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**韓国の第5次国民年金改革(案)の所得再分配効果
—所得階層別の年金加入期間と平均余命の格差を中心に—**

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【要旨】

本稿は、韓国の保健福祉部が2023年10月30日に発表した第5次国民年金総合運営計画(案)に対して、各改革案による所得再分配効果をシミュレーション分析し、国民年金制度の設計当時から盛り込まれている所得再分配機能の観点から改革案を考察することに目的がある。

1998年度から2021年度の韓国労働パネル調査 (Korean Labor & Income Panel Study: KLIPS) のパネルデータを用いて、個別加入者の生涯所得を推定し、年金保険料総額を算定すると同時に、韓国統計庁の将来生命表に従って導出された性別及びコーホート別の平均余命から年金受給期間を設定し、年金受給総額を算定した。次に、現行制度と第5次国民年金総合運営計画(案)で提示された各改革案(改革案1から6まで)に対して、所得格差の指標として平均対数偏差 (Mean Log Deviation: MLD) を推計し、現行制度と比較して、改革案ごとに所得再分配はどうか、その効果を見極めた。そして、本稿では所得階層別に国民年金に加入する期間や平均余命に格差が存在する現実を踏まえて、所得階層別の加入期間格差と平均余命格差を反映した分析も別途実施している。

各改革案の所得再分配効果を雇用形態別(正規雇用労働者と非正規雇用労働者、自営業者)に考察したところ、国民年金の全加入者が20年間加入したと仮定した場合、保険料率の引上げ案(改革案1、改革案2、改革案3)や、保険料率の引上げ速度の改正案(改革案4)、年金支給年齢の引上げ案(改革案5、改革案6)の全ての改革案で所得再分配の改善効果が見られた。一方、各加入者における所得階層別の加入期間格差と平均余命格差を反映した場合、年金支給年齢の引上げ案は、全ての雇用形態の加入者に対して、所得再分配が悪化する結果が得られた。本結果は、全世代にわたる世代内所得再分配の悪化効果に起因することが確認された。

以上の分析結果より、韓国政府は「国民年金財政が長期的に均衡を維持できるように調整」という財政目標を掲げて、保険料率の引上げをはじめ、世代別保険料率引上げ速度の改正、年金支給年齢の引上げの内容を骨子とする国民年金改革案を提示しているが、同一な財政目標で出された案ごとに所得再分配効果は異なることが確認された。特に、年金支給年齢の引上げは、全ての雇用形態の加入者に対して、所得再分配の悪化を誘発する可能性があるとの示唆が得られた。

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Income Redistributive Effects of South Korea's 5th
National Pension Reform Plan:
Focusing on Disparities in Contribution Period and
Life Expectancy across Income Class*

Jeonyong Park[†]

Abstract

This paper aims to evaluate the income redistributive effects of various reform proposals under South Korea's 5th National Pension Comprehensive Plan (Draft), announced by the Ministry of Health and Welfare on October 30, 2023. By conducting a simulation analysis, the study examines the reform proposals from the perspective of the income redistribution function that has been embedded in the design of the National Pension System since its inception.

Using panel data from the Korean Labor & Income Panel Study (KLIPS) spanning from 1998 to 2021, we estimate the lifetime income of individual enrollees and calculate their total pension contributions. Simultaneously, we determine the pension benefit period based on the gender and cohort-specific life expectancies derived from the future life tables provided by Statistics Korea. Subsequently, we estimate the total pension benefits. The Mean Log Deviation (MLD) is calculated as a measure of income inequality to assess how each reform proposal (from Reform Proposal 1 to 6) affects income redistribution compared to the current system. Additionally, we perform a separate

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analysis that incorporates the disparities in contribution period and life expectancy among different income classes, reflecting the real-world inequalities in these aspects.

When evaluating the income redistributive effects of each reform proposal by employment type (regular employees, non-regular employees, and the self-employed), assuming a 20-year contribution period for all enrollees, all reform proposals—including those involving increased contribution rates (Proposals 1, 2, and 3), adjustments to the rate increase speed (Proposal 4), and raised the pensionable age (Proposals 5 and 6)—demonstrated improved income redistribution. However, when reflecting the income disparities by income bracket in contribution period and life expectancy, proposals to raise the pensionable age resulted in deteriorated income redistribution across all employment types. This outcome is attributed to the exacerbation of intragenerational income redistributive effects.

Based on these analysis results, it is confirmed that while the Korean government's proposed National Pension reforms—aiming to maintain long-term fiscal balance by increasing contribution rates, adjusting the speed of rate increases by generation, and raising the pensionable age—differ in their income redistributive effects under the same fiscal goal. Particularly, raising the pensionable age could potentially worsen income redistribution for enrollees across all employment types.

Keywords : National Pension reform, Income Redistribution, Intragenerational Income Redistribution, Mean Log Deviation (MLD), South Korea

JEL classification : D31, H23, H55

1 Introduction

The environment surrounding public pension system of South Korea (hereinafter, Korea) is exceedingly challenging. This is primarily due to the rapidly increasing old-age dependency ratio¹, severe low birth rates², and high elderly poverty rates³. Amidst these conditions, the National Pension, which forms the backbone of Korea's public pension system, has been the focus of serious reform discussions since August 2022. On October 30, 2023, the government announced its 5th National Pension Comprehensive Plan (Draft) (hereinafter, 5th National Pension Reform Plan), which has since been submitted to the National Assembly. However, the 5th National Pension Financial Estimate Results, released in March 2023, involves strong assumptions about individual enrollees, lacking detailed consideration of the income distribution among individuals.

This paper aims to address these limitations by conducting an empirical analysis that emphasizes the income redistribution function embedded in the National Pension System since its inception. By focusing on the income redistributive effects, we intend to evaluate the impact of the proposed 5th National Pension Reform Plan on both intergenerational and intragenerational income redistribution, considering the heterogeneity of individual enrollees by gender, employment type, and income class.

The paper proceeds as follows: Chapter 2 introduces the current state of Korea's public pension system and reviews relevant literature. Chapter 3 describes the data and estimation methods. Chapter 4 presents the simulation analysis of the income redistributive effects of the current National Pension System and each reform proposal, evaluating them from the perspective of income redistribution. Finally, Chapter 5 summarizes policy implications based on the analysis results, providing recommendations for advancing the 5th National Pension Reform Plan.

¹ The ratio of the working-age population, who support the pension system, to the elderly receiving pensions. According to the OECD, Korea's old-age dependency ratio is projected to reach 72.4% by 2050.

² Korea's total fertility rate recorded 0.78 in 2022 (Korean Statistical Information Service, "2022 Birth Statistics"), and it fell to 0.7 in the third quarter of 2023 (Korean Statistical Information Service, "Population Trends, September and Q3 2023").

³ In a survey of elderly poverty rates (ages 66 and above) released by the OECD in November 2019, Korea had the highest rate at 43.4%, more than three times the OECD average of 13.1%. Among the surveyed countries, only Korea, Latvia (39.0%), and Estonia (37.6%) exceeded 30%. Japan recorded a rate of 20%.

2 Current Situation Analysis

2.1 Korea's Public Pension System

Korea's public pension system is composed of four primary components: the National Pension, and the special occupational pensions for government employees, private school staff, and military personnel, as illustrated in Figure 2.1. The National Pension was introduced in 1988, individual pensions in 1994, retirement pensions in 2005, and the Basic Pension in 2014, establishing a multi-layered old-age income security system (Figure 2.2). The primary mechanisms for providing old-age income security are the Basic Pension⁴, the National Pension, and the National Basic Livelihood Security System, which offers public assistance. Despite the development of the Basic Pension, retirement pensions, and individual pensions (such as housing and agricultural land pensions), there is still a need for clearer role distribution among these systems and enhancement of each system's functionality (Ryu, 2022).

In August 2022, under the Ministry of Health and Welfare⁵, the 5th Financial Accounting Committee was established. Following this, the results of the 5th National Pension Financial Estimate Results⁶ were announced in March 2023, and the 5th National Pension Reform Plan was formulated and submitted to the National Assembly in October 2023, marking the start of substantial reforms.

Figure 2.1. Overview of Korea's Public Pension System

	National Pension	Special Occupational Pension		
		Government Employees Pension	Private School Teachers Pension	Military Pension
Year of introduction	1988	1960	1975	1963
Basis	NATIONAL PENSION ACT	PUBLIC OFFICIALS PENSION ACT	TEACHERS PENSION ACT	MILITARY PENSION ACT
Applicable subjects	Citizens aged 18 to 59	Civil servants, judges, police officers	Private school teachers (including hospital staff)	Career soldiers
System management	Ministry of Health and Welfare (National Pension Service)	Ministry of the Interior and Safety (Public Officers Pension Service)	Ministry of Education (Teachers Pension Service)	Ministry of National Defense (Welfare Division Military Pension Department)

Source: Compiled by the author from the Korea Institute for Health and Social Affairs (2018)

⁴ The Basic Pension, initially introduced as the "Basic Old-Age Pension" in 2008, was converted to the "Basic Pension" in 2014. It is provided to the bottom 70% of elderly individuals (6.24 million in 2022), with a base amount of 323,000 KRW as of 2023.

⁵ The Ministry of Health and Welfare is Korea's central administrative body responsible for welfare, social security, public health, and medical affairs.

⁶ Conducted every five years since 1998 to evaluate fiscal soundness and guide development, the National Pension Financial Estimate Results includes a comprehensive plan submitted to the National Assembly following presidential approval.

Figure 2.2. Korea's Multi-tier Old Age Income Security System

	Self-employed	Earned income workers	Civil servants, etc.
3rd tier	Private Pension (2.35 million people, 7.6%) ※ '21.12		
2nd tier	Retirement Pension (6.84 million people, 22.3%) ※ '21.12		Occupational Pension (1.81 million people, 5.9%)
1st tier	National Pension (22.5 million people, 73.3%)		
0th tier	Basic Pension (6.24 million people)		

Source: Compiled by the author from the Ministry of Health and Welfare's "The 5th National Pension Comprehensive Plan (Draft)," p.3

Notes: The figures in parentheses indicate the number of beneficiaries and the ratio of subscribers to the population aged 18 to 59, with Basic Pension representing the number of beneficiaries only (as of December 2022)

The current public interest in National Pension reforms is notably higher than usual. Over the past few years, the National Pension has become a significant social issue, with growing public distrust. Extreme proposals such as the abolition of the National Pension have even garnered some public support. This stems from concerns about fiscal sustainability and income adequacy due to the rapidly increasing old-age dependency ratio, severe low birth rates, and high elderly poverty rates. Indeed, candidates in the 2022 presidential election across various political parties recognized the need for National Pension Reform and proposed a range of pledges⁷ from parametric reforms to structural changes, reflecting public sentiment.

The criteria for evaluating National Pension reforms can be divided into fiscal sustainability and income adequacy. Fiscal sustainability implies maintaining a financial state where the pension system can continue to provide stable benefits not only to current pensioners but also to future contributors over a long period. This is particularly crucial in partially funded pension systems⁸ like Korea's (Figure 2.3). For the system to be perceived as reliable by new entrants, it must ensure intergenerational

⁷ Candidates from the ruling Democratic Party of Korea and opposition parties, including the People Power Party (PPP), Justice Party, and People's Party, acknowledged the need for National Pension reform but did not provide detailed plans (Dong-A Ilbo, February 5, 2022).

⁸ Korea operates a partially funded pension system where the National Pension Fund is sourced from contributions, investment returns, and government subsidies.

fairness and inclusivity, thereby fostering confidence that contributions will translate into future benefits. Concurrently, from the perspective of income adequacy, the pension system must ensure that those who consistently contribute receive stable benefits that prevent old-age poverty. This dual focus is central to the reform's core objectives.

Figure 2.3. Partially Funded National Pension Scheme
(Fund Status as of the End of January 2024)

	Cumulative Amount	For the current period in 2023	2022	2021	2020	2019	2018
Income (A)	1,120,815	63,169	81,957	91,551	69,387	64,197	59,762
Pension contributions	780,224	43,136	55,914	53,540	51,217	47,800	44,374
Investment returns	339,858	20,023	26,034	38,000	18,163	16,382	15,378
Government subsidies and others	733	9	8	12	6	15	10
Expenditure (B)	329,362	29,865	34,821	29,875	26,359	23,433	21,396
Pension benefit payments	317,807	29,231	34,020	29,137	25,654	22,764	20,753
Administrative expenses	11,371	627	792	729	697	660	635
Welfare village management and operational expenses	184	6	9	9	8	8	8
Fund Increase Amount (A-B)	791,453	33,304	47,136	61,676	43,027	40,764	38,366
Accumulated Reserve Funds (Based on Purchase Price)	791,453	791,453	758,149	711,013	649,336	606,309	565,544

Source: Compiled by the author from the "Fund Status" by the National Pension Fund Management Office.

Notes: The unit is billion KRW. The figures for income, expenditure, and fund status are prepared on a cash basis. "Government Subsidies, etc." refers to government subsidies, rental deposits for public corporation office buildings, and welfare pension transfers, while "Administrative and Operating Expenses" include personnel costs, operating expenses, and system-related business expenses.

However, balancing fiscal sustainability and income adequacy is challenging, as these concepts are not inherently complementary. Finding a solution that satisfies both criteria simultaneously is difficult, and such a compromise may not be viewed as satisfactory from any perspective. Hence, rather than pursuing an impossible goal of satisfying everyone with a reform package, it is more pragmatic to address urgent and longstanding issues sequentially. Notably, after the 4th National Pension Financial Estimate Results in 2018, attempts to find a single solution to all issues did not yield significant results over five years.

The demographic shifts since then have underscored the urgency of pension reform, as indicated by the 5th National Pension Financial Estimate Results. According to these results, the imbalance between contributions and benefits, with a rising number of

recipients and decreasing contributors, will exacerbate fiscal imbalances⁹. It is projected that the pension fund will start experiencing deficits by 2041, with depletion expected by 2055. The proposed 5th National Pension Reform Plan aligns with the Yoon Suk-yeol administration's emphasis on fiscal stabilization. Nevertheless, the plan reveals a sharp debate between fiscal stabilization and old-age income security, with the former prevailing in the final proposal.

Historically, the National Pension underwent reforms in 1998 and 2007 to enhance fiscal stability. The 1998 reform reduced the income replacement rate for a 40-year contribution period from 70% to 60% and raised the pensionable age to 61 by 2013, with subsequent increases every five years, reaching 65 by 2033. The 2007 reform further reduced the income replacement rate from 60% to 50% in 2008, with gradual reductions to 40% by 2028, but did not increase the contribution rate (Figure 2.4).

Figure 2.4. Evolution and Reform Plan of the National Pension System

Year		1988	1993	1998	1999	2000	2005	2008	2009	2013	2018	2023	2025	2028	2033	2038	
Contribution Rate (%)	Workplace-based Insured Persons	3	6	9									*5th National Pension Reform Plan				
	Individually Insured Persons	3			4	9											
Income Replacement Rate (%)		70			60			50	49.5	47.5	45	42.5		40			
Pensionable Age		60								61	62	63		64	65	*	
Monthly Pension Amount (10,000 won)		140			120			100	99	95	90	85		80			

Source: Compiled by the author from the homepage of National Pension Service (NPS).

Notes: Monthly Pension Amount assumes 40 years of participation with an average monthly income of 2 million KRW. Contribution rate: For Workplace-based Insured Persons, the rate was 9% at the enactment of the National Pension Act in 1988, 3% for the first 5 years of implementation, and 6% for the next 5 years. For Individually Insured Persons, the rate was initially 3%, increased by 1% each year starting in 2000, reaching 9% by 2005. Income Replacement Rate: Based on 40 years of participation. As of 2018, the actual average participation period was 23.8 years, with an effective income replacement rate of 23.9%.

Currently, the National Pension includes Workplace-based Insured Persons, Individually Insured Persons, and Voluntarily Insured Persons. Workplace-based Insured Persons includes employees and employers in workplaces with at least one employee, mainly covering regular and some non-regular workers. Contributions are

⁹ The dependency ratio (number of recipients/number of contributors) is projected to rise from 24% in 2023 to 95.6% in 2050 and 138.3% in 2070 (The 5th National Pension Financial Estimate Results).

shared equally between employers and employees (contribution rate of 4.5%). Individually Insured Persons includes self-employed individuals, agricultural and fishery workers, and non-regular workers aged 18-59, who bear the full cost themselves (contribution rate of 9%). Voluntarily Insured Persons includes those outside the other categories, such as homemakers and students, who opt to join. This paper focuses on Workplace-based Insured Persons and Individually Insured Persons.

Figure 2.5. Types of National Pension Enrollment

Enrollment Type	Eligible Participants	Contribution Rate (9%)	Method of Contribution Payment	Examples
Workplace-based Insured Persons	Workplaces (companies) employing one or more employees are required to participate in the National Pension Scheme. Employers and employees aged 18 to 59 working at these workplaces are classified as workplace-based enrollees.	Employer: 4.5% Employee: 4.5%	Employee pension contributions are deducted from monthly salary.	Regular employees, *Non-regular employees
Individually Insured Persons	Citizens aged 18 to 59 residing in Korea who have income from individual businesses. This includes all individuals with income except for those classified as workplace-based enrollees.	9%	Individuals must report their standard monthly income to the National Pension Service (NPS), which will determine the contribution amount based on this income.	Self-employed individuals, Agricultural and fisheries workers, Non-regular employees
Voluntarily Insured Persons (Voluntarily Insured/Voluntarily and Continuously Insured Persons)	Individuals aged 18 to 59 who do not fall under workplace-based or region-based categories and choose to enroll voluntarily by applying.	9%	Contributions are determined each year based on the standard monthly income as of December 31 of the previous year for all region-based enrollees, using the median standard monthly income as the reference point ("Median Standard Monthly Income").	Full-time homemakers, Students

Source: Compiled by the author from the homepage of National Pension Service (NPS).

Since the dual reforms of 1998 and 2007, efforts to raise contribution rates based on the 3rd National Pension Financial Estimate Results for 2013 failed due to participant opposition. In 2018, under the progressive Moon Jae-in administration and the Democratic Party, the 4th National Pension Comprehensive Plan (Draft) proposed (1) increasing both the income replacement rate and contribution rate and (2) explicitly ensuring state-guaranteed pension benefits to enhance public trust¹⁰. However, these proposals did not lead to legislative changes. The 5th National Pension Reform Plan announced on October 30, 2023, prioritizes fiscal stabilization. It introduces fiscal targets to ensure the pension fund does not deplete within the projection period (2023-2093) and maintains long-term financial equilibrium, marking a significant step compared to previous vague targets (Figure 2.6).

¹⁰ The 4th National Pension Comprehensive Plan (Draft), announced in December 2018, focused on old-age income security, proposing to maintain the income replacement rate and increase the contribution rate, counter to the results of the 4th National Pension Financial Estimate Results.

Figure 2.6. Comparison of Fiscal Objectives in Public Pension Systems

	Fiscal Objectives	Estimation Period	Explicit Statement
South Korea (National Pension System)	· Adjustments are made to ensure the long-term financial balance of the National Pension system.	70 years	○
Germany (National Pension System)	· Contribution Rate: Capped at 20% until 2020 and 22% until 2030. · Income Replacement Rate: Minimum of 46% until 2020 and 43% until 2030. · If contribution rates exceed the cap or income levels fall short of projections, the government will implement supplementary measures.	15 years (5-year medium-term outlook)	○
Canada (CPP)	· Applies the minimum contribution rate necessary to maintain a steady level of the funding ratio for up to 60 years from the valuation date.	75 years	○
Japan (National Pension System, Employees' Pension Insurance)	· Financial Objective: Maintain a funding ratio of 1.0 over 100 years. · Specifies a minimum income replacement rate.	100 years	×
United States (OASDI)	· Short-term Financial Objective: Balance income and expenditures over 10 years. · Long-term Financial Objective: Balance income and expenditures over 75 years.	75 years (10-year short-term outlook)	×
Sweden	· Equilibrium Ratio: 1.0	75 years	×

Source: Compiled by the author from p.106 of the Korea Institute for Health and Social Affairs' "Study on the Restructuring of Public Pensions."

Notes: The equilibrium ratio refers to the value obtained by dividing the sum of estimated contribution assets and the market value of reserve funds by the pension liabilities (accumulated nominal pension benefits and pension contributions).

The proposed 5th National Pension Reform Plan outlines scenarios combining increased contribution rates (12%, 15%, 18%), raising the pensionable age (from the current 65 to 68), and improving fund investment returns (0.5-1 percentage points above the 5th National Pension Financial Estimate Results). It also considers intergenerational equity in contribution rate increases¹¹. For analysis, this paper focuses on reform scenarios excluding investment return improvements, composed of increased contribution rates, raising the pensionable age, and varying intergenerational contribution rate increments, as shown in Figure 2.7.

¹¹ The plan proposes increasing the contribution rate by 0.6% annually for those born in 1986 or later (20s-30s) from 2025, and by 1% annually for those born up to 1985 (40s-50s) from 2025 (5th Comprehensive National Pension Management Plan).

