

# Effects of Immobility of Inequality on Lifetime Income Distribution

Koji HAMADA

Executive Research Fellow

Economic and Social Research Institute (ESRI), Japan

## 1. Introduction

The inequality in lifetime income mainly results from the inequality in annual income as well as from immobility of inequality, including unlikeliness to change income ranking on the time series basis. Identifying immobility of income inequality requires collection of panel data by continually surveying the same persons. Higuchi, et al. (2003), Sakaguchi (2003) and Ota and Sakaguchi (2004) employ “Japanese Panel Survey on Consumers” of IRHE (the Institute for Research on Household Economics) to analyze immobility of inequality based on how many households in a certain income quintile group will shift to a different income quintile group or stay in the same income quintile group on a percentage basis (the percentage of households staying in the same income quintile group is referred to as “staying percentage”). Based on the said survey data, Hamada (2007) also uses the indicators of immobility of income inequality to quantify income immobility of inequality by incorporating a shift within the same income quintile group.

As IRHE has been conducting “Japanese Panel Survey on Consumers” for 20 years, the survey provides the panel data that cover the longest time span in Japan, but it is not long enough to cover lifetime income. On the other hand, “The Japanese Longitudinal Survey on Employment and Fertility (LOSEF): the 2011 Internet Version” as seen in Takayama, Inagaki and Oshio (2012) is a retrospective survey but provides highly correct data because respondents are supposed to transcribe their data from their Social Security Statements, which are sent to public pension plan participants. For this reason, analysts are able to estimate lifetime wage for respondents with membership in KNH (Kosei-Nenkin-Hoken, employees’ pension). They are also able to calculate lifetime income from the said estimated lifetime wage as well as from transcribed data on pension benefits and pension contributions (a deductible item).

Based on the data from “The Japanese Longitudinal Survey on Employment and Fertility (LOSEF),” this paper recognizes the income ranking consistency indicator, as seen in Toyoda (2005a, 2005b), would serve as an income immobility of inequality indicator and monitors how much income inequality is immobile as well as how much immobility contributes to lifetime income inequality, with focus put on respondents with membership in KNH born in the 1950s. In addition,

this paper also estimates redistribution effect of public pension program. Based on these findings, this paper analyzes how much immobility of inequality, its contribution to lifetime income inequality, and redistribution effect of public pension program would change between those born in the early 1950s and those born in the late 1950s, and whether intergenerational inequality exists between these two groups. In addition, by incorporating respondents with Category 3 membership born in the 1950s into respondents with membership in KNH, this paper also analyzes any difference in terms of income inequality, immobility and pension program's redistribution effects.

As for analytical methods, Section 2 describes how to estimate lifetime income, and then Section 3 explains immobility of income inequality indicators and redistribution effect indicators. Section 4 estimates wage level and pension for quintile groups, while Section 5 measures indicators of immobility of inequality and public pension's redistribution effect. At last, Section 6 describes the conclusion of this paper.

## 2. Basic data and how to estimate lifetime income

### (1) Basic data and what is analyzed

Income data in this paper come from individual survey data on "The Japanese Longitudinal Survey on Employment and Fertility (LOSEF): the 2011 Internet Version" as stated in Takayama, Inagaki and Oshio (2012) (5,953 valid responses are available). Although the survey is not a panel survey but a retrospective survey, it provides highly accurate data because pension plan participants are supposed to transcribe their data from their Social Security Statements. The survey covers public pension plan participants that are registered as Internet survey service provider's monitors, are born from the 1950s and the 1970s and receive/keep their Social Security Statements, which provide all of their past pension records in details, but it does not include mutual aid association pension participants because their pension records are not stated on their Social Security Statements.

This paper mainly analyzes respondents with membership in KNH born in the 1950s because their lifetime income, consisting of their lifetime wage, public pension benefits and pension contributions (a deductible item), is able to be estimated. This paper also analyzes respondents with Category 3 membership born in the 1950s by estimating their income. It analyzes respondents with membership in KNH for 20 years or longer; or in other words, their membership in KNH is a half or longer of their 40-year-long pension contribution paying period to qualify for receiving the full amount of their basic pension benefits in the future. In a similar way, this paper analyzes respondents with Category 3 membership for 20 years or longer.

