Pension, Retirement Pensions and Personal Pensions," *Proceedings of the Korean Data and Information Science Society*, 24, 1385-1400.

OECD (2013), *Pensions at a Glance 2013*.

Financial Supervisory Service's webpage on retirement pensions (http://pension.fss.or.kr).

Statistics Korea (2012), *Household Finance and Welfare Survey 2012*.