Figure 2.7. Contents of the 5th National Pension Reform Plan used in This Paper

		Main Contents of the 5th National Pension Reform Plan			
Types of Reforms	(1) Increase in the contribution rate (currently 9%)		(2) Differences in the rate of increase by age group	(3) Raising the pensionable age (currently 65)	
	Proposal 1	12%	Increase by 0.6% annually for 5 years starting from 2025	×	×
Proposal 2	15%	Increase by 0.6% annually for 10 years starting from 2025	×	×	
Proposal 3	18%	Increase by 0.6% annually for 15 years starting from 2025	×	×	
Proposal 4	18%	Increase by 0.6% annually for 15 years starting from 2025	For the generation born in or after 1986 (those in their 20s and 30s as of 2025): Proposal 1 For the generation born up to 1985 (those in their 40s and 50s as of 2025): Increase by 1% annually for 9 years starting from 2025	×	
Proposal 5	18%	Increase by 0.6% annually for 15 years starting from 2025	×	68	Raise the pensionable age by 1 year every 5 years starting from 2038
Proposal 6	18%	Increase by 0.6% annually for 15 years starting from 2025	For the generation born in or after 1986 (those in their 20s and 30s as of 2025): Proposal 1 For the generation born up to 1985 (those in their 40s and 50s as of 2025): Increase by 1% annually for 9 years starting from 2025	68	Raise the pensionable age by 1 year every 5 years starting from 2038

Source: Compiled by the author from p.48-49 of the Ministry of Health and Welfare's "The 5th National Pension Comprehensive Plan (Draft)."

2.2 Literature Review

Research analyzing the effects of National Pension reforms on income redistribution includes the following studies:

Kim (2004) constructed a panel dataset from the statistics of the National Pension Corporation and analyzed the intragenerational income redistributive effects of the National Pension Act amendment proposal submitted to the National Assembly in 2004. Kim's analysis showed that, for younger generations, the structure shifts towards generating higher net transfers from low-income groups.

Kim and Kang (2005) utilized income data from 1988 to 2003 and estimated future incomes to analyze the income redistributive effects of the National Pension. They constructed a pseudo-panel based on cross-sectional data and found that the income redistributive effect, measured by the Gini coefficient, improved by 6 percentage points for Workplace-based Insured Persons of a single generation. However, there were limitations in estimating future incomes for post-2004 participants due to the inability to reflect individual characteristics, the application of a uniform wage growth rate, and the assumption that participants would remain continuously employed without experiencing unemployment.

Lee (2006) analyzed the income redistributive effects of the National Pension System, considering differences in life expectancy across income levels and generations, using data from the Korean Labor & Income Panel Study (KLIPS). Lee estimated past and future incomes of individual participants not included in the panel data through regression analysis and attempted to reflect the expected differences in life expectancy across income levels. However, due to the absence of domestic data on life expectancy differences by income level, education level was used as a proxy variable, which did not adequately capture the actual differences in elderly mortality rates across educational standards.

Kang et al. (2008) analyzed the income redistributive effects of the 2007 National Pension Reform using data from KLIPS. Their findings indicated that the income redistributive effect of the 2007 reform was only 0.3 percentage points, having negligible substantial impact on income redistribution. Although improvements were made by estimating lifetime incomes of participants through regression analysis, the study faced limitations due to the strong assumption that participants would remain continuously employed without experiencing unemployment in the future.

Kim (2008), similar to Kang et al. (2008), analyzed the income redistributive effects of the 2007 National Pension Reform using KLIPS data. However, Kim's study differed by estimating the number of children in households after the survey period and including

self-employed and non-regular workers in the analysis. The study used Gini coefficients, net transfers, and benefit ratios as indicators of income redistributive effects.

Yuh and Yang (2011) used data from the Household Income and Expenditure Survey of Statistics Korea and future population projections to form income quintiles based on lifetime income. They measured and compared the expected return rates by income quintile, considering survival rates. Their analysis showed that as income quintiles increased, the expected return rates decreased, indicating a significant improvement in the income redistributive effects of the National Pension.

Additionally, Lee et al. (2016), Choi (2016), Choi and Han (2017), and Kim (2019) analyzed the income redistributive effects using the benefit ratio as an indicator. After estimating lifetime earned income, they calculated the present value of total pension contributions and total pension benefits under the current system, and then determined the benefit ratio. They analyzed the income redistributive effects of the National Pension by forming income quintiles based on lifetime earned income or lifetime income and measuring the average benefit ratio for each quintile.

All these prior studies evaluated the redistributive effects based on lifetime income. The redistributive effects of social security and tax systems should be assessed on a lifetime income basis rather than an annual income basis, as taxes and social insurance contributions during working years largely offset each other (Haider and Solon (2006)¹², Ojima (2010)). Internationally, numerous studies have assessed the income redistributive effects of their pension systems using panel data to estimate lifetime income (Coronado et al. (2000, 2011), Liebman (2002), Leimer (2004), Levell et al. (2015), Bengtsson et al. (2016), Haan et al. (2017), Xing (2021)).

However, the aforementioned studies analyzing the income redistributive effects of National Pension reforms identified several limitations in estimating lifetime income from panel data. Specifically, these studies did not reflect individual heterogeneity, assuming participants would remain employed for all future periods post-survey and that the number of children would remain unchanged. Additionally, they did not account for differences in participation periods by income level (Kim (2019)¹³) or differences in

¹² Haider and Solon (2006) demonstrate that income redistribution metrics based on annual income tend to be exaggerated. They attribute this to errors-in-variables bias.

¹³ An analysis considering the varying contribution periods to the National Pension System across different income levels examines how these variations impact the effectiveness of income redistribution.

life expectancy by income level (Coronado et al. (2000)¹⁴, Woo et al. (2016)¹⁵). This paper addresses these limitations (detailed in Figure 2.8) by constructing several estimation models that reflect individual heterogeneity.

Figure 2.8. Limitations in Previous Studies

Limitations in Reflecting the Heterogeneity of Individual Participants	
A	The number of children after the survey period is assumed to remain unchanged based on the latest survey data.
B	Employment status after the survey period is assumed to remain unchanged based on the latest survey data.
C	Future income after the survey period is calculated by applying the same wage growth rate (forecasted value).
D	Differences in contribution periods across income quintiles are not reflected.
E	Differences in average life expectancy across income quintiles are not reflected.
F	Self-employed individuals and non-regular workers are excluded from the analysis.
G	The analysis is based on the average income of all participants rather than on an empirical analysis at the level of individual participants.

<Summary of Previous Research Analyzing the Income Redistributive Effects of National Pension Reform using Lifetime Income>

Researcher's name (Year of publication)	Data	Scope of analysis	Limitations
Kim (2004)	Statistical data from the National Pension Service (NPS) (currently the NPS Big Data Portal)	• 2004 National Pension Reform Proposal	A,B,D,E,F
Kim and Kang (2005)	Korean Labor & Income Panel Study	• Initial National Pension and the 1997 National Pension Reform Proposal	A,B,C,D,E,F
Lee (2006)			B,D,E,F
Kang et al. (2008)		• 2007 National Pension Reform Proposal	A,B,D,E,F
Kim (2008)			B,D,E
Yuh and Yang (2011)	Household Income and Expenditure Survey & Population Projections	• 2018 National Pension Reform Proposal	A,B,G
Lee et al. (2016)	Korean Labor & Income Panel Study		B,F
Choi (2016)			B,F
Choi and Han (2017)			B,F
Kim (2019)			B,F,G

Source: Created by the author

Since the announcement of the 5th National Pension Reform Plan on October 30, 2023, no studies have analyzed the income redistributive effects of the proposed

¹⁴ Coronado et al. (2000), in their study on the U.S. public pension system (Old-Age, Survivors, and Disability Insurance: OASDI), found that when reflecting the longer life expectancy of high-income groups compared to low-income groups, the U.S. public pension system was shown to redistribute income in a regressive manner.

¹⁵ Woo et al. (2016) analyzed the effects of the 1998 and 2007 National Pension reforms on retirement income security by incorporating the life expectancy differentials by gender and income class.

reforms¹⁶. Moreover, this paper includes self-employed and non-regular workers in the analysis to examine policy effects by employment type, distinguishing it from previous studies. Prior research excluded self-employed and non-regular workers due to the representativeness issues arising from their low national pension participation rates. However, considering their relatively unstable employment conditions compared to regular workers, disparities in participation rates and periods, and their vulnerability from a retirement income security perspective, it is essential to scrutinize these groups considering the National Pension Act's objective to enhance public welfare and stabilize livelihoods.

This paper analyzes the income redistributive effects of the proposed National Pension Reform from both intergenerational and intragenerational perspectives. The rationale is that the Korean national pension formula includes an earnings-related component ("B value"), which may carry forward income disparities from working years into old age, necessitating an examination from the perspective of intragenerational income redistribution (Oshio and Urakawa (2008)¹⁷).

Chapter 3 will explain the data and estimation methods. Chapter 4 will analyze the estimation results and clarify the income redistributive effects of the current National Pension System and each reform proposal. Finally, Chapter 5 will summarize the implications of each reform proposal from the perspective of income redistribution based on the estimation results.

¹⁶ As of May 1, 2024, according to the academic information provided by the Korea Citation Index, there are no academic papers that have studied the 5th National Pension Reform Plan as a research theme. However, there is an academic paper by Jeong and Kim (2023) that critically evaluates the main points of 5th National Pension Financial Estimate Results announced in March 2023.

¹⁷ Oshio and Urakawa (2008) point out the necessity of examining not only intergenerational but also intragenerational income redistributive effects. For example, in the case of Japan's Employees' Pension Insurance, they highlight that the earnings-related component of pension benefits tends to carry forward income disparities from working years into retirement. They also note the significant disparity in pension benefits between recipients of the National Pension, who receive only the basic pension, and recipients of the Employees' Pension, who receive both the basic and earnings-related components.

3 Analysis Preparation

3.1 Data and Assumptions in Statistical Analysis

This paper utilizes data from the Korean Labor & Income Panel Study (KLIPS) to estimate lifetime income, lifetime pension benefits, and lifetime pension contributions while tracking national pension enrollment histories. The KLIPS is a longitudinal survey that tracks economic activity, labor market mobility, income activities, consumption, education, vocational training, and social life among household members residing in non-rural areas of Korea. The panel consists of approximately 5,000 households and is surveyed annually. In Korea, other large-scale labor market surveys include the "Economically Active Population Survey" and "Survey on the Economically Active Population Employment Structure" by Statistics Korea, and the "Labor Force Flow Survey" and "Basic Survey on Wage Structure" by the Ministry of Employment and Labor. However, these are all cross-sectional surveys limited to specific points in time, restricting their ability to capture dynamic aspects of economic activity, labor market transitions, income, and consumption changes at the individual level. Conversely, KLIPS's panel data, which allows for long-term tracking of changes and transitions in households and individuals, is more suitable for estimating lifetime income on an individual basis. Additionally, the richness of KLIPS's questions for explanatory variables in income estimation models is another reason for its selection. This study uses data from the 1st to the 24th waves of the KLIPS.

Figure 3.1. Overview of the Korean Labor & Income Panel Study (KLIPS)

Survey start year	1998
Survey objective	The initial survey aimed to illustrate the labor market characteristics of urban households.
Population	Households residing in urban areas of South Korea and individuals aged 15 and above. (However, households on Jeju Island, those fulfilling military service, and those residing in institutions were excluded from the survey.)
Sampling frame	The 19,025 survey districts from the "1995 Population and Housing Census" by the Korea National Statistical Office.
Sampling method	Two-stage cluster systematic sampling (A method was used to first select 1,000 survey districts and then randomly extract five households from each selected district.)
Sampling results	5,000 households

Source: Created by the author from the "Survey Overview" of the KLIPS.

The sample selection for this study adheres to the following criteria:

- Focus on Workplace-based Insured Persons and Individually Insured Persons, excluding those with histories in special occupational pensions.
- Include participants enrolled in the national pension from 2018 to 2020, aged 25 to 57 in 2020. The age of 25 for pension enrollment is based on Kim (2019)¹⁸, and the age of 57 corresponds to individuals who were 25 in 1988, the year the national pension started.
- Exclude individuals with a history of receiving National Pension benefits.
- Exclude foreign workers due to employment instability and differing employment patterns.
- Exclude participants whose employment status changed during the survey period, such as those shifting from regular employment to self-employment or non-regular employment.

The representativeness analysis of the KLIPS data and the selected sample based on the above criteria is summarized in Figure 3.2. Comparing the number of participants and gender ratios by enrollment type between the KLIPS data and the 2020 National Pension Service (NPS) data confirms that using KLIPS data poses no issues regarding representativeness. Additionally, since the study conducts separate analyses for Workplace-based Insured Persons and Individually Insured Persons, any differences in their ratios do not affect the analysis.

Figure 3.2. Number of Participants and Gender Ratio by
Type of National Pension Enrollment (1997-2020)

		National Pension Service (NPS)	Korean Labor & Income Panel Study (KLIPS)	Sample used in this study (KLIPS)
Workplace-based Insured Persons	Male	8,307,000 (58)	8,113 (56.9)	5,792 (58.5)
	Female	6,012,000 (42)	6,150 (43.1)	4,117 (41.5)
Individually Insured Persons	Male	1,858,000 (48.9)	6,807 (50.7)	3,073 (51.6)
	Female	1,941,000 (51.1)	6,622 (49.3)	2,885 (48.4)

Source: Created by the author from the data of the National Pension Service (NPS) and the KLIPS.

Notes: The units represent the number of participants, and the figures in parentheses indicate the gender ratio percentage. The data from the National Pension Service (NPS) reflect the number of participants as of 2020. The data from the KLIPS represent the cumulative totals from 1997 to 2020 (from the 1st to the 24th survey waves).

¹⁸ Kim (2019) sets the age of 25 for pension enrollment based on the average age of new male participants, which was 26.5 in 2008 and 24.3 in 2017, due to the lack of official data on average ages for new National Pension participants.

This study makes several assumptions for the statistical analysis:

- Future values for real wage growth, real interest rates, and inflation rates, necessary for the present value calculation of lifetime pension benefits and lifetime pension contributions, use the basic demographic and economic assumptions from the 5th National Pension Financial Estimate Results (Figure A1 in the Appendix). The actual real interest rates from 1988 to 2019 are derived from subtracting the Consumer Price Index (CPI) from nominal interest rates, using deposit bank interest rates.
- Life expectancy for individuals is based on the 2021 Life Tables published by Statistics Korea in December 2022, reflecting gender- and cohort-specific life expectancy for estimating lifetime pension benefits.
- Only labor income is included in the income range analyzed, excluding financial income, secondary job income, and inheritance income.
- Retirement age is assumed to be 60 for regular employees, following the guidelines of Article 19, Paragraph 1 of the Act on the Promotion of Employment for the Elderly. For self-employed and non-regular workers, it is assumed they work until the year before pension benefits begin, based on the "actual retirement age" reported by the Korea Future Asset Retirement Pension Center.
- Residential locations are assumed to remain unchanged from the last survey response.
- The number of children is assumed to remain constant for married women over the age of 40, based on their number of children at age 39. For individuals over 40 without data, the number of children is inferred from their status at 39. In estimating future income, the number of children is a crucial variable. Therefore, instead of adhering to the strong assumption from previous studies that the number of children remains unchanged from the last survey response, this paper uses data from the Korean Labor & Income Panel Study (KLIPS) to estimate the number of children for married women. According to Kim (2007)¹⁹, there are differences in the determinants of the number of children between married women over 40 and those 39 or younger. Hence, the above assumptions are made for analytical convenience.
- Employment status is assumed to remain unchanged during the employment period.
- The study uses income earned in the year preceding the survey year due to KLIPS collecting previous year's income data.
- The base year for present value calculations is 2020, the latest year with available

¹⁹ Kim (2007) analyzes the determinants of the number of children in Korean households using a Count Data Model.

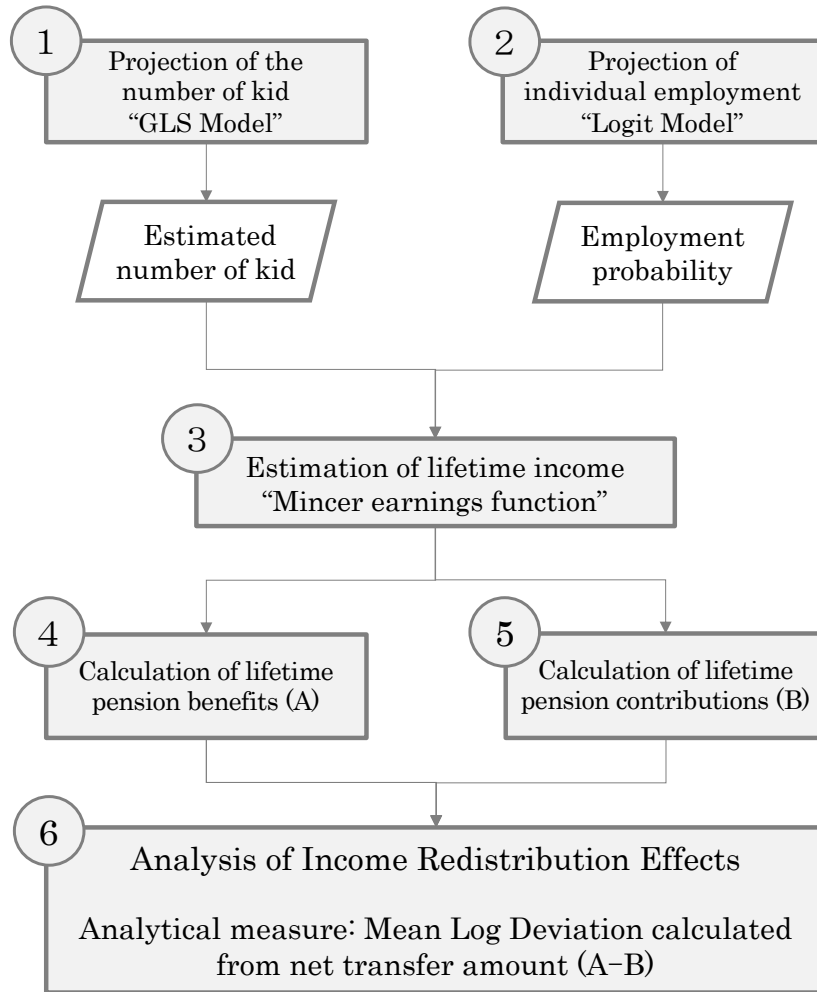
KLIPS data (survey year 2021).

3.2 Estimation Method

To examine the intragenerational income redistributive effect of the national pension, the following estimations are performed. First, the determinants of the number of children each participant will have in the future are estimated using Generalized Least Squares (GLS), and these estimates are used to predict future numbers of children. Next, a Logit model estimates the determinants of future employment, and these estimates are used to predict future employment status. For employed participants, the Mincer earnings function is used to elucidate the relationship between age, tenure, and wage income, segmented by gender and employment type (regular employees, self-employed, and non-regular employees). This allows the prediction of annual wage income from employment to retirement for each participant. These predictions are then adjusted for wage growth rates and discount rates to determine annual wage levels. Subsequently, annual contributions and future pension benefits are calculated.

The estimation equations for the determinants of future children are unique to this study, while those for future employment follow Xing (2021). The estimated lifetime pension benefits and contributions, based on the projected lifetime income, are calculated using formulas for pension benefits and contributions published by the Ministry of Health and Welfare. They represent the theoretical values if participants' income follows the projections. Finally, the net transfer amount, derived by subtracting lifetime contributions from lifetime pension benefits, is calculated for each gender, employment type, and income level, and the Mean Log Deviation (MLD) index is derived to assess the income redistributive effect. The flow of these estimation methods is summarized in Figure 3.3.

Figure 3.3. Analysis Flow



Source: Created by the author.

3.2.1 Lifetime Income

In this study, we estimate individuals' lifetime income using the Mincer earnings function to predict future earnings beyond the survey period of the Korean Labor & Income Panel Study (KLIPS). Additionally, the projected number of future children and the likelihood of future employment are incorporated into the lifetime income estimations.

First, we estimate the number of children for married women. The number of children for the husbands within the same household follows the estimated number for their wives. As mentioned in the assumptions for the statistical analysis, it is assumed that women do not give birth after the age of 40. For individuals over 40 without data, the number of children at age 39 is used.

The KLIPS, as detailed by Song (2012), is a panel data set that comprehensively captures the economic situation of households, thereby overcoming the limitations of the "National Fertility and Family Health and Welfare Survey" conducted by the Korea Institute for Health and Social Affairs (KIHASA), which excludes variables related to the economic status of households. By utilizing the strengths of the KLIPS, which includes many variables relevant to the determinants of the number of children, we employ the Generalized Least Squares (GLS) method to estimate the number of children for married women under 39, as shown in equation (1).

The number of children for each married woman is determined by variables such as age, employment status, labor income from the previous year (wage or business income), household income from the previous year, and attributes of each married woman (such as education level, whether they reside in a metropolitan area, and homeownership status). The rationale for using the previous year's labor and household income is that the economic situation immediately before childbirth serves as a key decision factor for having children. Moreover, since this study uses the number of children in the relevant year to estimate future income (as referenced in equation (4) later), the predicted values of labor and household income from equation (4) are used to estimate the future number of children.