Among these survey samples, 1,153 samples (out of this total, 783 respondents with membership in KNH) have all the data on their wage, public pension benefits and pension contributions necessary

for analytical purposes in this paper.<sup>1</sup>

## (2) How to estimate lifetime income

In the similar manner to Inagaki (2012) as follows, this paper has estimated lifetime income for respondents with membership in KNH based on standard compensation, public pension benefit, pension contribution (a deductible item) and other data from transcribed information from Social Security Statements. This paper has also calculated lifetime wage of respondents with Category 3 membership by Category 3 accreditation criteria. As with Inagaki (2012), this paper employs wage growth rates (reevaluation rate of standard compensation) as a discount rate for calculation of their present value (valued as of FY2011).<sup>2</sup>

### 1) Lifetime wage

This paper has estimated annual revenues of respondents with membership in KNH by assuming that their standard compensation in April as stated in Social Security Statements would represent their monthly salary and that their bonus would stand at 30% of the annual sum of their monthly salaries. Then, this paper calculates the present values of the sum of their annual revenues that they are supposed to receive until 59 years old. If a respondent with membership in KNH is younger than age 59 as of the survey, this paper assumes that the present value of his/her annual revenues as of the survey would represent the present value of his/her annual revenues that he/she is supposed to receive from the survey timing up until 59 years old.<sup>3</sup>

As for lifetime wage of respondents with Category 3 membership, this paper estimates their annual revenues by assuming that they would earn wage income of 0 in an unemployed year or make wage income at the amount of Category 3 accreditation criteria value in a year when they get employed. As respondents with Category 3 membership are often facing lower wage income than the accreditation criteria value even if they are working, this assumption will increase their lifetime wage or in other words decrease redistribution effect of the public pension program.

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<sup>1</sup> A large number of people join private pension schemes, such as personal pension plans, but personal pension is excluded from income and is regarded as withdrawal from their savings according to the universal definitions of SNA (system of national accounts). However, operating surplus, property income and remittance from family members are included in income according to SNA, but these data are unable to estimate because they are not stated on Social Security Statements. As for respondents with membership in KNH, which this paper puts focus on, wages and public pension benefits will account for a high percentage of their lifetime income. For this reason, this paper analyzes their wages and public pensions.

<sup>2</sup> Analysts often use interest rate as a discount rate and assume interest rate at a higher level than wage growth rate. However, labor will get less available than capital due to dwindling birthrate and aging population, possibly increase wage growth rate quicker than interest rate, so wage growth rate may stand at a higher level than interest rate. For this reason, using wage growth rate as discount rate is not necessarily a biased assumption. In addition, as in Inagaki (2012), public pension program is primarily based on the concept of intergenerational support and is designed to reflect wage growth to insurance contributions as well as pension benefits. In this context, using wage growth rate as discount rate complies with the basic concept.

<sup>3</sup> As wage growth rate is used as discount rate, fluctuation of general wage level will not pose any impact even under such assumption.

## 2) Pension contributions

In transcribed data from Social Security Statements, pension contributions of respondents with membership in KNH do not include exempted contribution payable during employees' pension funds membership period. For this reason, this paper employs the approach of Inagaki (2012) by multiplying annual standard compensation as mentioned in 1) above (i.e., overall compensation including bonuses since FY2003 when the overall compensation program is introduced) by the annual contribution rate for the corresponding year. By doing so, this paper has calculated the sum of present value of their annual pension contributions payable up until 59 years old. If a respondent with membership in KNH is younger than age 59 as of the survey, this paper puts the same assumption as 1) above that the present value of his/her overall compensations (annual revenues) as of the survey would represent the present value of his/her overall compensations that he/she is supposed to receive from the survey timing up until 59 years old. Then, this paper calculates the present value of annual pension contributions payable up until 59 years old by multiplying the overall compensation's present value by the pension contribution rate for the corresponding year.

In addition, as mentioned in 3) below, since estimated annual pension benefits are calculated in line with the old-age pension program, pension contribution will correspond to the old-age pension portion. This paper has multiplied the said amount by 85% because old-age pension benefits account for 85% of the entire pension benefits.