By using these comprehensive variables, we construct the estimation equation for the number of children for married women under 39, leveraging the advantages of the KLIPS data set for more accurate and representative estimations of lifetime income.

$$kid_{MW,t} = \alpha_0 + \alpha_1 A_{MW,t} + \alpha_2 ES_{MW,t} + \alpha_3 \ln wage_{MW,t-1} + \alpha_4 \ln hwage_{MW,t-1} + \lambda X_{MW,t} + e_{MW,t} \quad (1)$$

$kid_{MW,t}$: Number of children for married women in year t , $A_{MW,t}$: Age of married women in year t , $ES_{MW,t}$: Employment status of married women in year t , $\ln wage_{MW,t-1}$: Labor income (salary income or business income) of married women in year $t - 1$, $\ln hwage_{MW,t-1}$: Household income in year $t - 1$ (total labor income of household members excluding married women), $X_{MW,t}$: Attributes of married women (education level, residence in a metropolitan area, homeownership), $e_{MW,t}$: Error term

Based on the parameters estimated from equation (1), we derive the estimation equation (2) for the future number of children ($\widehat{kid}_{MW,t}$) to estimate the future number of children for married women under the age of 39.

$$\widehat{kid}_{MW,t} = \hat{\alpha}_0 + \hat{\alpha}_1 A_{MW,t} + \hat{\alpha}_2 ES_{MW,t} + \hat{\alpha}_3 \ln wage_{MW,t-1} + \hat{\alpha}_4 \ln hwage_{MW,t-1} + \hat{\lambda} X_{MW,t} \quad (2)$$

$\widehat{kid}_{MW,t}$: The predicted number of children for married women in year t

Next, since this study focuses on workers who bear pension contributions, it is necessary to predict whether individuals will continue to be employed beyond the survey period. Specifically, we employ a Logit Model to estimate each participant's probability of employment using equation (3). The likelihood of an individual being employed is determined by variables such as age and its square, the number of children and its square, household income representing the total labor income of other household members, the population of the city or province where they reside, and various personal attributes (education level, whether they live in a metropolitan area, homeownership status, health status, and marital status).

By incorporating these variables, we construct a detailed model to accurately predict the employment probabilities of the individuals in our study, thereby enabling a more precise estimation of their future labor income and corresponding pension contributions.

$$\begin{aligned} & \Pr(PE_i = 1) \\ &= F(\beta_0 + \beta_1 A_i + \beta_2 A_i^2 + \beta_3 kid_i + \beta_4 kid_i^2 + \beta_5 \ln hwage_{i,t} + \beta_6 PCP_i + \lambda X_i + u_{i,t}) \\ &= \frac{\exp(\beta_0 + \beta_1 A_i + \beta_2 A_i^2 + \beta_3 kid_i + \beta_4 kid_i^2 + \beta_5 \ln hwage_{i,t} + \beta_6 PCP_i + \lambda X_i + u_{i,t})}{1 + \exp(\beta_0 + \beta_1 A_i + \beta_2 A_i^2 + \beta_3 kid_i + \beta_4 kid_i^2 + \beta_5 \ln hwage_{i,t} + \beta_6 PCP_i + \lambda X_i + u_{i,t})} \quad (3) \end{aligned}$$

$\Pr(PE_i)$: The employment probability of participant i , A_i : The age of participant i , A_i^2 : The square of the age of participant i , kid_i : The number of children of participant i , kid_i^2 : The square of the number of children of participant i , $\ln hwage_{i,t}$: The household income of participant i in year t (Sum of labor income of household members), PCP_i : The population of the city/province where participant i resides, X_i : The attributes of participant i (education level, residence in a metropolitan area, homeownership, health status, marital status), $u_{i,t}$: Error term

Based on the employment probability ($\Pr(PE_i)$) of participant (i) estimated from equation (3), the future employment status (ES_i) of participant (i) is determined as follows.

$$ES_i = \begin{cases} 1 & \text{if } \Pr(PE_i = 1) \geq 0.5 \\ 0 & \text{if } \Pr(PE_i = 1) < 0.5 \end{cases}$$

Finally, using the values of the future number of children and employment status obtained from equations (2) and (3), we estimate the future income. In this study, we utilize the Mincer earnings function, which effectively leverages the rich set of variables capturing worker attributes in the Korean Labor & Income Panel Study (KLIPS), to estimate the income of each participant beyond the survey period using equation (4). Specifically, the income of each participant is structured as follows:

1. For regular employees, income is determined by variables such as age and its square, tenure and its square, number of children, personal attributes (education level, metropolitan area residence, health status, marital status, firm size, occupation), and unobservable individual-specific residuals.
2. For self-employed individuals and non-regular employees, the income estimation excludes the firm size and occupation variables from equation (4), focusing instead on tenure and its square and other personal attributes.

By applying these detailed models, we can accurately predict the future labor income for different categories of workers, reflecting their distinct employment characteristics and personal attributes.

$$\ln w_{i,t} = \theta_0 + \theta_1 A_{i,t} + \theta_2 A_{i,t}^2 + \theta_3 CE_{i,t} + \theta_4 CE_{i,t}^2 + \theta_5 kid_{i,t} + \lambda X_{i,t} + v_i + \varepsilon_{i,t} \quad (4)$$

$\ln w_{i,t}$: The natural logarithm of participant i 's annual income in year t , $CE_{i,t}$: Participant i 's years of tenure in year t (Continuous years of Employment: CE), $CE_{i,t}^2$: The square of participant i 's years of tenure in year t , $X_{i,t}$: The attributes of participant i (education level, metropolitan area residence, health status, marital status, firm size, occupation), v_i : Unobservable individual effects (unobservable individual-specific residual), $\varepsilon_{i,t}$: Error term

The calculation of lifetime income is structured according to equation (5), using the year 2020 as the base year. This comprises both the self-reported labor income (either wage income or business income) during the survey period and the projected income estimates derived from equation (4). For household members who are excluded from the sample in specific years within the survey period, we use projected annual income values, similar to the method for estimating future income.

The first term of equation (5) represents the annual income converted to the 2020 value from the time of initial National Pension enrollment up to the present (2020). The second term represents the annual income from the present until just before retirement,

adjusted to the 2020 value, taking into account the future employment probabilities derived from equation (3). The present value of each participant's annual income is determined by the real interest rate (r) and the real wage growth rate (π). Additionally, to ensure consistency between sample estimates and actual values, we incorporate an adjustment factor (α) into equation (5). This factor is the average ratio over a ten-year period (2011 to 2020) between the median income estimated from the KLIPS sample and the actual nominal monthly average wages by gender and employment type from the Ministry of Employment and Labor's "Survey on Labor Conditions by Employment Type."

$$W_i = \left[\sum_{t=k}^h w_{i,t} \cdot \prod_{j=t}^h (1 + r_j) + \sum_{t=h+1}^{R-1} \hat{w}_{i,t} \cdot ES_i \cdot \prod_{j=h+1}^{R-1} \frac{(1 + \pi_j)}{(1 + r_j)} \right] \cdot \alpha_h \quad (5)$$

$w_{i,t}$: The reported annual income of participant i in year t , $\hat{w}_{i,t}$: The predicted annual income of participant i in year t , k : Initial year of National Pension enrollment, h : 2020 (Reference year), R : Retirement year, r_j : The real interest rate (discount rate) in year j , π_j : The real wage growth rate in year j , ES_i : Employment status of participant i (employed = 1, not employed = 0), α_h : Adjustment coefficient, W_i : The lifetime income of participant i (evaluated as of 2020)

3.2.2 Lifetime Pension Benefits

The benefit structure of the National Pension follows a defined benefit scheme, similar to traditional public pension systems. Each participant's pension benefit amount is determined according to equation (6), which includes factors such as the fixed portion (A value), the income-proportional portion (B value), actuarial proportional constants, and the contribution period.

To understand the National Pension, one must first grasp the concept of the standard monthly income. The standard monthly income refers to the declared monthly income of a participant, truncated to the nearest thousand KRW, with set upper and lower limits. These limits are adjusted annually based on the average income of all Workplace-based Insured Persons and Individually Insured Persons (excluding exempted contributors) over the preceding three years. The Minister of Health and Welfare announces these limits by the end of March each year, which are then applied from July for a year. The actual and assumed future values of the standard monthly income used in this paper are

detailed in Figure A2 in the Appendix.

Next, the A value (fixed portion) in equation (6) is the average standard monthly income of all participants over the three years preceding the pension receipt. For example, the A value applied from April 2020 is the average of the standard monthly incomes of all participants from 2017 to 2019, adjusted to 2020 present value by reflecting the national consumer price index as reported by Statistics Korea. Therefore, the A value incorporates inflation and wage growth rates. The projected A values beyond the survey period reflect the same assumptions about real interest and real wage growth rates used in estimating lifetime income.

The B value (income-proportional portion) represents the average of each participant's annual average standard monthly income during their contribution period, re-evaluated to present value. Hence, the B value is proportional to the participant's past labor income. This structure ensures that the National Pension integrates an income redistribution function within the system, as it considers both the average income of all participants (A value) and the individual participant's average income during their contribution period (B value).

Following the 1998 National Pension Reform, the weightings of the A and B values were adjusted, shifting from a 4:3 ratio to a 1:1 ratio, thereby reducing the redistributive function of pension benefits. The actuarial proportional constant, which reflects the income replacement rate specified by the National Pension Act, was also adjusted. Initially, the pension system aimed to guarantee 70% of the average lifetime income for a 40-year average income contributor. However, reforms in 1998 and 2007 reduced the income replacement rate to 60% and then to 50%, respectively. Since 2009, this rate has been incrementally reduced by 0.5% annually, aiming for a 40% replacement rate by 2028.

The contribution period also affects the pension benefit level. As shown in equation (6), a contribution period of 20 years allows for full pension benefits. For periods between 10 and 20 years, the pension benefit amount is incrementally increased by 5% per additional year beyond the 10-year minimum. Contributions beyond 20 years result in higher pension benefits.

Using equation (6), we calculate each participant's annual pension benefit amount at the start of pension receipt. We then apply equation (7) to estimate the present value of each participant's lifetime pension benefits, considering their remaining life expectancy based on the 2021 life tables by gender and cohort published by Statistics Korea in December 2022.

For this analysis, only the participant's old-age pension is considered, excluding

survivor pensions, aligning with the scope of the National Pension Research Institute.

$$P_{i,PBB} = \frac{[2.4 \cdot p_1(A + 0.75B) + 1.8 \cdot p_2(A + B) + 1.5 \cdot p_3(A + B) + \alpha \cdot p_4(A + B)]}{P} \cdot \left(1 + \frac{0.05n}{12}\right) \quad (6)$$

$P_{i,PBB}$: The monthly pension benefits for participant i at the commencement of pension receipt (Pension Benefits Begin: PBB), P : Total contribution period (months),

A : Average of the standard monthly income of all participants for the three years preceding pension receipt (flat-rate component), B : Average of the standard monthly income during participant i 's contribution period (earnings-related component),

p_1 : Contribution period from 1988 to December 31, 1998 (months), p_2 : Contribution period from 1999 to 2007 (months), p_3 : Contribution period in 2008 (months), p_4 : Contribution period from 2009 onwards (months), α : Actuarial proportional constant (Earnings replacement rate coefficient), n : Years exceeding 20 years of contributions

$$P_i = \sum_{t=R}^D P_{i,PBB} \cdot \frac{\prod_{j=R}^t (1 + p_j)}{\prod_{j=h+1}^t (1 + r_j)} \quad (7)$$

P_i : The lifetime monthly pension benefits of participant i , p_j : Inflation rate in year j ,

D : Year of death

3.2.3 Lifetime Pension Contributions

The calculation formula for each participant's lifetime pension contributions involves multiplying the standard monthly income of each year by the contribution rates and then discounting this amount to present value as of the base year, 2020. For convenience in discounting to the base year, the formula is divided into two parts: one for the period from the first year of pension enrollment (k) to 2020 (h), and another for the period from 2021 ($h + 1$) to the year before retirement ($R - 1$).

As illustrated in Figure 2.5, "Types of National Pension Enrollment," regular employees enrolled through workplaces share the contribution costs equally with their employers, while self-employed individuals and irregular workers who are regional enrollees bear the full cost themselves. Therefore, there are separate formulas: equation (8) for regular employees and equation (9) for self-employed and irregular workers.

- For Workplace-based Insured Persons (事業場加入者):

$$C_i = \left[\sum_{t=k}^h c_t \cdot SMI_{i,t} \cdot \prod_{j=t}^h (1 + r_j) + \sum_{t=h+1}^{R-1} c_t \cdot SMI_{i,t} \cdot ES_i \cdot \prod_{j=h+1}^t \frac{(1 + \pi_j)}{(1 + r_j)} \right] \cdot \frac{1}{2} \quad (8)$$

- For Individually Insured Persons (地域加入者):

$$C_i = \sum_{t=k}^h c_t \cdot SMI_{i,t} \cdot \prod_{j=t}^h (1 + r_j) + \sum_{t=h+1}^{R-1} c_t \cdot SMI_{i,t} \cdot ES_i \cdot \prod_{j=h+1}^t \frac{(1 + \pi_j)}{(1 + r_j)} \quad (9)$$

C_i : The lifetime monthly contribution for participant i , c_t : The national pension contribution rate in year t , ES_i : The employment status of participant i (employed = 1, not employed = 0), $SMI_{i,t}$: The standard monthly income of participant i in year t

3.2.4 Income Redistribution Index

In this study, to assess the income redistributive effect of the proposed 5th National Pension Reform Plan, we use the Mean Log Deviation (MLD).

Firstly, the Mean Log Deviation (MLD) can be defined as a measure that reflects the characteristic of household income generally following a log-normal distribution. It is calculated as the mean of the deviations of the natural logarithms of incomes. The MLD reaches its minimum value of 0 when income distribution is perfectly equal. This measure is linear, making it suitable for decomposing income inequality into contributing factors, and it is particularly sensitive to changes in the lower tail of the income distribution compared to other inequality indices.

To examine the income redistributive effect, we decompose the MLD as shown in equation (10) to identify the contributions of intergenerational income disparity changes (intergenerational income redistributive effect) and intragenerational income disparity changes (intragenerational income redistributive effect). Further, within the intragenerational income redistributive effect, we decompose the MLD by income classes within each generation group to pinpoint the effects more precisely. Specifically, as illustrated in equation (11), the intragenerational income redistributive effect consists of the contributions from changes in income disparity between income classes (inter-class income redistributive effect) and changes in income disparity within income classes (intra-class income redistributive effect).

Finally, the comprehensive income redistributive effect, combining the elements from equations (10) and (11), is represented in equation (12).

This analytical approach allows us to clearly differentiate and quantify the impacts of income redistribution both across and within generations, providing a detailed understanding of the proposed reform's effectiveness in addressing income inequality.

$$\begin{aligned}
MLD &= \frac{1}{N} \sum_{i=1}^m \sum_{j=1}^{N_i} \ln \left(\frac{\bar{y}}{y_{ij}} \right) \\
&= \sum_{i=1}^m \frac{N_i}{N} \ln \left(\frac{\bar{y}}{y_i} \right) + \sum_{i=1}^m \frac{N_i}{N} \left[\frac{1}{N_i} \sum_{j=1}^{N_i} \ln \left(\frac{y_i}{y_{ij}} \right) \right] \\
&= \sum_{i=1}^m \frac{N_i}{N} \ln \left(\frac{\bar{y}}{y_i} \right) + \sum_{i=1}^m \frac{N_i}{N} MLD_i \quad (10)
\end{aligned}$$

$$\begin{aligned}
MLD_i &= \frac{1}{N_i} \sum_{k=1}^n \sum_{l=1}^{N_{ik}} \ln \left(\frac{\bar{y}_l}{y_{ikl}} \right) \\
&= \sum_{k=1}^n \frac{N_{ik}}{N_i} \ln \left(\frac{\bar{y}_l}{y_{ik}} \right) + \sum_{k=1}^n \frac{N_{ik}}{N_i} \left[\frac{1}{N_{ik}} \sum_{j=1}^{N_{ik}} \ln \left(\frac{y_{ik}}{y_{ikl}} \right) \right] \\
&= \sum_{k=1}^n \frac{N_{ik}}{N_i} \ln \left(\frac{\bar{y}_l}{y_{ik}} \right) + \sum_{k=1}^n \frac{N_{ik}}{N_i} MLD_{ik} \quad (11)
\end{aligned}$$

$$MLD = \sum_{i=1}^m \frac{N_i}{N} \ln \left(\frac{\bar{y}}{y_i} \right) + \sum_{i=1}^m \frac{N_i}{N} \left\{ \sum_{k=1}^n \frac{N_{ik}}{N_i} \ln \left(\frac{\bar{y}_l}{y_{ik}} \right) + \sum_{k=1}^n \frac{N_{ik}}{N_i} MLD_{ik} \right\} \quad (12)$$

n : The number of income quintile groups ($n = 5$; first quintile group, second quintile group, third quintile group, fourth quintile group, fifth quintile group),

N_{ik} : The number of participants belonging to income quintile group k ($k = 1$ (first quintile group), 2(second quintile group), 3(third quintile group), 4(fourth quintile group), 5(fifth quintile group)) in generation group i ($i = 1$ (Born in the 1960s), 2(Born in the 1970s), 3(Born in the 1980s), 4(Born in the 1990s)), N_i : The total number of participants in generation group i ($i = 1, 2, 3, 4$), y_{ikl} : The net transfer amount for participant l belonging to income quintile group k ($k = 1, 2, 3, 4, 5$) in generation group i ($i = 1, 2, 3, 4$),

y_{ik} : The average net transfer amount for income quintile group k ($k = 1,2,3,4,5$) in generation group i ($i = 1,2,3,4$), \bar{y}_i : The average net transfer amount for the entire sample of generation group i ($i = 1,2,3,4$)

3.2.4 Income Redistribution Index

In this study, to measure the income redistributive effects of the current National Pension System and various reform proposals, we calculate the Mean Log Deviation (MLD) based on each participant's net transfer amount. The net transfer amount used in this study is defined, as shown in equation (13), as the difference between each participant's lifetime pension benefits calculated from equation (7) and their lifetime contributions calculated from equations (8) and (9).

$$\text{Net Transfer Amount} = \text{Lifetime Pension Benefits } (P_i) - \text{Lifetime Contributions } (C_i) \quad (13)$$

4 Analysis Results

4.1 Case assuming all National Pension participants contribute for 20 years

This paper compares the Mean Log Deviation (MLD) for income redistribution under the current National Pension System with the MLD under six proposed reforms outlined in Figure 2.7, "Contents of the 5th National Pension Reform Plan used in This Paper" to measure the effects of income redistribution.

Figure 4.1 breaks down the income redistributive effects of each reform into intergenerational and intragenerational effects, showing the respective values. For intragenerational effects, as introduced in equation (11), the analysis is further divided into effects between income strata and within income strata. The "Difference from the Current System" column in Figure 4.1 indicates how much each reform improves (positive values) or worsens (negative values) income redistribution compared to the current system.

Upon examining the results, assuming that all participants have contributed to the National Pension for 20 years, the 5th National Pension Reform Plan generally improves income redistribution across all employment types compared to the current system. Specifically, reforms that include raising the pensionable age (Reform Plans 5 and 6) show significant improvements in income redistribution, largely due to better intergenerational income redistributive effects.

When analyzing by generation, all reforms improve intragenerational income redistribution for younger cohorts (those born in the 1980s and 1990s), while worsening it for middle-aged cohorts (those born in the 1960s and 1970s).

Further, when analyzing by gender (Figure A9 in the Appendix), for male regular employees who are Workplace-based Insured Persons, the reforms that raise the pensionable age (Reform Plans 5 and 6) result in worse income redistribution compared to the current system. Similarly, for male self-employed and non-regular employees who are Individually Insured Persons, Reform Plan 6, which includes raising the pensionable age, also results in worse income redistribution.

Conversely, for female regular employees who are Workplace-based Insured Persons and female self-employed and non-regular employees who are Individually Insured Persons, all reform plans show an improvement in income redistributive effects.

Figure 4.1 Income Redistributive Effects of the 5th National Pension Reform Plan
Based on Mean Log Deviation (MLD)
(Case assuming all National Pension participants contribute for 20 years)

		Absence of NPS	The Current NPS	Difference from the Current System						
				Proposal 1	Proposal 2	Proposal 3	Proposal 4	Proposal 5	Proposal 6	
Workplace-based Insured Persons	Intergenerational Effect	0.00160019	0.00293970	0.00052390	0.00079429	0.00084680	0.00077277	0.00251903	0.00242297	
	Intragenerational Effect	0.09428879	0.00651700	0.00025057	0.00035747	0.00037800	0.00020480	0.00041966	0.00013364	
	Born in the 1960s	0.00440052	0.00014886	▲ 0.00000196	▲ 0.00000196	▲ 0.00000196	▲ 0.00000331	▲ 0.00000196	▲ 0.00000331	
	Inter: Income Class Effect	0.00390502	0.00006833	▲ 0.00000116	▲ 0.00000116	▲ 0.00000116	▲ 0.00000194	▲ 0.00000116	▲ 0.00000194	
	Intra: Income Class Effect	0.00049550	0.00080852	▲ 0.00000080	▲ 0.00000080	▲ 0.00000080	▲ 0.00000137	▲ 0.00000080	▲ 0.00000137	
	1st Quintile Group	-0.00164085	-0.00027645	0.00000219	0.00000219	0.00000219	0.00000365	0.00000219	0.00000365	
	2nd Quintile Group	-0.00245919	-0.00029426	0.00000505	0.00000505	0.00000505	0.00000841	0.00000505	0.00000841	
	3rd Quintile Group	-0.00071986	0.00019171	▲ 0.00000074	▲ 0.00000074	▲ 0.00000074	▲ 0.00000124	▲ 0.00000074	▲ 0.00000124	
	4th Quintile Group	0.00146856	0.00031762	▲ 0.00000366	▲ 0.00000366	▲ 0.00000366	▲ 0.00000612	▲ 0.00000366	▲ 0.00000612	
	5th Quintile Group	0.00384684	0.00014190	▲ 0.00000364	▲ 0.00000364	▲ 0.00000364	▲ 0.00000607	▲ 0.00000364	▲ 0.00000607	
	Born in the 1970s	0.04475081	0.00209380	▲ 0.00004735	▲ 0.00006838	▲ 0.00007009	▲ 0.00015419	▲ 0.00025429	▲ 0.00041056	
	Inter: Income Class Effect	0.04061230	0.00083587	▲ 0.00011781	▲ 0.00016451	▲ 0.00016915	▲ 0.00027953	▲ 0.00022194	▲ 0.00034976	
	Intra: Income Class Effect	0.00413852	0.00125794	0.00007046	0.00009613	0.00009906	0.00012541	▲ 0.00003234	▲ 0.00006080	
	1st Quintile Group	-0.03230555	-0.00509015	0.00041498	0.00048077	0.00049583	0.00078070	0.00045581	0.00075301	
	2nd Quintile Group	-0.02217965	-0.00258727	0.00037645	0.00049335	0.00050128	0.00080708	0.00078180	0.00110383	
	3rd Quintile Group	-0.00340992	0.00196330	0.00006978	0.00006782	0.00006721	0.00010665	0.00055596	0.00058902	
	4th Quintile Group	0.01959034	0.00354400	▲ 0.00028300	▲ 0.00038049	▲ 0.00038828	▲ 0.00063258	▲ 0.00039107	▲ 0.00066833	
	5th Quintile Group	0.04247429	0.00342805	▲ 0.00041475	▲ 0.00056533	▲ 0.00057698	▲ 0.00093643	▲ 0.00143485	▲ 0.00183834	
	Born in the 1980s	0.03707093	0.00311778	0.00021428	0.00027276	0.00027660	0.00044343	0.00031504	0.00031504	
	Inter: Income Class Effect	0.03290713	0.00074245	▲ 0.00007187	▲ 0.00013974	▲ 0.00015733	▲ 0.00027708	▲ 0.00007988	▲ 0.00021731	
	Intra: Income Class Effect	0.00416380	0.00237533	0.00028616	0.00041250	0.00043393	0.00046587	0.00054532	0.00053236	
	1st Quintile Group	-0.04359013	-0.00714487	0.00034951	0.00065571	0.00073213	0.00124057	0.00033646	0.00092723	
	2nd Quintile Group	-0.01863288	-0.00125195	0.00034585	0.00058811	0.00064120	0.00091046	0.00061259	0.00093935	
	3rd Quintile Group	0.00051591	0.00196088	0.00013408	0.00017549	0.00018012	0.00012184	0.00036372	0.00029348	
	4th Quintile Group	0.01946176	0.00387013	▲ 0.00013802	▲ 0.00029061	▲ 0.00033100	▲ 0.00061101	▲ 0.00018085	▲ 0.00052239	
	5th Quintile Group	0.04640914	0.00494115	▲ 0.00040527	▲ 0.00071620	▲ 0.00078852	▲ 0.00119597	▲ 0.00060661	▲ 0.00110532	
	Born in the 1990s	0.00806653	0.00115655	0.00008559	0.00015504	0.00017345	0.00017345	0.00023247	0.00023247	
	Inter: Income Class Effect	0.00641583	0.00014570	0.00001858	0.00002088	0.00001849	0.00001849	0.00004455	0.00004455	
	Intra: Income Class Effect	0.00165070	0.00101085	0.00006701	0.00013416	0.00015496	0.00015496	0.00018792	0.00018792	
	1st Quintile Group	-0.01280589	-0.00170672	▲ 0.00013074	▲ 0.00014681	▲ 0.00012428	▲ 0.00012428	▲ 0.00032372	▲ 0.00032372	
	2nd Quintile Group	-0.00567492	-0.00055760	▲ 0.00004433	▲ 0.00002389	▲ 0.00000065	▲ 0.00000065	▲ 0.00010054	▲ 0.00010054	
	3rd Quintile Group	-0.00071140	-0.00014252	0.00000832	0.00002293	0.00002261	0.00002261	0.00001372	0.00001372	
	4th Quintile Group	0.00483566	0.00073852	0.00007440	0.00009500	0.00008327	0.00008327	0.00017667	0.00017667	
	5th Quintile Group	0.01600726	0.00267917	0.00015936	0.00018693	0.00017403	0.00017403	0.00042180	0.00042180	
	Income Redistribution Effect	0.09588899	0.00945669	0.00077447	0.00115175	0.00122480	0.00097757	0.00293868	0.00255661	
	Individually Insured Persons	Intergenerational Effect	0.00814005	0.00285813	0.00050872	0.00076861	0.00081140	0.00073035	0.00222171	0.00217578
		Intragenerational Effect	0.17431980	0.00503482	0.00037804	0.00047442	0.00048145	0.00041330	0.00074316	0.00013107
		Born in the 1970s	0.04735664	0.00117451	▲ 0.00009687	▲ 0.00014615	▲ 0.00014958	▲ 0.00027956	▲ 0.00021694	▲ 0.00040542
		Inter: Income Class Effect	0.04003910	0.00058384	▲ 0.00001340	▲ 0.00003019	▲ 0.00003162	▲ 0.00004980	▲ 0.00001594	▲ 0.00005201
		Intra: Income Class Effect	0.00732053	0.00059062	▲ 0.00008627	▲ 0.00011596	▲ 0.00011796	▲ 0.00022977	▲ 0.00020100	▲ 0.00035341
		1st Quintile Group	-0.03742322	-0.00399499	▲ 0.00010150	▲ 0.00009159	▲ 0.00008670	▲ 0.00016931	▲ 0.00005543	▲ 0.00102259
		2nd Quintile Group	-0.01434611	-0.00208292	0.00006051	0.00010216	0.00010218	0.00015898	0.00034037	0.00043558
		3rd Quintile Group	0.00208520	-0.00011334	0.00014538	0.00020676	0.00021104	0.00033298	0.00005672	0.00110238
		4th Quintile Group	0.01473004	0.00164098	▲ 0.00003500	▲ 0.00007398	▲ 0.00007768	▲ 0.00012312	▲ 0.00034111	▲ 0.00045010
		5th Quintile Group	0.04227462	0.00514089	▲ 0.00015567	▲ 0.00025931	▲ 0.00026680	▲ 0.00042929	▲ 0.00020155	▲ 0.00041867
		Born in the 1980s	0.09583730	0.00283731	0.00029492	0.00034709	0.00034236	0.00040419	0.00060300	0.00017940
		Inter: Income Class Effect	0.08162196	0.00116223	0.00022112	0.00028320	0.00028462	0.00034380	0.00060025	0.00063810
Intra: Income Class Effect		0.01421534	0.00167509	0.00007380	0.00006389	0.00005774	▲ 0.00023961	0.00000276	▲ 0.00045871	
1st Quintile Group		-0.07158814	-0.00853962	▲ 0.00079182	▲ 0.00106084	▲ 0.00107571	▲ 0.00136505	▲ 0.00257115	▲ 0.00290885	
2nd Quintile Group		-0.02767670	-0.00229280	▲ 0.00045187	▲ 0.00053203	▲ 0.00050627	▲ 0.00072009	▲ 0.00147205	▲ 0.00167653	
3rd Quintile Group		0.00475267	0.00068919	▲ 0.00016394	▲ 0.00020154	▲ 0.00021932	▲ 0.00036248	▲ 0.00152145	▲ 0.00177721	
4th Quintile Group		0.02942181	0.00352759	0.00037428	0.00043726	0.00042738	0.00049531	0.00151321	0.00161644	
5th Quintile Group		0.07930571	0.00892597	0.00110715	0.00142104	0.00143166	0.00171270	0.00405420	0.00428744	
Born in the 1990s		0.03112286	0.00102299	0.00018279	0.00027348	0.00028868	0.00028868	0.00035709	0.00035709	
Inter: Income Class Effect		0.02423277	0.00027522	0.00013199	0.00018124	0.00018676	0.00018676	0.00021559	0.00021559	
Intra: Income Class Effect		0.00689009	0.00074778	0.00005080	0.00009225	0.00010191	0.00010191	0.00014150	0.00014150	
1st Quintile Group		-0.01962108	-0.00179317	▲ 0.00050483	▲ 0.00075838	▲ 0.00079259	▲ 0.00079259	▲ 0.00153547	▲ 0.00153547	
2nd Quintile Group		-0.00698580	-0.00051894	▲ 0.00027450	▲ 0.00040662	▲ 0.00041587	▲ 0.00041587	▲ 0.00078541	▲ 0.00078541	
3rd Quintile Group		-0.00071129	-0.00064670	▲ 0.00020707	▲ 0.00033481	▲ 0.00037722	▲ 0.00037722	▲ 0.00070888	▲ 0.00070888	
4th Quintile Group		0.01010798	0.00112770	0.00019084	0.00028354	0.00030274	0.00030274	0.00045977	0.00045977	
5th Quintile Group		0.02410028	0.00257889	0.00084635	0.00130852	0.00138485	0.00138485	0.00270948	0.00270948	
Income Redistribution Effect		0.18245985	0.00789295	0.00089676	0.00124303	0.00129285	0.00084365	0.00296487	0.00230685	

Source: Author's calculations from the KLIPS data.

Notes: The age classification for Reform Plan 4 is based on the participants' age as of 2025. Self-employed individuals and non-regular workers classified under regional members, particularly those born in the 1960s, are excluded from the analysis due to insufficient sample size. The Mean Log Deviation (MLD) in the absence of a pension system is calculated based on each member's lifetime labor income.

4.2 Case reflecting differences in contribution periods and life expectancy across income class

This paper incorporates individual heterogeneity among National Pension participants by estimating future child numbers and employment status for each participant. Additionally, we account for disparities in contribution periods and life expectancy across income quintiles.

First, using data from the final report "In-Depth Analysis of Multi-Layered Old Age Income Security System Using Administrative Data²⁰" submitted by the Seoul National University Industry-Academic Cooperation Foundation to the Ministry of Health and Welfare in November 2021, we reflect different contribution periods across income quintiles. Specifically, we assume contribution periods of 10 years for the first quintile, 12 years for the second quintile, 14 years for the third quintile, 16 years for the fourth quintile, and 20 years for the fifth quintile.

Figure 4.2 Average Contribution Period (months) for Cases with National Pension Participation History

	Overall	Gender		Income Quintile Group				
		Male	Female	1st	2nd	3rd	4th	5th
Ages 15-24	13.51	11.34	15.67	6.48	10.55	15.53	16.34	13.87
Ages 25-29	33.95	28.64	40.03	17.79	24.24	33.84	38.91	37.97
Ages 30-34	67.66	63.42	73.47	37.05	49.47	65.91	73.87	78.4
Ages 35-39	105.16	106.53	103.05	56.6	78.03	103.7	117.72	125.23
Ages 40-44	134.63	144.38	120.74	74.8	99.87	130.63	151.48	167.55
Ages 45-49	158.07	181.61	127.43	91.33	121.88	151.15	175.36	201.48
Ages 50-54	170.9	212.21	123.11	107.36	134.02	158.21	182.82	220.87
Ages 55-59	175.68	228.41	116	122.86	143.53	162.61	186.6	233.56

Source: Compiled by the author based on Table III-18, "Average Contribution Period (months) for Cases with National Pension Participation History," p.48 from Koo et al. (2021) "In-Depth Analysis of the Multi-Layered Retirement Income Security System Using Administrative Data"

²⁰ The data on "Average Contribution Period (months) for Cases with National Pension Participation History" used in this paper is compiled based on materials related to the National Pension from the National Pension Corporation (NPS) under the Ministry of Health and Welfare, income and taxation information, as well as labor and child-rearing incentive tax system-related materials from the National Tax Service, and demographic information (gender, age, region), along with household information, from the Social Security Committee under the Ministry of Public Administration and Security, as provided by Koo et al. (2021).

Simultaneously, we utilize the 2017 life expectancy data by income quintile presented by Khang et al. (2019), based on the National Health Insurance Service database from 2004 to 2017. For convenience, we use rounded values from Khang et al. (2019) for calculating annual pension benefits and contributions.

Figure 4.3 Disparities in Life Expectancy by Income Class (2017)

Gender	Income Quintile Group	Average life expectancy by income quintile (Khang et al., 2019)	Assumed values in this paper
Male	1st quintile group	75.31	75
	2nd quintile group	79.81	80
	3rd quintile group	80.81	81
	4th quintile group	81.81	82
	5th quintile group	83.22	83
Female	1st quintile group	83.38	83
	2nd quintile group	86.12	86
	3rd quintile group	86.22	86
	4th quintile group	86.71	87
	5th quintile group	87.72	88

Source: Compiled by the author based on Figure 3, "Trends in life expectancy by income in (A) women and (B) men in Korea and projections to 2030," from Khang et al. (2019) "Trends in Inequality in Life Expectancy at Birth between 2004 and 2017 and Projections for 2030 in Korea."

Incorporating these disparities in contribution periods and life expectancy by income quintile, we summarize the results of our analysis using Mean Log Deviation (MLD) in Figure 4.4, similar to Figure 4.1. The results indicate that the income redistributive effects of the 5th National Pension Reform Plan differ from the results before reflecting income quintile disparities. Specifically, while the proposals for increasing the contribution rate (Reform Plans 1, 2, and 3) and modifying the contribution rate increase pace (Reform Plan 4) continue to improve income redistribution, the proposals for raising the pensionable age (Reform Plans 5 and 6) show a deterioration in income redistribution, unlike the results before accounting for income quintile disparities. This outcome is attributed to the worsening intragenerational income redistribution outweighing the improvements in intergenerational income redistribution, leading to a deterioration in intragenerational income redistribution across all generations. Furthermore, compared to the analysis

results before reflecting income quintile disparities, overall income inequality, as measured by MLD, has increased under the current system and all reform plans.

When analyzed by generation, all reform plans worsen intragenerational income redistribution for the middle-aged cohorts (born in the 1960s and 1970s). Meanwhile, the proposals to raise the pensionable age (Reform Plans 5 and 6) also deteriorate intragenerational income redistribution for the younger cohorts (born in the 1980s and 1990s), differing from the results before accounting for income quintile disparities. Thus, the proposals to raise the pensionable age (Reform Plans 5 and 6) exacerbate intragenerational income redistribution for all generations.

Next, when analyzed by gender (Figure A9 in the Appendix), for male regular employees who are Workplace-based Insured Persons, the proposals to raise the pensionable age (Reform Plans 5 and 6), along with the proposal to increase the contribution rate (Reform Plan 1 only) and the proposal to modify the contribution rate increase pace (Reform Plan 4), worsen income redistribution compared to the current system. This deterioration in income redistribution, due to the proposal to increase the contribution rate (Reform Plan 1 only) and the proposal to modify the contribution rate increase pace (Reform Plan 4), is attributed to the worsening intragenerational income redistribution for the middle-aged cohorts (born in the 1960s and 1970s). For male self-employed and non-regular employees who are Individually Insured Persons, the proposals to raise the pensionable age (Reform Plans 5 and 6) worsen income redistribution, consistent with the overall analysis of Individually Insured Persons. Conversely, for female regular employees who are Workplace-based Insured Persons and female self-employed and non-regular employees who are Individually Insured Persons, all reform plans improve income redistribution, with the proposals to raise the pensionable age (Reform Plans 5 and 6) showing the most significant improvement.

From these analysis results, it is evident that when considering disparities in pension contribution periods and life expectancy by income quintile, the proposals to raise the pensionable age (Reform Plans 5 and 6) have the potential to worsen income redistribution for both Workplace-based Insured Persons and Individually Insured Persons. Under the current system, where over 95% of the income inequality, as indicated by MLD, is due to intragenerational income inequality, raising the pensionable age significantly worsens intragenerational income redistribution for male participants and slightly worsens it for female Workplace-based Insured Persons. This exacerbates overall income inequality, leading to a deterioration in overall income redistribution.

Figure 4.4 Income Redistributive Effects of the 5th National Pension Reform Plan
 Based on Mean Log Deviation (MLD)
 (Case reflecting differences in contribution periods and life expectancy
 across income quintiles)