## 3) Estimated pension benefits

As Inagaki (2012), basic pension data in principle come from transcribed data from Social Security Statements. Recognizing KNH old-age pension benefits (earnings-related portion) for age 65 or older in the similar manner to Inagaki (2012), this paper calculates the amount of KNH pension benefits based on the sum of present value of annual standard compensations that they are supposed to receive up until 59 years old (overall compensation including bonuses since FY2003 when the overall compensation program is introduced) as mentioned in 1) above, because the transcribed data from Social Security Statements do not include employees' pension fund's subrogated portion of KNH old-age pension benefits.

This paper estimates the present value of estimated pension benefits based on the Actuarial Affairs Division, Pension Bureau, Ministry of Health, Labour and Welfare (2010) so that annual reduction of pension benefits in real terms (income replacement ratio of 50.1% at minimum) due to macroeconomic slide will be reflected.<sup>4</sup> In addition, because their pension benefits are revised based on price growth after they start receiving the pension benefits (income replacement ratio of 40.1% at

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<sup>4</sup> Inagaki (2012) estimates the data, assuming that pension benefits would decrease 15% in real terms on average during the pension eligibility period.

minimum; the pension benefits are revised based on wage growth thereafter), the annual discount rate will stand at a gap with wage growth rate (real wage growth rate of 1.5%).

### 3. Indicators that represent immobility of inequality, contribution and redistribution effect

To analyze the relation of income (such as wages and public pension benefits) in each age category (income in their 20's, 30's, etc.) to the inequality in lifetime wage and lifetime income, lifetime wage (income) inequality is decomposed by various factors that contribute to. To do so, inequality indicators must be able to be decomposed by several factors. In addition, as income might stand at zero in some cases, inequality indicators must be able to define zero status (this requirement cannot be satisfied with Theil index or Atkinson index). From these perspectives, this paper uses Gini coefficient, quasi-Gini coefficient, relative variance and quasi-relative variance as inequality indicators.

#### (1) Gini coefficient and quasi-Gini coefficient

Gini coefficient (G) is defined as the ratio of the area surrounded by the complete equality line and Lorenz Curve (the inequality indicator based on the weakest value judgment) over the total area under the complete equality line. If we assign a number to each member in an ascending order of their income,

$$G = [1/2 - 1/(2n^2u) \{ Y_1 + \sum_{j=1}^{n-1} ( \sum_{i=1}^j Y_i + \sum_{i=1}^{j+1} Y_i ) \} ] / (1/2) ,$$

where  $Y_i$ : Lifetime wage of the  $i$ th member;  $u$ : average of  $Y_i$ ; and  $n$ : the number of members.

On the other hand, quasi-Gini coefficient ( $G_m$ ) ( $m=1-M$ ,  $M$  represents the number of factors) comes from similar calculation process on term-specific wage levels, pension benefits and other factors by putting them in an ascending order of their lifetime wage:

$$G_m = 1/2 - 1/(2n^2u_m) \{ Y_{1m} + \sum_{j=1}^{n-1} ( \sum_{i=1}^j Y_{im} + \sum_{i=1}^{j+1} Y_{im} ) \} ] / (1/2) ,$$

where  $Y_{im}$ : the value of the factor  $m$  for the  $i$ th member; and  $u_m$ : average of  $Y_{im}$ .

#### 1) Indicator representing immobility of inequality

As an indicator for immobility of income inequality, this paper would like to measure immobility of income inequality in the following manner.

As Toyoda (2005a and 2005b) explains, quasi-Gini coefficient is rewritten as income ranking consistency indicator multiplied by the Gini coefficient. For this reason, the ratio between the

quasi-Gini coefficient ( $G_m$ ) of term-specific income ( $Y_m$ ) based on lifetime wage  $Y$ 's ranking ( $s(Y)$ ) and the term-specific income's Gini coefficient ( $G(Y_m)$ ) based on term-specific income ranking ( $s(Y_m)$ ) will denote how much immobile term-specific income ranking is in relation with lifetime income. This is expressed as follows:

$$G_m / G(Y_m) = r(s(Y), Y_m) / r(s(Y_m), Y_m) ,$$

where ( $r(s(Y), Y_m), r(s(Y_m), Y_m)$ ): Correlation coefficient between lifetime wage ranking and term-specific income and between term-specific income ranking and term-specific income.<sup>5</sup>

This immobility indicator takes a smaller value if term-specific income ranking deviates from lifetime wage ranking. It will stand at 1 if both income rankings completely match, or turn -1 if they move in the opposite direction.