		Absence of NPS	The Current NPS	Difference from the Current System						
				Proposal 1	Proposal 2	Proposal 3	Proposal 4	Proposal 5	Proposal 6	
Workplace-based Insured Persons	Intergenerational Effect	0.00477780	0.00259180	0.00038460	0.00049176	0.00050318	0.00048904	0.00249645	0.00248040	
	Intragenerational Effect	0.12368756	0.19969447	0.00008418	0.00081312	0.00089565	0.00020906	▲ 0.02210077	▲ 0.02310780	
	Born in the 1960s	0.01232903	0.00939895	▲ 0.00007818	▲ 0.00007818	▲ 0.00007818	▲ 0.0013187	▲ 0.00007818	▲ 0.0013187	
	Intra-Income Class Effect	0.01099840	0.00944917	▲ 0.00007207	▲ 0.00007207	▲ 0.00007207	▲ 0.0012065	▲ 0.00007207	▲ 0.0012065	
	Intra-Income Class Effect	0.00133063	-0.0005022	▲ 0.00000611	▲ 0.00000611	▲ 0.00000611	▲ 0.00001122	▲ 0.00000611	▲ 0.0001122	
	1st Quintile Group	-0.00494473	-0.00580417	0.00002545	0.00002545	0.00002545	0.00004248	0.00002545	0.00004248	
	2nd Quintile Group	-0.00417287	-0.00444890	0.00003077	0.00003077	0.00003077	0.00005136	0.00003077	0.00005136	
	3rd Quintile Group	-0.00025261	0.00013543	▲ 0.00001272	▲ 0.00001272	▲ 0.00001272	▲ 0.00002152	▲ 0.00001272	▲ 0.00002152	
	4th Quintile Group	0.00254812	0.00357066	▲ 0.00002520	▲ 0.00002520	▲ 0.00002520	▲ 0.00004244	▲ 0.00002520	▲ 0.00004244	
	5th Quintile Group	0.00815273	0.00649676	▲ 0.00002441	▲ 0.00002441	▲ 0.00002441	▲ 0.00004111	▲ 0.00002441	▲ 0.00004111	
	Born in the 1970s	0.07065293	0.08099264	▲ 0.00076742	▲ 0.00074431	▲ 0.00074376	▲ 0.00127539	▲ 0.00417365	▲ 0.00481354	
	Intra-Income Class Effect	0.06396100	0.07831183	▲ 0.00078320	▲ 0.00076618	▲ 0.00076572	▲ 0.00128598	▲ 0.00390844	▲ 0.00450437	
	Intra-Income Class Effect	0.00669193	0.00268081	0.00001579	0.00002186	0.00002196	0.00001058	▲ 0.00026521	▲ 0.00030917	
	1st Quintile Group	-0.04241038	-0.04868109	0.00024629	0.00023389	0.00023360	0.00038966	0.00036018	0.00052768	
	2nd Quintile Group	-0.02722656	-0.04210451	0.00036884	0.00037726	0.00037724	0.00062691	0.00215125	0.00243389	
	3rd Quintile Group	-0.00215003	0.00212884	▲ 0.00006042	▲ 0.00005532	▲ 0.00005522	▲ 0.00009953	0.00048221	0.00042379	
	4th Quintile Group	0.02431903	0.03529212	▲ 0.00023141	▲ 0.00022736	▲ 0.00022720	▲ 0.00038720	▲ 0.00094204	▲ 0.0113064	
	5th Quintile Group	0.05415988	0.05604545	▲ 0.00030751	▲ 0.00030660	▲ 0.00030646	▲ 0.00051926	▲ 0.00231681	▲ 0.00256389	
	Born in the 1980s	0.03343109	0.07758694	0.00035173	0.00059804	0.00061406	0.00051279	▲ 0.01399410	▲ 0.01430755	
	Intra-Income Class Effect	0.02967611	0.07430119	0.00014051	0.00034612	0.00036019	0.00022272	▲ 0.01417734	▲ 0.01447728	
	Intra-Income Class Effect	0.00375497	0.00328575	0.00021123	0.00025192	0.00025387	0.00029008	0.00018324	0.00016973	
	1st Quintile Group	-0.03931020	-0.06658633	0.00003982	▲ 0.00002518	▲ 0.00002868	0.00010226	0.00060707	0.00681590	
	2nd Quintile Group	-0.01680339	-0.03526441	0.00005376	0.00001072	0.00000720	0.00005465	0.00520232	0.00531399	
	3rd Quintile Group	0.00046525	0.00753637	▲ 0.00007667	▲ 0.00009809	▲ 0.00010144	▲ 0.00017415	▲ 0.00256788	▲ 0.00269770	
	4th Quintile Group	0.01755089	0.03796782	▲ 0.00006478	▲ 0.00005030	▲ 0.00005116	▲ 0.00014853	▲ 0.00429315	▲ 0.00445982	
	5th Quintile Group	0.04185242	0.05963231	0.00025909	0.00041477	0.00042795	0.00045585	▲ 0.00478379	▲ 0.00480265	
	Born in the 1990s	0.00727451	0.03171594	0.00057805	0.00103757	0.00110352	0.00085484	▲ 0.00385484	▲ 0.00385484	
	Intra-Income Class Effect	0.00578589	0.02996781	0.00048055	0.00090540	0.00096609	0.00096609	▲ 0.00404644	▲ 0.00404644	
	Intra-Income Class Effect	0.00148863	0.00174814	0.00009750	0.00013218	0.00013743	0.00013743	0.00019160	0.00019160	
	1st Quintile Group	-0.01154853	-0.03304805	▲ 0.00013732	▲ 0.00029038	▲ 0.00030429	▲ 0.00030429	0.00035016	0.0035016	
	2nd Quintile Group	-0.00511773	-0.01188351	▲ 0.00012283	▲ 0.00024852	▲ 0.00026408	▲ 0.00026408	▲ 0.00038613	▲ 0.00008613	
	3rd Quintile Group	-0.00064155	0.00359801	▲ 0.00005444	▲ 0.00012430	▲ 0.00013919	▲ 0.00013919	▲ 0.00113860	▲ 0.00113860	
	4th Quintile Group	0.00436086	0.01660590	0.00002337	0.00003755	0.00002472	0.00002472	▲ 0.00144503	▲ 0.00144503	
	5th Quintile Group	0.01435558	0.02647579	0.00040871	0.00075782	0.00082027	0.00082027	▲ 0.00066881	▲ 0.00066881	
	Income Redistribution Effect	0.12846536	0.20228627	0.00046879	0.00130488	0.00139882	0.00069810	▲ 0.00164332	▲ 0.00262740	
	Individually Insured Persons	Intergenerational Effect	0.02622996	0.00478982	0.00059586	0.00079581	0.00081346	0.00083544	▲ 0.00393877	0.00398535
		Intragenerational Effect	0.18186499	0.19982290	0.0032906	0.00503980	0.00520160	0.00569645	▲ 0.01088618	▲ 0.01040251
		Born in the 1960s	0.00183385	0.00817112	▲ 0.00013693	▲ 0.00013693	▲ 0.00013693	▲ 0.00023259	▲ 0.00013693	▲ 0.00023259
		Intra-Income Class Effect	0.00169449	0.00537913	▲ 0.00010011	▲ 0.00010011	▲ 0.00010011	▲ 0.00016877	▲ 0.00010011	▲ 0.00016877
		Intra-Income Class Effect	0.00013936	0.00279200	▲ 0.00003681	▲ 0.00003681	▲ 0.00003681	▲ 0.00006382	▲ 0.00003681	▲ 0.00006382
		1st Quintile Group	-0.00167480	-0.00110739	0.00000290	0.00000290	0.00000290	0.00000480	0.00000290	0.00000480
		2nd Quintile Group	-0.00054963	0.00005065	0.00001672	0.00001672	0.00001672	0.00002814	0.00001672	0.00002814
		3rd Quintile Group	0.00017705	0.00029931	0.00002499	0.00002499	0.00002499	0.00004201	0.00002499	0.00004201
		4th Quintile Group	0.00028330	-0.00025074	▲ 0.00001968	▲ 0.00001968	▲ 0.00001968	▲ 0.00003413	▲ 0.00001968	▲ 0.00003413
		5th Quintile Group	0.00190342	0.00380017	▲ 0.00006175	▲ 0.00006175	▲ 0.00006175	▲ 0.00010464	▲ 0.00006175	▲ 0.00010464
		Born in the 1970s	0.06936274	0.07424611	▲ 0.00032185	▲ 0.00022119	▲ 0.00021546	▲ 0.00042923	▲ 0.00076043	▲ 0.00099427
		Intra-Income Class Effect	0.06053792	0.06993413	▲ 0.00003956	0.00006966	0.00007558	▲ 0.00010584	▲ 0.00155057	▲ 0.00156879
Intra-Income Class Effect		0.00882482	0.00431198	▲ 0.00028229	▲ 0.00029085	▲ 0.00029104	▲ 0.00053507	0.00079013	0.00057452	
1st Quintile Group		-0.04728284	-0.05441336	▲ 0.00007813	▲ 0.00014897	▲ 0.00015190	▲ 0.00025117	▲ 0.00041544	▲ 0.00049368	
2nd Quintile Group		-0.02071644	-0.02773737	0.00005252	0.00003738	0.00003504	0.00005858	▲ 0.00019174	▲ 0.00039546	
3rd Quintile Group		0.00290585	0.00404028	▲ 0.00005922	▲ 0.00005064	▲ 0.00005106	▲ 0.00009504	0.00591772	▲ 0.00586051	
4th Quintile Group		0.02409390	0.02925458	▲ 0.00005237	▲ 0.00005058	▲ 0.00000076	▲ 0.00002605	0.00052991	0.00081668	
5th Quintile Group		0.04982435	0.05316784	▲ 0.00014515	▲ 0.00012354	▲ 0.00012236	▲ 0.00022139	▲ 0.00152492	▲ 0.00164353	
Born in the 1980s		0.08353929	0.08796072	0.00232542	0.00313778	0.00319380	0.00398909	▲ 0.00860323	▲ 0.00779006	
Intra-Income Class Effect		0.07114808	0.08503524	0.00227402	0.00308406	0.00314320	0.00409126	▲ 0.00819221	▲ 0.00712221	
Intra-Income Class Effect		0.01239121	0.00292547	0.00005140	0.00005372	0.00005060	▲ 0.00009317	▲ 0.00041103	▲ 0.00066784	
1st Quintile Group		-0.06240182	-0.07014471	▲ 0.00074297	▲ 0.00097904	▲ 0.00099068	▲ 0.00130995	▲ 0.00095216	0.00059453	
2nd Quintile Group		-0.02412517	-0.03926444	▲ 0.00041215	▲ 0.00059714	▲ 0.00061115	▲ 0.00082163	0.00199544	0.00178734	
3rd Quintile Group		0.00414280	0.00511340	▲ 0.00038723	▲ 0.00053594	▲ 0.00055189	▲ 0.00078915	▲ 0.00013449	▲ 0.00041893	
4th Quintile Group		0.02564635	0.03732741	0.00012562	0.00010557	0.00009461	0.00010996	▲ 0.00081505	▲ 0.00083740	
5th Quintile Group		0.06912906	0.06989381	0.00146813	0.00206026	0.00210971	0.00217160	▲ 0.00240909	▲ 0.00179338	
Born in the 1990s		0.02712912	0.02944495	0.00146241	0.00226013	0.00236018	0.00236018	▲ 0.00138559	▲ 0.00138559	
Intra-Income Class Effect		0.02112318	0.02773680	0.00137559	0.00215497	0.00225612	0.00225612	▲ 0.00180323	▲ 0.00180323	
Intra-Income Class Effect		0.00600594	0.00170816	0.00008682	0.00010515	0.00010406	0.00010406	0.00041764	0.00041764	
1st Quintile Group		-0.01710327	-0.02679471	▲ 0.00042179	▲ 0.00062761	▲ 0.00064996	▲ 0.00064996	0.00055067	0.00055067	
2nd Quintile Group		-0.00608937	-0.00918435	▲ 0.00025633	▲ 0.00041881	▲ 0.00044020	▲ 0.00044020	0.00145332	0.00145332	
3rd Quintile Group		-0.00062002	0.00282186	▲ 0.00024322	▲ 0.00041180	▲ 0.00043705	▲ 0.00043705	▲ 0.00078479	▲ 0.00078479	
4th Quintile Group		0.00881090	0.01277135	0.00017663	0.00021025	0.00020571	0.00020571	▲ 0.00082126	▲ 0.00082126	
5th Quintile Group		0.02100769	0.02209400	0.00083153	0.00135312	0.00142556	0.00142556	0.00001968	0.00001968	
Income Redistribution Effect		0.20809496	0.20461272	0.00392492	0.00583561	0.00601506	0.00653189	▲ 0.00695032	▲ 0.00641716	

Source: Author's calculations from the KLIPS data.

Notes: The age classification for Reform Plan 4 is based on the participants' age as of 2025. The Mean Log Deviation (MLD) in the absence of a pension system is calculated based on each participant's lifetime labor income.

5 Conclusions

This paper conducted simulation analysis on the income redistributive effects of various reform proposals in the 5th National Pension Comprehensive Plan (Draft) announced by the Ministry of Health and Welfare of Korea on October 30, 2023, using individual data from the Korean Labor & Income Panel Study (KLIPS). It aimed to determine how each reform proposal affects income redistribution compared to the current system, utilizing lifetime income to estimate income redistribution indicators, with the Mean Log Deviation (MLD) used as the income redistribution indicator.

Differing from previous studies, this paper has two main distinctions. Firstly, in estimating the lifetime income of each participant, it individually estimates the number of future children and whether they will be employed in the future, thus reflecting the heterogeneity of each participant. Secondly, in calculating the lifetime pension benefits and lifetime pension contributions for each participant, instead of assuming that all participants enroll for the same period, it reflects the disparity in contribution periods and life expectancies among income strata, conducting analyses that are more realistic.

Summarizing the key findings, when considering the disparity in contribution periods and life expectancies among income strata, reform proposals such as raising the pensionable age (reform proposals 5 and 6) lead to an overall deterioration in income redistribution for all participants, regardless of employment status. Furthermore, it was found that, even when considering the absence of the National Pension System, over 95% of the income disparity among all participants in the current system and in the 5th National Pension Reform Plan is due to intragenerational income redistributive effects. Specifically, the proposal to raise the pensionable age leads to a worsening of intragenerational income redistribution, resulting in an overall deterioration in income redistribution. Additionally, the 5th National Pension Reform Plan exhibit different income redistributive effects across generations. All proposals worsen intragenerational income redistribution for the middle-aged cohorts (born in the 1960s and 1970s), while the proposal to raise the pensionable age worsens intragenerational income redistribution for younger cohorts (born in the 1980s and 1990s) as well.

In light of these findings, it is crucial to consider the current income distribution among National Pension participants and the heterogeneity among income strata when deliberating on the 5th National Pension Reform Plan in the future. The analysis presented here underscores the need for discussions on income redistribution from the

perspective of National Pension function, alongside the stated fiscal goal of achieving long-term equilibrium in the National Pension finances, given that the income redistributive effects vary across each proposal. Furthermore, for a more realistic analysis of income redistributive effects, it is necessary to conduct analyses that take into account strata that are currently outside the focus of analysis in the National Pension System, a task that remains a future challenge for this study.

References

- 小塩隆士・浦川邦夫 (2008) 「公的年金による世代内再分配効果」 貝塚啓明・財務省財務総合政策研究所編著『人口減少社会の社会保障制度改革の研究』中央経済社
(Translated in English) Oshio, T. and Urakawa, K. (2008). The intragenerational redistribution effects of public pensions. In K. Kaizuka & Policy Research Institute, Ministry of Finance (Eds.), Study on Social Security System Reform in a Declining Population Society. Chuo Keizai-sha.
- 小塩隆士 (2010) 『再分配の厚生分析——公平と効率を問う』日本評論社 (Translated in English) Oshio, T. (2010). Welfare Analysis of Redistribution: Questioning Equity and Efficiency. Nihon Hyoron-sha.
- 川口大司 (2011) 「ミンサー型賃金関数の日本の労働市場への適用」, RIETI Discussion Paper Series, No. 11-J-026 (Translated in English) Kawaguchi, D. (2011). Application of the Mincer wage function to the Japanese labor market. RIETI Discussion Paper Series, No. 11-J-026.
- 邢雪歌 (2021) 「中国における年金制度の問題点——所得再分配効果の視点から」『年金研究』No. 14, pp. 39-64 (Translated in English) Xing, X. (2021). Issues with the pension system in China: From the perspective of income redistributive effects. Pension Studies, No. 14, 39-64.
- Bengtsson, N., Holmlund, B., and Waldenstorm, D. (2016) “Lifetime versus Annual Tax-and Transfer Progressivity: Sweden, 1968-2009”, Scand. J. of Economics 118(4), pp.619-645.
- Coronado, J. L., Fullerton, D., and Glass, T. (2000) “The Progressivity of Social Security”, National Bureau of Economic Research, Cambridge, MA, NBER Working Paper No.7520.
- Coronado, J. L., D. Fullerton, and T. Glass, “The Progressivity of Social Security”, The B.E. Journal of Economic Analysis and Policy, Vol. 11, Issue 1, 2011, pp.1-43.
- Khang Y-H, Bahk J, Lim D, et al., “Trends in inequality in life expectancy at birth between 2004 and 2017 and projections for 2030 in Korea: multiyear cross-sectional differences by income from national health insurance data”, BMJ Open, 2019, pp.1-8.
- Yuh, Yoonkyung, and Jaehwan Yang, “The Valuation and Redistributive Effect of the Korea National Pension”, Hitotsubashi Journal of Economics, Vol. 52, 2011, pp.113-142.
- Leimer, Dean R., “Historical Redistribution Under the Social Security Old-Age and Survivors Insurance and Disability Insurance Programs”, ORES Working Paper

Series Number 102, 2004.

- Haan, p., Kemptner, D., and Prowse, V. (2017) “Insurance, Redistribution and the Inequality of Lifetime Income”, German Institute for Economic Research, Berlin, DIW Discussion Paper No.1716
- Haider, S., and G. Solon, “Life-Cycle Variation in the Association between Current and Lifetime Earnings”, *American Economic Review*, Vol. 96, 2006, pp.1308-1320.
- Han, J. and Lee, H. (2014). Benefit-cost analysis of national pensioners by income and life expectancy, *The Korean Journal of Applied Statistics*, 27, 211-226.
- 김준영 · 강성호, “국민연금의 소득계층별 재분배 기여도 분석 : 지니계수 요인분해를 통한 새로운 접근”, 『공공경제』, 제 12 권 제 2 호, 2007, pp.90-118. (Translated in English) Sung Ho Kang · Jun Young Kim, “A study on the contributions of National Pension Scheme to Life-time Income Redistribution based on using Gini Decomposition”, *The Korean Association of Public Finance*, Vol. 12, No. 2, 2007, pp.90-118.
- 강성호 · 전승훈 · 임병인, “국민연금법 개정의 소득분배 및 노동공급 효과 분석”, 『경제학연구』, 제 56 집 제 3 호, 한국경제학회, 2008, pp.75-107. (Translated in English) Kang, Sung-ho, Seung-Hoon Jeon, and Byung In Lim, “An Analysis on the Effect of Both the Income Distribution and Labor Supply of the National Pension Act Revision,” *Korean Journal of Economic Studies*, Vol. 23, No. 3, 2008, pp.75-107.
- 김상호, “국민연금법 개정의 소득분배 및 노동공급 효과 분석”, 『경제학연구』, 제 56 집 제 3 호, 한국경제학회, 2004, pp.229-248. (Translated in English) Kim, Sangho, “An Analysis on the Effect of Both the Income Distribution and Labor Supply of the National Pension Act Revision” *Korean Journal of Economic Studies*, Vol. 56, No. 3, 2004, pp.75-107.
- 김상호, “국민연금법 개정의 소득재분배 효과”, 『우리나라 노후소득보장체계 구축에 관한 종합연구, 공적연금제도의 평가와 정책과제(II)』 한국개발연구원, 2008, pp.88-113. (Translated in English) Kim, Sangho, “Income Redistributive Effect of National Pension Act Revision”, *A Comprehensive Study on the Establishment of Korea's Retirement Income Security System and Evaluation of Public Pension System and Policy Tasks (II)*, Korea Development Institute, 2008, pp.88-113.
- 김상호, “국민연금 재정불균형과 개혁(안)의 소득재분배 효과”, 『재정학연구』, Vol.12, No.4, 한국재정학회, 2019, pp.79-104. (Translated in English) Kim, Sangho, “Financial Imbalance of National Pension Scheme and Effect of Reform Proposals on Income Distribution: Based on Representative Insurer”, *The Korean Association of Public Finance*, Vol. 12, No. 4, 2019, pp.79-104.
- 김준일 · 류재린, “국민연금기금의 사회책임투자과 인구구조 변화: 미시모의실험을 통한

- 연금재정분석”, 『경제발전연구』, Vol.24, No.4, 2018, pp.65-94. (Translated in English) Kim, Joon-il and Ryu, Jae-rin, “Social Responsibility Investment of the National Pension Fund and Changes in the Demographic Structure: Pension Financial Analysis through Micimetric Experiments”, Economic Development Research, Vol. 24, No. 4, 2018, pp.65-94.
- 김현숙, “우리나라 가구의 자녀 수 결정요인에 관한 Count 모형 분석 및 경제적함의”, 『한국인구학』, Vol. 30, No. 3, 2007, pp.107-135. (Translated in English) Kim, Hyun-Sook, “The Economic and Social Implication of Count Regression Models for Married Women’s Completed Fertility in Korea”, Applied Economy, Vol. 30, No. 3, 2007, pp.107-135.
- 송헌재, “노동패널 자료를 이용한 우리나라 가구의 출산결정요인 분석”, 『응용경제』, Vol. 14, No. 3, 2012, pp.51-78. (Translated in English) Heonjae Song, “The Analysis of Household's Fertility Decision in Korea using KLIPS”, Applied Economy, Vol. 14, No. 3, 2012, pp.51-78.
- 이상은, “소득계층별 및 세대별 기대여명 차이를 고려한 국민연금제도의 소득재분배 효과”, 『사회보장연구』, 제 22 권 제 1 호, 2006, pp.217~240. (Translated in English) Lee, Sang-Eun, “The effect of redistributing income of the National Pension System in consideration of differences in life expectancy by income class and generation”, Social Security Research, Vol. 22, No. 1, 2006, pp.217-240.
- 이동열 · 최웅비 · 김우창, “국민연금의 세대내 세후 소득재분배 효과 분석”, 『사회보장연구』, 제 32 권 제 3 호, 한국사회보장학회, 2016, pp.159-174. (Translated in English) Lee, Dongyeol, Woongbee Choi, and Woochang Kim, “An Analysis on the Intragenerational After-tax Income Redistributive Effect of the National Pension Scheme,” Korean Social Security Studies, Vol. 32, No. 3, 2016, pp.159-174.
- 우해봉 · 한정림, “국민연금의 소득계층별 노후소득보장 효과 분석: 기대여명 격차와 재정 안정화 개혁의 효과를 중심으로”, 『사회복지정책』, Vol.43, No.4, 2016, pp.192-217. (Translated in English) Woo, Haebong and Han, Jeonglim, “Differential Mortality, Pension Reforms, and Old-Age Income Protection Effects of the National Pension”, Social Welfare Policy, Vol. 43, No. 4, 2016, pp.192-217.
- 정세은 · 김종호, “제 5 차 국민연금 재정추계 결과의 주요 내용과 비판적 평가”, 『동향과 전망』, Vol., No.119, 2023, pp.213-260. (Translated in English) Jeong, Seeun · Kim, Jong-Ho, “Key Contents and Critical Evaluation of the Fifth Actuarial Estimate of the National Pension,” Journal of Korean Social Trend and Perspective (KSTP), Vol., No.119, 2023, pp.213-260.
- 최기홍, “세대간 회계에 의한 국민연금의 세대간 형평성과 지속가능성 측정”,

『경제분석』, 제 22 권 제 2 호, 한국은행 경제연구원, 2016, pp.50-89. (Translated in English) Choi, Ki-Hong, “Intergenerational Equity and Sustainability of the Korean National Pension: A Generational Accounting,” *Economic Analysis*, Vol. 22, No. 2, 2016, pp.50-89.

최기홍 · 한정림, “국민연금 가입자의 소득계층별 수익성 측정”, 『통계연구』, 제 22 권 제 1 호, 2017, pp.44-64. (Translated in English) Choi, Ki-Hong Choi, and Jeong-Lim Han, “Measurement of the Profitabilities of the National Pension by Income Class,” *Journal of Korean Official Statistics*, Vol. 22, No. 1, 2017, pp.44-64.

National Pension Service (NPS). (n.d.). Standard income monthly amount. Retrieved May 1, 2023, from https://www.nps.or.kr/jsppage/cyber_pr/easy/easy_03_01.jsp#:~:text=%EA%B8%B0%EC%A4%80%EC%86%8C%EB%93%9D%EC%9B%94%EC%95%A1%EC%9D%B4%EB%9E%80,%EB%B2%94%EC%9C%84%EB%A1%9C%20%EA%B2%B0%EC%A0%95%ED%95%98%EA%B2%8C%20%EB%90%A9%EB%8B%88%EB%8B%A4

National Pension Service (NPS) Big Data Portal. (n.d.). Number of workplace subscribers by gender and age (2020) and Number of regional subscribers by gender and age (2020). Retrieved May 1, 2023, from <https://data.nps.or.kr/pportal/main/listStandardIncome.do?cmsid=102020103000>

National Pension Fund Management Committee. (n.d.). Fund Status. Retrieved December 10, 2023, from https://fund.nps.or.kr/jsppage/fund/mcs/mcs_02_02.jsp

Dong-A Ilbo. (2018, November 7). President Moon Jae-in orders a complete review of the national pension reform plan. Dong-A Ilbo Digital. Retrieved August 25, 2023, from <https://www.donga.com/news/Politics/article/all/20181107/92771205/1>

Dong-A Ilbo. (2022, February 5). Pension reform agreement among presidential candidates: If serious, it should be a pledge. Dong-A Ilbo Digital. Retrieved August 25, 2023, from <https://www.donga.com/news/Opinion/article/all/20220204/111583116/1>

Ministry of Health and Welfare, Korea. (2023, June 21). Composition and operation of the 5th Financial Accounting Committee. Retrieved August 25, 2023, from <https://www.mohw.go.kr/menu.es?mid=a10714020200>

Ministry of Health and Welfare, Korea. (2023, October 30). 5th National Pension Comprehensive Operation Plan (Draft). Ministry of Health and Welfare, 81p.

Korea Law Information Center. (2023, September 29). National Pension Act. Retrieved October 1, 2023, from <https://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EA%B5%AD%EB%AF%BC%EC%97%B0%EA%B8%88%EB%B2%95>

- Statistics Korea. (2023, August 30). 2022 Birth Statistics. Retrieved September 1, 2023.
- Statistics Korea. (2023, November 29). Population Trends for September and the Third Quarter of 2023. Retrieved December 1, 2023.
- Statistics Korea. (2022, December 6). 2021 Life Table. Retrieved March 1, 2023.
- Statistics Korea. (2022, October 20). Future Household Projections (City and Province Level): 2020-2050. Retrieved March 1, 2023.
- Korea Development Institute. (2022, September 6). Possibility and expected effects of adjusting the retirement age. KDI Focus, No. 115, 8p.
- Korea Institute for Health and Social Affairs. (2018). Social Security Systems in Major Countries and South Korea. 591p.
- Korea Institute for Health and Social Affairs. (2022). Research on Restructuring Public Pensions. 237p.
- Korea Institute for Health and Social Affairs. (2022). Research on Pension Reform and Social Consensus Models. 262p.
- Mirae Asset Retirement and Pension Center. (2022). Delayed retirement, preparing for the life cycle budget deficit. Mirae Asset Retirement and Pension Report, No. 54, 9p.
- Seoul National University Industry-University Cooperation Foundation. (2021). In-depth analysis of multi-layered retirement income security system using administrative data. Ministry of Health and Welfare, 260p.
- OECD. (2019). Pensions at a Glance 2019. OECD Publishing. https://www.oecd-ilibrary.org/social-issues-migration-health/pensions-at-a-glance-2019_b6d3dcfc-en (accessed April 1, 2023).

Appendix

Figure A1. Assumed Values of Macroeconomic Indicators Used in This Study

Economic variables	Year					
	2023~2030	2031~2040	2041~2050	2051~2060	2061~2070	2071~2080
Real economic growth rate	1.9	1.3	0.7	0.4	0.2	0.2
Real wage growth rate	1.9	1.9	1.8	1.7	1.6	1.6
Real interest rate	1.4	1.4	1.3	1.2	1.2	1.2
Inflation rate	2.2	2	2	2	2	2

Source: Created by the author from "Table 5. Assumptions of Economic Variables in Combined Scenarios" in the Ministry of Health and Welfare's "The 5th National Pension Financial Estimate Results" p.7.

Notes: Population and economic outlook will use the median values, which serve as the fundamental assumptions. The unit is expressed in percentage (%).

Figure A2. Actual and Assumed Values of Standard Monthly Income

Upper limit	Lower limit	Applicable period
2,000,000	70,000	1988.11. ~ 1995.3.
3,600,000	220,000	1995.4. ~ 2007.3.
3,600,000	220,000	2007.4. ~ 2008.3. (Employee)
		2007.4. ~ 2008.6. (Employer)
3,600,000	220,000	2008.4. ~ 2009.6. (Employee)
		2008.7. ~ 2009.6. (Employer)
3,600,000	220,000	2009.7. ~ 2010.6.
3,680,000	230,000	2010.7. ~ 2011.6.
3,750,000	230,000	2011.7. ~ 2012.6.
3,890,000	240,000	2012.7. ~ 2013.6.
3,980,000	250,000	2013.7. ~ 2014.6.
4,080,000	260,000	2014.7. ~ 2015.6.
4,210,000	270,000	2015.7. ~ 2016.6.
4,340,000	280,000	2016.7. ~ 2017.6.
4,490,000	290,000	2017.7. ~ 2018.6.
4,680,000	300,000	2018.7. ~ 2019.6.
4,860,000	310,000	2019.7. ~ 2020.6.
5,030,000	320,000	2020.7. ~ 2021.6.
5,240,000	330,000	2021.7. ~ 2022.6.
5,530,000	350,000	2022.7. ~ 2023.6.
5,900,000	370,000	2023.7. ~ 2024.6.
Multiplying the inflation rate (assumed value) of the fifth National Pension fiscal estimate by the value of the previous year.		2024.7. ~ 2081.6.

Source: Created by the author from the homepage of National Pension Service (NPS).

Notes: Currency unit is KRW.

Table A3. Descriptive Statistics for the Estimation of Number of Children

Variable	Obs	Mean	Std. dev.	Min	Max
kid	36,846	1.442219	0.863746	0	5
age	36,868	33.22263	4.178013	16	39
education level (No formal education to middle school graduate=1, High school graduate=2, Junior college graduate=3, University graduate=4, Graduate school graduate=5)	36,856	2.741507	0.988337	1	5
employment status	36,868	0.449957	0.497496	0	1
<i>lnwage</i>	36,868	1.979052	2.459094	0	7.600903
<i>lnhwage</i> (total labor income of household members excluding married women)	36,868	6.7881	3.162861	0	28.00957
homeownership	36,868	0.498861	0.500006	0	1
residence in a metropolitan area (Seoul Special City, Gyeonggi Province, Metropolitan Cities (Busan, Daegu, Daejeon, Incheon, Gwangju, Ulsan) = 1, Others = 0)	36,868	0.715037	0.451403	0	1
year	36,868	2008.15	7.075877	1997	2020
region	36,868	6.970082	4.611014	1	19

Source: Created by the author from the KLIPS data.

Table A4. Estimation of Number of Children Using
Generalized Least Squares (GLS) Method

VARIABLES	kid
age	0.0605*** (0.00105)
education level	-0.0657*** (0.00466)
employment status	0.00566 (0.0190)
<i>lnwage</i>	-0.0744*** (0.00423)
<i>lnhwage</i>	0.0362*** (0.00190)
homeownership	0.133*** (0.00861)
residence in a metropolitan area	-0.123 (0.0799)
year	YES
region	YES
Constant term	-0.886*** (0.0892)
Observations	36,834
Sample size	5,826
Log likelihood	-43750.36
Wald chi2(45)	6797.60
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Source: Created by the author from the KLIPS data.

Table A5. Descriptive Statistics for Employment Probability Estimation

Male						
Variable	Obs	Mean	Std. dev.	Min	Max	
employment status	59,193	0.394354	0.488716	0	1	
age	59,193	36.63639	7.390114	25	57	
age ²	59,193	1396.838	565.5429	625	3249	
kid	59,193	0.950873	0.967501	0	5	
kid ²	59,193	1.840201	2.447556	0	25	
employment experience	59,193	0.891119	0.311493	0	1	
residence in a metropolitan area (Seoul Special City, Gyeonggi Province, Metropolitan Cities (Busan, Daegu, Daejeon, Incheon, Gwangju, Ulsan) = 1, Others = 0)	59,193	0.732131	0.442853	0	1	
<i>lnhwage</i> (total labor income of household members excluding married women)	59,193	6.309842	3.08751	0	22.40521	
homeownership	59,193	0.55167	0.497327	0	1	
education level (No formal education to middle school graduate=1, High school graduate=2, Junior college graduate=3, University graduate=4, Graduate school graduate=5)	59,191	2.945414	1.034599	1	5	
unhealthy condition (Unhealthy = 1, Healthy = 0)	51,963	0.038085	0.191403	0	1	
marital status	59,193	0.689085	0.462872	0	1	
population by city/province	59,193	229829.1	166068.3	3315	585772	
year	59,193	2010.477	6.534704	1997	2020	
region	59,193	6.80915	4.593756	1	19	

Female						
Variable	Obs	Mean	Std. dev.	Min	Max	
employment status	55,806	0.246103	0.430743	0	1	
age	55,806	36.47563	7.473477	25	57	
age ²	55,806	1386.323	572.4163	625	3249	
kid	55,806	1.103	0.971376	0	5	
kid ²	55,806	2.160162	2.581674	0	25	
employment experience	55,806	0.568201	0.495331	0	1	
residence in a metropolitan area (Seoul Special City, Gyeonggi Province, Metropolitan Cities (Busan, Daegu, Daejeon, Incheon, Gwangju, Ulsan) = 1, Others = 0)	55,806	0.735082	0.441293	0	1	
<i>lnhwage</i> (total labor income of household members excluding married women)	55,806	5.839738	3.559387	0	22.40521	
homeownership	55,806	0.554295	0.497048	0	1	
education level (No formal education to middle school graduate=1, High school graduate=2, Junior college graduate=3, University graduate=4, Graduate school graduate=5)	55,785	2.690687	0.976857	1	5	
unhealthy condition (Unhealthy = 1, Healthy = 0)	48,678	0.045236	0.207824	0	1	
marital status	55,806	0.830896	0.374847	0	1	
population by city/province	55,806	215160.6	158417.9	3145	541289	
year	55,806	2010.019	6.371594	1997	2020	
region	55,806	6.726123	4.606665	1	19	

Source: Created by the author from the KLIPS data.

Table A6. Estimation of Employment Probability Using Logit Model

VARIABLES	Male		Female	
	employment status		employment status	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
age	0.538*** (0.0167)	0.092	0.453*** (0.0190)	0.066
age ²	-0.00913*** (0.000218)	-0.002	-0.00737*** (0.000247)	-0.001
kid	0.285*** (0.0406)	0.049	0.518*** (0.0451)	0.075
kid ²	-0.0806*** (0.0138)	-0.014	-0.128*** (0.0150)	-0.019
employment experience	0.679*** (0.0474)	0.116	0.837*** (0.0321)	0.121
residence in a metropolitan area	0.1000 (0.239)	0.017	1.610*** (0.287)	0.233
<i>lnhwage</i>	0.0191*** (0.00428)	0.003	0.0601*** (0.00427)	0.009
homeownership	0.163*** (0.0222)	0.028	-0.0596** (0.0249)	-0.009
education level	0.227*** (0.0107)	0.039	-0.0502*** (0.0134)	-0.007
unhealthy condition	-0.270*** (0.0657)	-0.046	-0.245*** (0.0706)	-0.035
marital status	0.212*** (0.0380)	0.036	-0.170*** (0.0470)	-0.025
population by city/province	3.06e-07 (2.77e-07)	5.23E-08	-2.95e-06*** (3.22e-07)	-4.27E-07
Constant term	-5.172*** (0.367)	0.428	-4.795*** (0.429)	0.267
year		YES		YES
region		YES		YES
Observations		51,961		48,658
Pseudo R2		0.2535		0.2264
Log pseudolikelihood		-26486.845		-21844.672
Wald chi2(45)		11497.1		9225.56

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations from the KLIPS data.

Table A7. Descriptive Statistics for Future Income Estimation

Male					
Variable	Obs	Mean	Std. dev.	Min	Max
<i>lnwage</i>	18,282	5.71934	0.435339	1.609438	8.006368
age	18,282	35.60103	5.929402	25	54
age ²	18,282	1302.589	439.3385	625	2916
continuous years of employment	18,249	6.302044	5.577653	0	37
continuous years of employment ²	18,249	70.82426	115.3605	0	1369
kid	18,282	1.014495	0.951569	0	5
marital status	18,282	0.71863	0.44968	0	1
education level (No formal education to middle school graduate=1, High school graduate=2, Junior college graduate=3, University graduate=4, Graduate school graduate=5)	18,282	3.364019	0.897408	1	5
residence in a metropolitan area (Seoul Special City, Gyeonggi Province, Metropolitan Cities (Busan, Daegu, Daejeon, Incheon, Gwangju, Ulsan) = 1, Others = 0)	18,282	0.728586	0.444702	0	1
unhealthy condition (Unhealthy = 1, Healthy = 0)	18,282	0.010502	0.101943	0	1
firm size (Large/Medium-sized enterprise = 1, Small/Micro enterprise = 0)	16,586	0.3017	0.45901	0	1
Legislators, Senior Officials, and Managers	18,269	0.012918	0.112924	0	1
Professionals	18,269	0.210849	0.407923	0	1
Technicians and Associate Professionals	18,269	0.122393	0.327748	0	1
Clerical Support Workers	18,269	0.223767	0.416779	0	1
Service Workers	18,269	0.039794	0.195481	0	1
Occupation Sales Workers	18,269	0.059609	0.236768	0	1
Skilled Agricultural, Forestry, and Fishery Workers	18,269	0.004981	0.070403	0	1
Craft and Related Trades Workers	18,269	0.128414	0.33456	0	1
Plant and Machine Operators and Assemblers	18,269	0.151185	0.358239	0	1
Elementary Occupations	18,269	0.046089	0.209684	0	1
year	18,282	2015.871	3.449272	2002	2020
region	18,282	7.042938	4.555748	1	19

Female

Variable	Obs	Mean	Std. dev.	Min	Max
<i>lnwage</i>	6,078	5.327467	0.446229	2.302585	7.313221
age	6,078	35.91922	6.915953	25	55
age ²	6,078	1338.013	517.2262	625	3025
continuous years of employment	6,075	5.195226	5.370692	0	33
continuous years of employment ²	6,075	55.82996	111.7608	0	1089
kid	6,078	1.019579	0.964114	0	5
marital status	6,078	0.724087	0.44701	0	1
education level (No formal education to middle school graduate=1, High school graduate=2, Junior college graduate=3, University graduate=4, Graduate school graduate=5)	6,078	3.086542	0.893035	1	5
residence in a metropolitan area (Seoul Special City, Gyeonggi Province, Metropolitan Cities (Busan, Daegu, Daejeon, Incheon, Gwangju, Ulsan) = 1, Others = 0)	6,078	0.721948	0.448076	0	1
unhealthy condition (Unhealthy = 1, Healthy = 0)	6,078	0.014149	0.118116	0	1
firm size (Large/Medium-sized enterprise = 1, Small/Micro enterprise = 0)	5,394	0.202818	0.402135	0	1
Occupation Legislators, Senior Officials, and Managers	6,076	0.00181	0.042514	0	1
Professionals	6,076	0.203753	0.40282	0	1
Technicians and Associate Professionals	6,076	0.186801	0.389783	0	1
Clerical Support Workers	6,076	0.359941	0.480022	0	1
Service Workers	6,076	0.085583	0.27977	0	1
Sales Workers	6,076	0.066162	0.248585	0	1
Skilled Agricultural, Forestry, and Fishery Workers	6,076	0.000988	0.031411	0	1
Craft and Related Trades Workers	6,076	0.020902	0.143068	0	1
Plant and Machine Operators and Assemblers	6,076	0.039829	0.195573	0	1
Elementary Occupations	6,076	0.034233	0.181842	0	1
year	6,078	2017.965	2.11118	2008	2020
region	6,078	6.853735	4.703885	1	19

Source: Created by the author from the KLIPS data.

Notes: Occupations are classified based on the "5th Revision of the Korean Standard Classification of Occupations" by Statistics Korea. Regions are classified according to the wide-area city and province codes in the KLIPS as follows: Seoul Special City (1), Busan Metropolitan City (2), Daegu Metropolitan City (3), Daejeon Metropolitan City (4), Incheon Metropolitan City (5), Gwangju Metropolitan City (6), Ulsan Metropolitan City (7), Gyeonggi Province (8), Gangwon Province (9), North Chungcheong Province (10), South Chungcheong Province (11), North Jeolla Province (12), South Jeolla Province (13), North Gyeongsang Province (14), South Gyeongsang Province (15), Jeju Special Self-Governing Province (16), Sejong Special Self-Governing City (19).

Table A8. Estimation of Future Income Using Mincer Wage Equation

VARIABLES	Regular Employees		Self-employed & Non-regular Employees	
	Male <i>lnwage</i>	Female <i>lnwage</i>	Male <i>lnwage</i>	Female <i>lnwage</i>
age	0.0400*** (0.00445)	0.0162** (0.00771)	0.190*** (0.0234)	0.0520* (0.0300)
age ²	-0.000395*** (5.97e-05)	-0.000190* (0.000102)	-0.00247*** (0.000331)	-0.000678* (0.000394)
continuous years of employment	0.0105*** (0.00122)	0.0223*** (0.00219)	NO	NO
continuous years of employment ²	9.06e-05 (5.74e-05)	9.99e-06 (0.000101)	NO	NO
kid	0.0453*** (0.00323)	-0.0315*** (0.00633)	0.0396** (0.0164)	-0.0592** (0.0247)
marital status	0.0937*** (0.00711)	0.0231* (0.0140)	0.400*** (0.0357)	-0.251*** (0.0621)
education level	0.0748*** (0.00301)	0.0932*** (0.00574)	0.0408*** (0.0122)	0.0546*** (0.0179)
residence in a metropolitan area	-0.138*** (0.0292)	0.0577 (0.0771)	-0.357 (0.315)	-0.0101 (0.215)
unhealthy condition	-0.103*** (0.0226)	-0.0709* (0.0411)	-0.213* (0.111)	-0.148 (0.109)
firm size	0.232*** (0.00512)	0.191*** (0.0114)	NO	NO
Occupation	YES	YES	NO	NO
year	YES	YES	YES	YES
region	YES	YES	YES	YES
Constant term	4.318*** (0.179)	4.651*** (0.280)	1.871** (0.750)	4.261*** (0.769)
Observations	14,896	4,650	2,531	1,028
Sample size	3,552	1,893	935	573
Log likelihood	-1745.765	-925.8452	-2042.939	-766.7597
Wald chi2(52)	15093.77			
Wald chi2(46)		3112.14		
Wald chi2(38)			1034.86	
Wald chi2(34)				155.85

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations from the KLIPS data.

Figure A9. Income Redistributive Effects of the National Pension Reform Plan

Male Participants

(Case assuming all National Pension participants contribute for 20 years)