## 2) Indicators of contribution to inequality and redistribution effect

As mentioned in Mizoguchi, Takayama and Terasaki (1978) and Takayama (1980), income inequality is decomposed by several factors based on quasi-Gini coefficient. In other words, according to (1) above, because the sum of quasi-Gini coefficient ( $G_m$ ) multiplied by the percentage of a factor to lifetime wage (i.e.,  $u_m/u \times G_m$ ) is equal to lifetime wage's Gini coefficient ( $G$ ), it is decomposed by factors based on quasi-Gini coefficient. For this reason,  $u_m/u \times G_m$  represents how much such factor contributes to lifetime wage inequality, while quasi-Gini coefficient ( $G_m$ ) denotes how much a unit of such factor contributes to the inequality.

In addition, by making use of this decomposition of income inequality based on quasi-Gini coefficient, this paper would like to examine the following indicator of income redistribution effect of pension.<sup>6</sup>

If average and quasi-Gini coefficient of redistribution factors(including pension), redistributed lifetime income among members are  $u_r$  and  $G_r$  ( $r=1-R$ ;  $R$  denotes the number of redistribution factors) and  $u_d$  and  $G_d$ , respectively, these data, average and Gini coefficient of lifetime wage among all members,  $u$  and  $G$  will lead to the following formula:

<sup>5</sup> If  $s(Y)_i$  and  $s(Y_m)_i$  represent the ranking of the  $i$ th household's lifetime wage ( $Y_i$ ) and term-specific income ( $Y_{im}$ ), respectively, term-specific income's quasi-Gini coefficient ( $G_m$ ) in terms of lifetime wage ranking and term-specific income's Gini coefficient ( $G(Y_m)$ ) are expressed as follows:

$$G_m = 2 / (n^2 u_m) \sum_{i=1}^n s(Y)_i (Y_{im} - u_m) , \quad G(Y_m) = 2 / (n^2 u_m) \sum_{i=1}^n s(Y_m)_i (Y_{im} - u_m) , \quad \text{which leads to:}$$

$$G_m / G(Y_m) = 1 / n \sum_{i=1}^n s(Y)_i (Y_{im} - u_m) / \{ 1 / n \sum_{i=1}^n s(Y_m)_i (Y_{im} - u_m) \} = \text{Cov}(s(Y), Y_m) / \text{Cov}(s(Y_m), Y_m) ,$$

where  $\text{Cov}(s(Y), Y_m)$  and  $\text{Cov}(s(Y_m), Y_m)$  denote covariance of lifetime wage ranking and term-specific income and that of term-specific income ranking and term-specific income, respectively. The ranking  $s(Y)$  and  $s(Y_m)$  have the same standard deviation, the following formula holds true:

$$G_m / G(Y_m) = r(s(Y), Y_m) / r(s(Y_m), Y_m) .$$

<sup>6</sup> It is the same indicator as Hamada (2004).

$$G_d = u/u_d \times G + \sum_{r=1}^R (u_r / u_d \times G_r) .$$

Because an average gap between redistributed lifetime income and lifetime wage ( $u_d - u$ ) is the sum of redistribution factor ( $u_r$ ), the following formula holds true:

$$G_d - G = \sum_{r=1}^R \{ u_r / u_d \times (G_r - G) \} .$$

Therefore,

$$u_r / u_d \times (G_r - G) ,$$

which denotes that a difference between redistribution factor disparity and lifetime wage disparity ( $G_r - G$ ) multiplied by the percentage of the redistribution factor to redistributed lifetime income ( $u_r / u_d$ ),<sup>7</sup> will represent an indicator that shows redistribution effect (hereinafter, it is referred to as the redistribution effect indicator).<sup>8</sup>

## (2) Relative variance and quasi-relative variance

As relative variance ( $V$ ; squared coefficient of variation) is expressed as follows:

$$V = 1/n \sum_{i=1}^n (Y_i - u)^2 / u^2 ,$$

where  $Y_i$ : Lifetime wage of the  $i$ th member;  $u$ : average of  $Y_i$ ; and  $n$ : the number of members. On the other hand, quasi- relative variance ( $V_m$ ) is weighted average of deviation rate of each member's each factor (such as term-specific wage or pension) from the average of each factor among all members, by using weight of deviation rate of each member's lifetime wage from average lifetime wage among all members. It is expressed as follows:

$$V_m = 1/n \sum_{i=1}^n (Y_{im} - u_m)(Y_i - u) / u_m u ,$$

where  $Y_{im}$ : The value of factor  $m$  for the  $i$ th member; and  $u_m$ : Average of  $Y_{im}$ .