Workplace-based Insured Persons		Absence of NPS	The Current NPS	Difference from the Current System						
				Proposal 1	Proposal 2	Proposal 3	Proposal 4	Proposal 5	Proposal 6	
Workplace-based Insured Persons	Intergenerational Effect	0.00139272	0.00071385	0.00027190	0.00037528	0.00039151	0.00041019	▲ 0.00044670	▲ 0.00051794	
	Intragenerational Effect	0.08056773	0.00560632	0.0024745	0.00035111	0.00037072	0.00019688	▲ 0.00018402	▲ 0.00014269	
	Born in the 1960s	0.00491046	0.00018578	▲ 0.0000279	▲ 0.0000279	▲ 0.00000279	▲ 0.00000472	▲ 0.00000279	▲ 0.00000472	
	Inter: Income Class Effect	0.00447973	0.00006605	▲ 0.00000159	▲ 0.00000159	▲ 0.00000159	▲ 0.00000267	▲ 0.00000159	▲ 0.00000267	
	Intra: Income Class Effect	0.00043074	0.00011973	▲ 0.00000120	▲ 0.00000120	▲ 0.00000120	▲ 0.00000205	▲ 0.00000120	▲ 0.00000205	
	1st Quintile Group	-0.00513106	-0.00080322	0.00000995	0.00000995	0.00000995	0.00000995	▲ 0.00000995	0.00000995	
	2nd Quintile Group	-0.00194131	0.00013734	0.00000201	0.00000201	0.00000201	0.00000335	▲ 0.00000201	▲ 0.00000335	
	3rd Quintile Group	0.00026976	0.00034918	▲ 0.00000416	▲ 0.00000416	▲ 0.00000416	▲ 0.00000695	▲ 0.00000416	▲ 0.00000695	
	4th Quintile Group	0.00218184	0.00036373	▲ 0.00000470	▲ 0.00000470	▲ 0.00000470	▲ 0.00000786	▲ 0.00000470	▲ 0.00000786	
	5th Quintile Group	0.00505150	0.00007271	▲ 0.00000430	▲ 0.00000430	▲ 0.00000430	▲ 0.00000718	▲ 0.00000430	▲ 0.00000718	
	Born in the 1970s	0.04149507	0.00215176	▲ 0.00005927	▲ 0.00007452	▲ 0.00007372	▲ 0.00017921	▲ 0.00043377	▲ 0.00063573	
	Inter: Income Class Effect	0.03732126	0.00075790	▲ 0.00014151	▲ 0.00019306	▲ 0.00019729	▲ 0.00033057	▲ 0.00031790	▲ 0.00047690	
	Intra: Income Class Effect	0.00417381	0.00139386	0.00008824	0.00011854	0.00012157	0.00015136	▲ 0.00011587	▲ 0.00015874	
	1st Quintile Group	-0.04816292	-0.00880360	0.00010041	0.000102695	0.000102695	0.000164207	0.000122111	0.000187422	
	2nd Quintile Group	-0.01863077	-0.00040838	0.00033140	0.00040608	0.00040936	0.00066329	0.000103381	0.00029839	
	3rd Quintile Group	0.00012156	0.00297583	▲ 0.00005948	▲ 0.00009616	▲ 0.00009543	▲ 0.00016865	▲ 0.00018968	▲ 0.00039607	
	4th Quintile Group	0.02051240	0.00406803	▲ 0.00040390	▲ 0.00053199	▲ 0.00054272	▲ 0.00088442	▲ 0.00087874	▲ 0.00126734	
	5th Quintile Group	0.05033354	0.00356193	▲ 0.00051598	▲ 0.00066380	▲ 0.00067652	▲ 0.00110094	▲ 0.00198173	▲ 0.00246008	
	Born in the 1980s	0.02892890	0.00255345	0.00023379	0.00030354	0.00030985	0.00024145	0.00041674	0.00029392	
	Inter: Income Class Effect	0.02446929	0.00048142	▲ 0.00007385	▲ 0.00013960	▲ 0.00015599	▲ 0.00028690	▲ 0.00010704	▲ 0.00021159	
	Intra: Income Class Effect	0.00355962	0.00207202	0.00030744	0.00044314	0.00046586	0.00051035	0.00052378	0.00053551	
	1st Quintile Group	-0.04285118	-0.00738702	0.00051842	0.00095686	0.000106101	0.000177472	0.00061924	0.00147812	
	2nd Quintile Group	-0.01530193	-0.00007275	0.00035895	0.00058113	0.00062936	0.00089030	0.00085034	0.00116621	
	3rd Quintile Group	-0.00001884	0.00166848	0.00004040	0.00001256	0.00000575	▲ 0.00021103	▲ 0.00062925	▲ 0.00021054	
	4th Quintile Group	0.01644852	0.00363967	▲ 0.00017367	▲ 0.00034774	▲ 0.00039475	▲ 0.00067572	▲ 0.00030235	▲ 0.00065799	
	5th Quintile Group	0.04528304	0.00422364	▲ 0.00043687	▲ 0.00075968	▲ 0.00083551	▲ 0.00126492	▲ 0.00070640	▲ 0.00124029	
	Born in the 1990s	0.00613329	0.00071533	0.00006972	0.00012488	0.00013936	0.00013936	0.00020384	0.00020384	
	Inter: Income Class Effect	0.00459437	0.00010993	0.00001796	0.00002179	0.00001978	0.00001978	0.00004637	0.00004637	
	Intra: Income Class Effect	0.00153892	0.00060540	0.00005176	0.00010309	0.00011958	0.00011958	0.00015747	0.00015747	
	1st Quintile Group	-0.00956633	-0.00157019	▲ 0.00013452	▲ 0.00016885	▲ 0.00014759	▲ 0.00014759	▲ 0.00037326	▲ 0.00037326	
	2nd Quintile Group	-0.00375649	-0.00027537	▲ 0.00002821	▲ 0.00000165	0.00002265	0.00002265	▲ 0.00005314	▲ 0.00005314	
	3rd Quintile Group	-0.00061602	-0.00004368	▲ 0.00000777	▲ 0.00000900	▲ 0.00001222	▲ 0.00001222	▲ 0.00003339	▲ 0.00003339	
	4th Quintile Group	0.00329342	0.00056285	0.00006922	0.00008021	0.00006653	0.00006653	0.00015619	0.00015619	
	5th Quintile Group	0.01225434	0.00193180	0.00015934	0.00020039	0.00019022	0.00019022	0.00046107	0.00046107	
	Income Redistribution Effect	0.08196044	0.00632017	0.00051935	0.00072639	0.00076223	0.00060707	▲ 0.00026268	▲ 0.00060663	
	Individually Insured Persons	Intergenerational Effect	0.00914842	0.00148084	0.00052423	0.00073210	0.00075989	0.00071623	▲ 0.00026771	▲ 0.00014236
		Intragenerational Effect	0.18290994	0.00447763	0.00035786	0.00042249	0.00042949	▲ 0.00009320	0.00052154	▲ 0.00038375
		Born in the 1970s	0.06740677	0.00144910	▲ 0.00015934	▲ 0.00023127	▲ 0.00023705	▲ 0.00043596	▲ 0.00038162	▲ 0.00066596
		Inter: Income Class Effect	0.05657571	0.00080685	▲ 0.00002908	▲ 0.00005812	▲ 0.00006034	▲ 0.00009581	▲ 0.00009235	▲ 0.00015757
		Intra: Income Class Effect	0.01083107	0.00064225	▲ 0.00013026	▲ 0.00017315	▲ 0.00017672	▲ 0.00034015	▲ 0.00028927	▲ 0.00050769
		1st Quintile Group	-0.05685652	-0.00640916	▲ 0.00012641	▲ 0.00008810	▲ 0.00007899	▲ 0.00017497	▲ 0.00160715	▲ 0.00171664
		2nd Quintile Group	-0.01824089	-0.00242050	0.00005060	0.000031408	0.000031249	0.00050487	▲ 0.00180674	0.00213545
		3rd Quintile Group	0.00267611	-0.00070425	0.00017755	0.00023553	0.00024154	0.00038258	0.00017047	0.00026517
		4th Quintile Group	0.02121354	0.00276404	▲ 0.00018418	▲ 0.00029641	▲ 0.00030514	▲ 0.00049109	▲ 0.00053612	▲ 0.00061769
		5th Quintile Group	0.06203883	0.00741265	▲ 0.00020282	▲ 0.00033826	▲ 0.00034661	▲ 0.00056155	▲ 0.00030321	▲ 0.00057399
Born in the 1980s		0.07865018	0.00196814	0.00027779	0.00030123	0.00029606	▲ 0.00002773	0.00045800	▲ 0.00016624	
Inter: Income Class Effect		0.06247033	0.00054147	0.00017236	0.00021720	0.00022080	0.00026702	0.00052607	0.00054233	
Intra: Income Class Effect		0.01617984	0.00142667	0.00010544	0.00008403	0.00007526	▲ 0.000029474	▲ 0.00006807	▲ 0.00070856	
1st Quintile Group		-0.06989198	-0.00552422	▲ 0.00104284	▲ 0.00129211	▲ 0.00128869	▲ 0.00175889	▲ 0.00412606	▲ 0.00469511	
2nd Quintile Group		-0.02167502	-0.00313642	▲ 0.00063894	▲ 0.00088457	▲ 0.00093196	▲ 0.00122458	▲ 0.00262588	▲ 0.00313743	
3rd Quintile Group		0.00375598	0.00020983	▲ 0.00002126	▲ 0.00005309	▲ 0.00005069	▲ 0.00013333	▲ 0.00053274	0.00060625	
4th Quintile Group		0.02314828	0.00194838	0.00057321	0.00068004	0.00066992	0.00085394	0.00165165	0.00176743	
5th Quintile Group		0.08084258	0.00729910	0.00123527	0.00163375	0.00167668	0.00196811	0.00449949	0.00475029	
Born in the 1990s		0.03623399	0.00106040	0.00023941	0.00035254	0.00037048	0.00037048	0.00044775	0.00044775	
Inter: Income Class Effect		0.02809578	0.00036293	0.00019483	0.00026754	0.00027566	0.00027566	0.00033841	0.00033841	
Intra: Income Class Effect		0.00813821	0.00069747	0.00004478	0.00008500	0.00009482	0.00009482	0.00010933	0.00010933	
1st Quintile Group		-0.02193520	-0.00293870	▲ 0.00008589	▲ 0.00013360	▲ 0.000142014	▲ 0.000142014	▲ 0.00277373	▲ 0.00277373	
2nd Quintile Group		-0.00953060	-0.00090545	▲ 0.00052568	▲ 0.00082375	▲ 0.00089764	▲ 0.00089764	▲ 0.00171676	▲ 0.00171676	
3rd Quintile Group		-0.00032939	0.00034792	▲ 0.00009977	▲ 0.00014177	▲ 0.00014200	▲ 0.00014200	▲ 0.00037566	▲ 0.00037566	
4th Quintile Group		0.00787537	0.00059342	0.00037704	0.00060871	0.00070210	0.00070210	0.00120843	0.00120843	
5th Quintile Group		0.03205804	0.00360027	0.00115187	0.00177840	0.00185251	0.00185251	0.00376706	0.00376706	
Income Redistribution Effect		0.19143936	0.00595848	0.00088210	0.00115459	0.00118938	0.00062303	0.00075184	▲ 0.00024139	

Notes: The age classification for Reform Plan 4 is based on the participants' age as of 2025. Self-employed individuals and non-regular workers classified under regional members, particularly those born in the 1960s, are excluded from the analysis due to insufficient sample size. The Mean Log Deviation (MLD) in the absence of a pension system is calculated based on each member's lifetime labor income.

Male Participants
(Case reflecting differences in contribution periods and life expectancy
across income quintiles)

		Absence of NPS	The Current NPS	Difference from the Current System					
				Proposal 1	Proposal 2	Proposal 3	Proposal 4	Proposal 5	Proposal 6
Workplace-based Insured Persons	Intergenerational Effect	0.00038687	0.00056954	0.00016836	0.00019826	0.00020000	0.00022389	▲ 0.00078155	▲ 0.00081292
	Intragenerational Effect	0.10654972	0.22858336	▲ 0.00032219	0.00044742	0.00053551	▲ 0.00035798	▲ 0.03543512	▲ 0.03681166
	Born in the 1960s	0.01447340	0.01166653	▲ 0.00010566	▲ 0.00010566	▲ 0.00010566	▲ 0.00017845	▲ 0.00010566	▲ 0.00017845
	Inter-Income Class Effect	0.01335188	0.01168689	▲ 0.00009772	▲ 0.00009772	▲ 0.00009772	▲ 0.00016364	▲ 0.00009772	▲ 0.00016364
	Intra-Income Class Effect	0.00112153	-0.00002036	▲ 0.00000795	▲ 0.00000795	▲ 0.00000795	▲ 0.00001481	▲ 0.00000795	▲ 0.00001481
	1st Quintile Group	-0.01073864	-0.01282231	0.00008498	0.00008498	0.00008498	0.00014194	0.00008498	0.00014194
	2nd Quintile Group	-0.00456641	-0.00294416	▲ 0.00001270	▲ 0.00001270	▲ 0.00001270	▲ 0.00002162	▲ 0.00001270	▲ 0.00002162
	3rd Quintile Group	0.00120512	0.00248735	▲ 0.00002711	▲ 0.00002711	▲ 0.00002711	▲ 0.00004566	▲ 0.00002711	▲ 0.00004566
	4th Quintile Group	0.00514527	0.00591479	▲ 0.00002624	▲ 0.00002624	▲ 0.00002624	▲ 0.00004419	▲ 0.00002624	▲ 0.00004419
	5th Quintile Group	0.01007619	0.00734398	▲ 0.00002688	▲ 0.00002688	▲ 0.00002688	▲ 0.00004528	▲ 0.00002688	▲ 0.00004528
	Born in the 1970s	0.06034912	0.09716618	▲ 0.00104164	▲ 0.00102942	▲ 0.00102942	▲ 0.00176108	▲ 0.00148276	▲ 0.00837709
	Inter-Income Class Effect	0.05410618	0.09423915	▲ 0.00104308	▲ 0.00103543	▲ 0.00103543	▲ 0.00173624	▲ 0.00090870	▲ 0.00772838
	Intra-Income Class Effect	0.00624294	0.00292702	0.00000144	0.00000601	0.00000601	▲ 0.00002484	▲ 0.00057406	▲ 0.00064871
	1st Quintile Group	-0.06376138	-0.10965635	0.00080618	0.00079969	0.00079969	0.00133356	0.00397836	0.00458704
	2nd Quintile Group	-0.02153125	-0.01908540	0.00001425	0.00001498	0.00001498	0.00001696	0.00010478	0.00103236
	3rd Quintile Group	0.00265405	0.01835804	▲ 0.00017240	▲ 0.00016846	▲ 0.00016846	▲ 0.00028957	▲ 0.00054500	▲ 0.00069465
	4th Quintile Group	0.02710373	0.04895213	▲ 0.00029965	▲ 0.00029307	▲ 0.00029307	▲ 0.00049813	▲ 0.00181908	▲ 0.00206182
	5th Quintile Group	0.06177779	0.06435861	▲ 0.00034694	▲ 0.00034712	▲ 0.00034712	▲ 0.00058766	▲ 0.00230712	▲ 0.00351164
	Born in the 1980s	0.02603107	0.08946587	0.00036878	0.00065595	0.00067163	0.00058258	▲ 0.02169939	▲ 0.02210882
	Inter-Income Class Effect	0.02272518	0.08640035	0.00014095	0.00038750	0.00040194	▲ 0.00176823	▲ 0.02176823	▲ 0.02214475
	Intra-Income Class Effect	0.00330589	0.00306551	0.00022783	0.00026844	0.00026968	0.00031464	0.00006884	0.00003593
	1st Quintile Group	-0.03979685	-0.10323792	0.00017166	0.00008328	0.00007968	0.00003076	0.01933551	0.01946741
	2nd Quintile Group	-0.01421125	-0.01952611	▲ 0.00008181	▲ 0.00014031	▲ 0.00014392	▲ 0.00017085	▲ 0.00200054	▲ 0.00208232
	3rd Quintile Group	-0.00001749	0.01483175	▲ 0.00012281	▲ 0.00014404	▲ 0.00014766	▲ 0.00027576	▲ 0.00452021	▲ 0.00474065
	4th Quintile Group	0.01527611	0.04610049	▲ 0.00011106	▲ 0.00010735	▲ 0.00011063	▲ 0.00021912	▲ 0.00623707	▲ 0.00643656
	5th Quintile Group	0.04205538	0.06489729	0.00037184	0.00057687	0.00059222	0.00069896	▲ 0.00627066	▲ 0.00617195
	Born in the 1990s	0.00569613	0.03028479	0.00045634	0.00092656	0.00099896	0.00099896	▲ 0.00614730	▲ 0.00614730
	Inter-Income Class Effect	0.00426690	0.02920093	0.00037959	0.00082181	0.00088922	0.00088922	▲ 0.00632594	▲ 0.00632594
	Intra-Income Class Effect	0.00142923	0.00108386	0.00007675	0.00010475	0.00010974	0.00010974	0.00017864	0.00017864
	1st Quintile Group	-0.00888447	-0.03368619	▲ 0.00007561	▲ 0.00021973	▲ 0.00023594	▲ 0.00023594	0.00017864	0.00016278
	2nd Quintile Group	-0.00348873	-0.00712703	▲ 0.00010352	▲ 0.00022328	▲ 0.00023945	▲ 0.00023945	▲ 0.00008558	▲ 0.00008558
	3rd Quintile Group	-0.00057211	0.00428681	▲ 0.00007568	▲ 0.00014255	▲ 0.00015855	▲ 0.00015855	▲ 0.00026936	▲ 0.000162936
	4th Quintile Group	0.00299366	0.01495629	▲ 0.00001251	▲ 0.00000136	▲ 0.00001559	▲ 0.00001559	▲ 0.00204864	▲ 0.00204864
	5th Quintile Group	0.01138088	0.02265397	0.00034407	0.00069167	0.00075927	0.00075927	▲ 0.00132056	▲ 0.00132056
	Income Redistribution Effect	0.10693659	0.22919291	▲ 0.00015383	0.00064569	0.00073551	▲ 0.00013409	▲ 0.03621867	▲ 0.03762389
	Intergenerational Effect	0.02068883	0.00198904	0.00061841	0.00079250	0.00080834	0.00086894	0.00150066	0.00149369
	Intragenerational Effect	0.18713532	0.24125925	0.00392984	0.00605328	0.00627509	0.00657118	▲ 0.02620123	▲ 0.02595268
	Born in the 1960s	0.00207750	0.00684412	▲ 0.00019326	▲ 0.00019326	▲ 0.00019326	▲ 0.00032886	▲ 0.00019326	▲ 0.00032886
	Inter-Income Class Effect	0.00200962	0.00623414	▲ 0.00014619	▲ 0.00014619	▲ 0.00014619	▲ 0.00024677	▲ 0.00014619	▲ 0.00024677
	Intra-Income Class Effect	0.00006788	0.00060998	▲ 0.00004707	▲ 0.00004707	▲ 0.00004707	▲ 0.00008209	▲ 0.00004707	▲ 0.00008209
	1st Quintile Group	-0.00252705	-0.00629374	0.00009249	0.00009249	0.00009249	0.00015533	0.00009249	0.00015533
	2nd Quintile Group	-0.00097887	-0.00073977	▲ 0.00000549	▲ 0.00000549	▲ 0.00000549	▲ 0.00001019	▲ 0.00000549	▲ 0.00001019
	3rd Quintile Group	-0.00008090	0.00125947	▲ 0.00004808	▲ 0.00004808	▲ 0.00004808	▲ 0.00008152	▲ 0.00004808	▲ 0.00008152
	4th Quintile Group	0.00094691	0.00226750	▲ 0.00003605	▲ 0.00003605	▲ 0.00003605	▲ 0.00006117	▲ 0.00003605	▲ 0.00006117
	5th Quintile Group	0.00270779	0.00411652	▲ 0.00004994	▲ 0.00004994	▲ 0.00004994	▲ 0.00008453	▲ 0.00004994	▲ 0.00008453
	Born in the 1970s	0.07803673	0.09330317	▲ 0.00073647	▲ 0.00070558	▲ 0.00073556	▲ 0.00125432	▲ 0.00493467	▲ 0.00505734
	Inter-Income Class Effect	0.06624131	0.08952889	▲ 0.00027804	▲ 0.00024047	▲ 0.00024047	▲ 0.00040361	▲ 0.00639394	▲ 0.00662684
	Intra-Income Class Effect	0.01179542	0.00377427	▲ 0.00045843	▲ 0.00046511	▲ 0.00046511	▲ 0.00085071	0.00145927	0.00111951
	1st Quintile Group	-0.06595051	-0.09739601	0.00014433	0.00012469	▲ 0.21407019	0.00019438	0.00492823	0.00504970
	2nd Quintile Group	-0.02006197	-0.02148738	▲ 0.00012021	▲ 0.00013651	▲ 0.06146047	▲ 0.00024301	0.00003289	▲ 0.00009135
	3rd Quintile Group	0.00329651	0.01241700	▲ 0.00005202	▲ 0.00004306	0.00620905	▲ 0.00008653	0.00011091	0.00011422
	4th Quintile Group	0.02507895	0.04604680	▲ 0.00036174	▲ 0.00035852	0.07356427	▲ 0.00061453	▲ 0.00187638	▲ 0.00215969
	5th Quintile Group	0.06943244	0.06419386	▲ 0.00006878	▲ 0.00005171	0.10976226	▲ 0.00010102	▲ 0.00173143	▲ 0.00179337
	Born in the 1980s	0.07326708	0.10258465	0.00273022	0.00365219	0.00372678	0.00470722	▲ 0.01778516	▲ 0.01682835
	Inter-Income Class Effect	0.05819464	0.09941391	0.00265706	0.00358365	0.00366467	0.00482396	▲ 0.01714249	▲ 0.01582098
	Intra-Income Class Effect	0.01507244	0.00317074	0.00007316	0.00006855	0.00006211	▲ 0.00011674	▲ 0.00064267	▲ 0.00100736
	1st Quintile Group	-0.06510833	-0.11352380	▲ 0.00080162	▲ 0.00106961	▲ 0.00109196	▲ 0.00149184	0.01809508	0.01764766
	2nd Quintile Group	-0.02019151	-0.02590525	▲ 0.00091716	▲ 0.00117902	▲ 0.00120086	▲ 0.00167323	▲ 0.00386640	▲ 0.00449887
	3rd Quintile Group	0.00349891	0.01546368	▲ 0.00034552	▲ 0.00054994	▲ 0.00057205	▲ 0.00075229	▲ 0.00479646	▲ 0.00497689
	4th Quintile Group	0.02156393	0.05145168	0.00013408	0.00002864	0.00000658	0.00002166	▲ 0.00677561	▲ 0.00680508
	5th Quintile Group	0.07530943	0.07568443	0.00200339	0.00283848	0.00292041	0.00377896	▲ 0.00329928	▲ 0.00237419
	Born in the 1990s	0.03375401	0.03852731	0.00212935	0.00329993	0.00344715	0.00344715	▲ 0.00328814	▲ 0.00328814
	Inter-Income Class Effect	0.02617281	0.03649235	0.00203035	0.00318515	0.00333635	0.00333635	▲ 0.00352801	▲ 0.00352801
	Intra-Income Class Effect	0.00758120	0.00203496	0.00009900	0.00011478	0.00011080	0.00011080	0.00023987	0.00023987
	1st Quintile Group	-0.02043388	-0.03978403	▲ 0.00069923	▲ 0.00104922	▲ 0.00108930	▲ 0.00108930	▲ 0.00565356	▲ 0.00565356
	2nd Quintile Group	-0.00887829	-0.00763937	▲ 0.00057821	▲ 0.00089600	▲ 0.00095366	▲ 0.00095366	▲ 0.00224442	▲ 0.00224442
	3rd Quintile Group	-0.00030685	0.00621580	▲ 0.00013629	▲ 0.00036357	▲ 0.00040409	▲ 0.00040409	▲ 0.00228887	▲ 0.00228887
	4th Quintile Group	0.00733635	0.01689353	0.00021464	0.00024910	0.00022165	0.00022165	▲ 0.00193035	▲ 0.00193035
	5th Quintile Group	0.02986387	0.02634903	0.00129809	0.00217446	0.00231622	0.00231622	0.00104995	0.00104995
	Income Redistribution Effect	0.20782416	0.24324829	0.00454824	0.00684378	0.00708343	0.00744013	▲ 0.02470037	▲ 0.02445899

Notes: The age classification for Reform Plan 4 is based on the participants' age as of 2025. The Mean Log Deviation (MLD) in the absence of a pension system is calculated based on each participant's lifetime labor income.

Female Participants

(Case assuming all National Pension participants contribute for 20 years)

		Absence of NPS	The Current NPS	Difference from the Current System						
				Proposal 1	Proposal 2	Proposal 3	Proposal 4	Proposal 5	Proposal 6	
Workplace-based Insured Persons	Intergenerational Effect	0.01842276	0.00353252	0.0040876	0.00062301	0.00066406	0.00054522	0.00258187	0.00249533	
	Intragenerational Effect	0.11881846	0.00814504	0.0025614	0.00036882	0.00039100	0.0021898	0.00084091	0.00062763	
	Born in the 1960s	0.00348857	0.00088284	▲ 0.0000047	▲ 0.00000047	▲ 0.00000047	▲ 0.00000080	▲ 0.00000047	▲ 0.00000080	
	Inter: Income Class Effect	0.00287760	0.00007242	▲ 0.00000038	▲ 0.00000038	▲ 0.00000038	▲ 0.00000064	▲ 0.00000038	▲ 0.00000064	
	Intra: Income Class Effect	0.00061127	0.00001042	▲ 0.00000009	▲ 0.00000009	▲ 0.00000009	▲ 0.00000016	▲ 0.00000009	▲ 0.00000016	
	1st Quintile Group	-0.00193873	-0.00041431	▲ 0.00000169	▲ 0.00000169	▲ 0.00000169	▲ 0.00000282	▲ 0.00000169	▲ 0.00000282	
	2nd Quintile Group	-0.00066043	-0.00016606	0.00000427	0.00000427	0.00000427	0.00000712	0.00000427	0.00000712	
	3rd Quintile Group	-0.00024045	-0.00000613	▲ 0.00000267	▲ 0.00000267	▲ 0.00000267	▲ 0.00000446	▲ 0.00000267	▲ 0.00000446	
	4th Quintile Group	0.00024175	0.00012523	0.00000236	0.00000236	0.00000236	0.00000393	0.00000236	0.00000393	
	5th Quintile Group	0.00320912	0.00047170	▲ 0.00000236	▲ 0.00000236	▲ 0.00000236	▲ 0.00000394	▲ 0.00000236	▲ 0.00000394	
	Born in the 1970s	0.05057124	0.00199019	▲ 0.00003677	▲ 0.00005739	▲ 0.00006004	▲ 0.00010928	0.00006659	▲ 0.00008082	
	Inter: Income Class Effect	0.04649581	0.00097526	▲ 0.00007544	▲ 0.00011345	▲ 0.00011886	▲ 0.00018829	▲ 0.00005039	▲ 0.00012231	
	Intra: Income Class Effect	0.00407543	0.00101493	0.00003867	0.00005606	0.00005882	0.00007901	0.00011698	0.00011429	
	1st Quintile Group	-0.03526103	-0.00662078	0.00014554	0.00022826	0.00024452	0.00036249	▲ 0.00013560	▲ 0.00018655	
	2nd Quintile Group	-0.01880932	-0.00240882	0.00024239	0.00035444	0.00036413	0.00057527	0.00059617	0.00081837	
	3rd Quintile Group	-0.00601387	0.00074517	0.00011833	0.00013456	0.00013631	0.00022013	0.00001934	0.00010264	
	4th Quintile Group	0.01637350	0.00539162	▲ 0.00013462	▲ 0.00021318	▲ 0.00022505	▲ 0.00034508	▲ 0.00004564	▲ 0.00017693	
	5th Quintile Group	0.04778615	0.00390774	▲ 0.00044802	▲ 0.00046110	▲ 0.00046110	▲ 0.00073381	▲ 0.00031730	▲ 0.00061114	
	Born in the 1980s	0.05232569	0.00412666	0.00017941	0.00021773	0.00021714	0.00009466	0.00049115	0.00035281	
	Inter: Income Class Effect	0.04739176	0.00120929	▲ 0.00006871	▲ 0.00014001	▲ 0.00015973	▲ 0.00029171	▲ 0.00003134	▲ 0.00017391	
	Intra: Income Class Effect	0.00524392	0.00291757	0.00024812	0.00038723	0.00037684	▲ 0.00038637	0.00052349	0.00052672	
	1st Quintile Group	-0.06320136	-0.01156039	0.00032339	0.00048654	0.00056472	▲ 0.00010579	▲ 0.00001283	0.00055332	
	2nd Quintile Group	-0.02338870	-0.00199421	0.00032675	0.00056938	0.00061796	0.00090541	0.00046909	0.00079473	
	3rd Quintile Group	0.00221130	0.00365803	0.00017521	0.00024961	0.00025950	0.00011301	0.00024726	0.00026118	
	4th Quintile Group	0.02615525	0.00546304	▲ 0.00005776	▲ 0.00018014	▲ 0.00022412	▲ 0.00048801	0.00012657	▲ 0.00017274	
	5th Quintile Group	0.06346747	0.00735110	▲ 0.00042847	▲ 0.00076765	▲ 0.00084122	▲ 0.00123982	▲ 0.00048660	▲ 0.00093977	
	Born in the 1990s	0.01152266	0.00194534	0.00011396	0.00020896	0.00023439	0.00023439	0.00028364	0.00028364	
	Inter: Income Class Effect	0.00967212	0.00020965	0.00001968	0.00001926	0.00001618	0.00001618	0.00004128	0.00004128	
	Intra: Income Class Effect	0.00185054	0.00173569	0.00009428	0.00018970	0.00021822	0.00021822	0.00024236	0.00024236	
	1st Quintile Group	-0.02038394	-0.00233274	▲ 0.00015948	▲ 0.00016046	▲ 0.00012931	▲ 0.00037439	▲ 0.00033749	▲ 0.00033749	
	2nd Quintile Group	-0.00762651	-0.00069212	▲ 0.00004173	▲ 0.00001753	0.00000310	0.00000310	▲ 0.00009175	▲ 0.00009175	
	3rd Quintile Group	-0.00070400	-0.00032315	0.00003955	0.00008134	0.00008409	0.00008409	0.00010239	0.00010239	
	4th Quintile Group	0.00767381	0.00103858	0.00009418	0.00012053	0.00011245	0.00011245	0.00020988	0.00020988	
	5th Quintile Group	0.02289118	0.00404513	0.00016176	0.00016581	0.00014789	0.00014789	0.00035923	0.00035923	
	Income Redistribution Effect	0.13724122	0.01167756	0.00066490	0.00099183	0.00105506	0.00076419	0.00342759	0.00312297	
	Individually Insured Persons	Intergenerational Effect	0.01045556	0.00161847	0.00020902	0.00033274	0.00035846	0.00025168	0.00124759	0.00117180
		Intragenerational Effect	0.16398256	0.00575739	0.00040420	0.00054176	0.00054884	0.00038110	0.00102689	0.00079853
		Born in the 1970s	0.02136183	0.00081841	▲ 0.00002230	▲ 0.00003576	▲ 0.00003615	▲ 0.00007675	▲ 0.00006341	▲ 0.00006851
		Inter: Income Class Effect	0.01859388	0.00029475	0.00000693	0.00000603	0.00000562	0.00000987	▲ 0.00003969	▲ 0.00004723
		Intra: Income Class Effect	0.00276796	0.00052366	▲ 0.00002923	▲ 0.00004179	▲ 0.00004176	▲ 0.00008662	0.00003628	▲ 0.00002128
		1st Quintile Group	-0.02570511	-0.00303392	▲ 0.00013499	▲ 0.00017033	▲ 0.00017183	▲ 0.00028751	▲ 0.00005306	▲ 0.00066116
		2nd Quintile Group	-0.00887076	0.00008530	0.00004012	0.00007531	0.00008187	0.00011306	0.00055756	0.00064652
		3rd Quintile Group	0.00231985	-0.00098842	0.00001909	0.00001116	0.00000668	0.00002013	0.00001921	0.00005926
		4th Quintile Group	0.00997599	0.00111177	0.00010695	0.00015438	0.00016257	0.00024678	0.00016980	0.00022814
		5th Quintile Group	0.02504799	0.00334594	▲ 0.00006040	▲ 0.00011231	▲ 0.00012105	▲ 0.00017907	▲ 0.00017123	▲ 0.00029405
		Born in the 1980s	0.11812614	0.00396449	0.00031713	0.00040656	0.00040240	0.00027526	0.00079072	0.00062745
		Inter: Income Class Effect	0.10645843	0.00196724	0.00028436	0.00036879	0.00036738	0.00044336	0.00079019	0.00086933
Intra: Income Class Effect		0.01166771	0.00199724	0.00003277	0.00003778	0.00003502	▲ 0.00016810	▲ 0.00000847	▲ 0.00024188	
1st Quintile Group		-0.10961986	-0.01290958	▲ 0.00101956	▲ 0.00141611	▲ 0.00145930	▲ 0.00017244	▲ 0.00287794	▲ 0.00323088	
2nd Quintile Group		-0.03770509	-0.00646034	▲ 0.00053514	▲ 0.00070752	▲ 0.00069636	▲ 0.00092460	▲ 0.00194899	▲ 0.00223744	
3rd Quintile Group		0.00610426	-0.00023829	▲ 0.00000066	0.00007110	0.00012277	0.00010268	0.00112971	0.00119004	
4th Quintile Group		0.04278002	0.00607749	0.00050383	0.00075532	0.00077680	0.00085429	0.00085603	0.00093084	
5th Quintile Group		0.11010239	0.01552797	0.00108430	0.00133499	0.00129111	0.00158096	0.00283271	0.00310557	
Born in the 1990s		0.02449458	0.00097449	0.00010937	0.00017093	0.00018259	0.00018259	0.00023958	0.00023958	
Inter: Income Class Effect		0.01922310	0.00016146	0.00005050	0.00006931	0.00007148	0.00007148	0.00010483	0.00010483	
Intra: Income Class Effect		0.00527149	0.00081303	0.00005887	0.00010165	0.00011111	0.00011111	0.00013475	0.00013475	
1st Quintile Group		-0.02433676	-0.00168326	▲ 0.00038563	▲ 0.00055487	▲ 0.00057394	▲ 0.00057394	▲ 0.00097051	▲ 0.00097051	
2nd Quintile Group		-0.00521582	0.00033081	▲ 0.00009035	▲ 0.00008850	▲ 0.00004973	▲ 0.00004975	▲ 0.00026229	▲ 0.00026229	
3rd Quintile Group		0.00048872	0.00022868	▲ 0.00000797	0.00000538	0.00002509	0.00002509	0.00008846	0.00008846	
4th Quintile Group		0.00786948	-0.00084853	0.00004372	0.00003459	▲ 0.00000076	▲ 0.00000076	0.00006260	0.00006260	
5th Quintile Group		0.02646586	0.00278533	0.00048929	0.00070506	0.00071047	0.00071047	0.00121650	0.00121650	
Income Redistribution Effect		0.17443812	0.00737586	0.00061322	0.00087450	0.00090730	0.00063278	0.00227447	0.00197033	

Notes: The age classification for Reform Plan 4 is based on the participants' age as of 2025. Self-employed individuals and non-regular workers classified under regional members, particularly those born in the 1960s, are excluded from the analysis due to insufficient sample size. The Mean Log Deviation (MLD) in the absence of a pension system is calculated based on each member's lifetime labor income.

Female Participants
 (Case reflecting differences in contribution periods and life expectancy
 across income quintiles)

		Absence of NPS	The Current NPS	Difference from the Current System						
				Proposal 1	Proposal 2	Proposal 3	Proposal 4	Proposal 5	Proposal 6	
Workplace-based Insured Persons	Intergenerational Effect	0.05500044	0.00517174	0.00039225	0.00043093	0.00044171	0.00035310	0.00370467	0.00365727	
	Intragenerational Effect	0.15197272	0.15201477	0.00075489	0.00141670	0.00148997	0.00114488	▲ 0.00009308	▲ 0.00049024	
	Born in the 1960s	0.00878985	0.00565641	▲ 0.00003281	▲ 0.00003281	▲ 0.00003281	▲ 0.00005498	▲ 0.00003281	▲ 0.00005498	
	Inter-Income Class Effect	0.00711410	0.00575592	▲ 0.00002973	▲ 0.00002973	▲ 0.00002973	▲ 0.00004969	▲ 0.00002973	▲ 0.00004969	
	Intra-Income Class Effect	0.01675755	-0.00009951	▲ 0.00003008	▲ 0.00003008	▲ 0.00003008	▲ 0.00000529	▲ 0.00003008	▲ 0.00000529	
	1st Quintile Group	-0.00508115	-0.00682994	0.00002496	0.00002496	0.00002496	0.00004166	0.00002496	0.00004166	
	2nd Quintile Group	-0.00269600	-0.00236554	0.00000556	0.00000556	0.00000556	0.00000556	0.00000556	0.00000556	
	3rd Quintile Group	-0.00021025	0.00050932	▲ 0.00001282	▲ 0.00001282	▲ 0.00001282	▲ 0.00002144	▲ 0.00001282	▲ 0.00002144	
	4th Quintile Group	0.00200427	0.00334538	▲ 0.00000973	▲ 0.00000973	▲ 0.00000973	▲ 0.00001628	▲ 0.00000973	▲ 0.00001628	
	5th Quintile Group	0.00765887	0.00534127	▲ 0.00001105	▲ 0.00001105	▲ 0.00001105	▲ 0.00001847	▲ 0.00001105	▲ 0.00001847	
	Born in the 1970s	0.08765887	0.05429902	▲ 0.00031479	▲ 0.00027375	▲ 0.00027375	▲ 0.00027234	▲ 0.00017381	0.00128789	
	Inter-Income Class Effect	0.08022591	0.05202457	▲ 0.00035427	▲ 0.00032178	▲ 0.00032059	▲ 0.00054285	0.00104336	0.00081673	
	Intra-Income Class Effect	0.00743297	0.00227445	0.00003947	0.00004803	0.00004826	0.00006904	0.00024454	0.00025122	
	1st Quintile Group	-0.05418923	-0.06192154	0.00016645	0.00013831	0.00013800	0.00023054	▲ 0.000085240	▲ 0.00076333	
	2nd Quintile Group	-0.02569653	-0.01994533	0.00008438	0.00007693	0.00007692	0.00012769	▲ 0.00031019	▲ 0.00026101	
	3rd Quintile Group	-0.00728789	0.00538699	0.00007928	0.00008486	0.00008455	0.00014096	0.00006347	0.00069460	
	4th Quintile Group	0.01962601	0.03151696	▲ 0.00000603	▲ 0.00000589	▲ 0.00000589	▲ 0.00001486	0.00047442	0.00046439	
	5th Quintile Group	0.07498062	0.04729736	▲ 0.00024438	▲ 0.00024604	▲ 0.00024503	▲ 0.00041527	0.00029793	0.00011656	
	Born in the 1980s	0.04564444	0.05798135	0.00032359	0.00050247	0.00051903	0.00051903	▲ 0.00017689	▲ 0.00143195	
	Inter-Income Class Effect	0.04114828	0.05433211	0.00013977	0.00027783	0.00029126	0.00014805	▲ 0.00164895	▲ 0.00182250	
	Intra-Income Class Effect	0.00449616	0.00364924	0.00018392	0.00022464	0.00022777	0.00022777	0.00023206	▲ 0.00039056	
	1st Quintile Group	-0.05418906	-0.07256241	▲ 0.00007124	▲ 0.00013378	▲ 0.00013719	▲ 0.00002439	0.00018765	0.000200780	
	2nd Quintile Group	-0.02005355	-0.02102845	0.00003974	0.00000663	0.00000663	0.00005244	▲ 0.00035297	▲ 0.00028811	
	3rd Quintile Group	0.00189597	0.00017021	0.00006117	0.00007033	0.00006695	0.00001984	▲ 0.00010544	▲ 0.00016235	
	4th Quintile Group	0.02242559	0.03465236	▲ 0.00000886	0.00001951	0.00001691	▲ 0.00003430	▲ 0.00045712	▲ 0.00051928	
	5th Quintile Group	0.05441729	0.05341754	0.00016300	0.00027183	0.00028773	0.00023594	0.000058406	0.00064750	
	Born in the 1990s	0.00987956	0.03407799	0.00077891	0.00122079	0.00127608	0.00127608	▲ 0.00007127	▲ 0.00007127	
	Inter-Income Class Effect	0.00829291	0.03123350	0.00064718	0.00104335	0.00109296	0.00109296	▲ 0.00028425	▲ 0.00028425	
	Intra-Income Class Effect	0.00158666	0.00284449	0.00013172	0.00017744	0.00018312	0.00018312	0.00001297	0.00001297	
	1st Quintile Group	-0.01747725	-0.03971536	▲ 0.00028754	▲ 0.00042498	▲ 0.00043776	▲ 0.00043776	0.00010513	0.00010513	
	2nd Quintile Group	-0.00653899	-0.01272424	▲ 0.00016729	▲ 0.00028724	▲ 0.00029994	▲ 0.00029994	▲ 0.00035670	▲ 0.00053670	
	3rd Quintile Group	-0.00060361	0.00309642	▲ 0.00001572	▲ 0.00008641	▲ 0.00009917	▲ 0.00009917	▲ 0.00032372	▲ 0.00032372	
	4th Quintile Group	0.00657955	0.01918877	0.00008074	0.00009584	0.00008424	0.00008424	▲ 0.00036217	▲ 0.00036217	
	5th Quintile Group	0.01962697	0.03299896	0.00052153	0.00088022	0.00093376	0.00093376	0.00038404	0.00038404	
	Income Redistribution Effect	0.20697317	0.15718651	0.00108714	0.00184763	0.00193168	0.00193168	0.00361159	0.00316703	
	Individually Insured Persons	Intergenerational Effect	0.03979218	0.00749069	0.00043442	0.00058518	0.00059611	0.00053358	0.00438571	0.00438935
		Intragenerational Effect	0.17596164	0.15157438	0.00270021	0.00394869	0.00404326	▲ 0.00479165	0.00629072	0.00760876
		Born in the 1970s	0.06153134	0.05457143	0.00014711	0.00033155	0.00034409	0.00051061	0.00404974	0.00430022
		Inter-Income Class Effect	0.05586024	0.04950190	0.00023476	0.00043021	0.00044317	0.00069785	0.00407418	0.00430223
		Intra-Income Class Effect	0.00567110	0.00506953	▲ 0.00008765	▲ 0.00009866	▲ 0.00009908	▲ 0.00018724	▲ 0.00002443	▲ 0.00010202
		1st Quintile Group	-0.05597484	-0.06134882	▲ 0.00015416	▲ 0.00024736	▲ 0.00025097	▲ 0.00041276	▲ 0.00329679	▲ 0.00349746
		2nd Quintile Group	-0.02291060	-0.01823596	0.00001053	▲ 0.00016824	▲ 0.00017177	▲ 0.000228024	▲ 0.00052026	▲ 0.00055602
		3rd Quintile Group	0.00158216	0.00653182	0.00004105	0.00003164	0.00002807	0.00005515	0.00173899	0.00178988
		4th Quintile Group	0.02806239	0.03150886	▲ 0.00001066	0.00001093	0.00000729	0.00001709	0.00053614	0.00051039
		5th Quintile Group	0.05691200	0.04661364	0.00013765	0.00027435	0.00028830	0.00043351	0.00151748	0.00165120
		Born in the 1980s	0.09804797	0.07384176	0.00193114	0.00264252	0.00267884	0.00330502	0.00175086	0.00242367
		Inter-Income Class Effect	0.08836344	0.07110726	0.00190326	0.00260423	0.00263994	0.00337388	0.00209592	0.00289705
Intra-Income Class Effect		0.00968452	0.00273450	0.00002788	0.00003830	0.00003889	▲ 0.00006886	▲ 0.00034506	▲ 0.00047338	
1st Quintile Group		-0.09098252	-0.09067978	▲ 0.00009406	▲ 0.00120144	▲ 0.00121172	▲ 0.00158954	0.00060762	0.00019252	
2nd Quintile Group		-0.03129627	-0.03023407	▲ 0.00056702	▲ 0.00079640	▲ 0.00080651	▲ 0.00105889	▲ 0.00253520	▲ 0.00283858	
3rd Quintile Group		0.00506670	0.00798560	▲ 0.00012276	▲ 0.00024978	▲ 0.00025977	▲ 0.00033745	0.00057678	0.00052478	
4th Quintile Group		0.03550860	0.04554562	0.00025196	0.00023998	0.00023096	0.00027362	▲ 0.00080617	▲ 0.00075407	
5th Quintile Group		0.09138802	0.07010714	0.00140655	0.00204594	0.00208593	0.00264338	0.00181191	0.00240197	
Born in the 1990s		0.02033118	0.01988905	0.00073795	0.00113005	0.00117876	0.00117876	0.00071955	0.00071955	
Inter-Income Class Effect		0.01595570	0.01849608	0.0006247	0.00103269	0.00107919	0.00107919	0.00058419	0.00058419	
Intra-Income Class Effect		0.00437548	0.00138451	0.00007548	0.00009736	0.00009957	0.00009957	0.00013536	0.00013536	
1st Quintile Group		-0.02020018	-0.02563286	▲ 0.00034705	▲ 0.00049067	▲ 0.00050414	▲ 0.00050414	0.00022053	0.00022053	
2nd Quintile Group		-0.00432927	-0.00683178	▲ 0.00010796	▲ 0.00021772	▲ 0.00023122	▲ 0.00023122	▲ 0.00053062	▲ 0.00053062	
3rd Quintile Group		0.00040565	0.00276298	▲ 0.00003719	▲ 0.00009039	▲ 0.00010269	▲ 0.00010269	▲ 0.00012100	▲ 0.00012100	
4th Quintile Group		0.00653189	0.01150366	▲ 0.00001656	▲ 0.00006380	▲ 0.00007733	▲ 0.00007733	▲ 0.00039153	▲ 0.00039153	
5th Quintile Group		0.02196739	0.01958250	0.00058424	0.00095995	0.00101494	0.00101494	0.00095797	0.00095797	
Income Redistribution Effect		0.21575382	0.15906508	0.00313463	0.00453387	0.00463937	0.00532522	0.01067643	0.01143811	

Notes: The age classification for Reform Plan 4 is based on the participants' age as of 2025. Self-employed individuals and non-regular workers classified under regional members, particularly those born in the 1960s, are excluded from the analysis due to insufficient sample size. The Mean Log Deviation (MLD) in the absence of a pension system is calculated based on each member's lifetime labor income.