### 1) Contribution of immobility to the inequality

As mentioned in Shorrocks (1980, 1982), as relative variance is usable for income inequality decomposition by factor components, lifetime wage inequality is decomposed by term-specific income inequality and income immobility of inequality. This is expressed as follows:

<sup>7</sup> If redistribution factors are distributed in the same manner as lifetime wage, redistribution will pose no impact on income inequality. This is because quasi-Gini coefficient is scale independent (independent of a proportional change in income). Not only quasi-Gini coefficient but also other commonly used distribution indexes (Atkinson index, coefficient of variation, Theil index, etc.) are scale independent.

<sup>8</sup> Redistribution effect is based on quasi-Gini coefficient, but it is similar to Gini coefficient change due to redistribution as mentioned in Ministry of Health, Labour and Welfare, "Survey on Income Redistribution." As seen in Table 4, lifetime income's quasi-Gini coefficient based on lifetime wage ranking takes almost the same value as lifetime income's Gini coefficient.

$$V^2 = \frac{1}{n} \sum_{i=1}^n \left\{ \sum_{m=1}^M (Y_{im} - u_m) \right\}^2 / u^2 = \sum_{m=1}^M \left\{ \frac{1}{n} \sum_{i=1}^n (Y_{im} - u_m)^2 \right\} / u^2 + 2 \sum_{m=2}^M \sum_{k=1}^{m-1} \left\{ \frac{1}{n} \sum_{i=1}^n (Y_{im} - u_m)(Y_{ik} - u_k) \right\} / u^2$$

In this context, lifetime wage inequality is decomposed by the following two factors: contribution of term-specific income inequality as seen in the first term; and term-specific mutual effect reflecting income immobility of inequality as seen in the second term.

## 2) Indicator of redistribution effect on inequality

As mentioned in Shorrocks (1982), quasi-relative variance is also usable for income inequality decomposition by factor components. In other words, as mentioned in (2), because the sum of quasi-relative variance multiplied by the percentage of its factors to lifetime wage (i.e.,  $u_m/u \times V_m$ ) is equal to lifetime wage's relative variance ( $V$ ), it is decomposed by factors based on quasi-relative variance. For this reason,  $u_m/u \times V_m$  represents how much such factor contributes to lifetime wage inequality, while quasi-relative variance ( $V_m$ ) denotes how much a unit of such factor contributes to the inequality.

In addition, if we make use of inequality decomposition based on quasi-relative variance, the redistribution effect similar to the quasi-Gini coefficient's redistribution effect as mentioned in (1)2) above, will serve as an indicator that represents pension's income redistribution effect. In other words, average and quasi-relative variance of redistribution factors (including pension), redistributed lifetime income among members are  $u_r$  and  $V_r$  and  $u_d$  and  $V_d$ , respectively,

$$u_r / u_d \times (V_r - V) ,$$

which denotes that a difference between redistribution factor disparity and lifetime wage disparity ( $V_r - V$ ) multiplied by the percentage of the redistribution factor to redistributed lifetime income ( $u_r/u_d$ ), will represent an indicator of redistribution effect (the redistribution effect indicator).

## 4. Estimated result for each quintile group

### (1) Distribution for quintile groups

Table 1 shows term-specific wage levels and public pension for respondents with membership in KNH born in the 1950s by quintile groups based on their lifetime wage level.

As shown in term-specific wage level data, the wage level in their 20's or younger does not necessarily rise in line with the lifetime wage-based quintile groups. The inequality among quintile groups is smaller than lifetime wage inequality, as seen in the ratio of the fifth group over the first group. On the other hand, wage levels in their 30's, 40's and 50's are increasing in line with the lifetime wage-based quintile groups. The inequality among quintile groups is also similar to that of

lifetime wage as seen in the ratio of the fifth group over the first group.<sup>9</sup> In this way, income inequality is mobile for wage in their 20's or younger, but it gets immobile for wage in their 30's or older.<sup>10</sup>

Pension contribution is proportional to lifetime wage and shows a similar inequality among quintile groups to lifetime wage level as seen in the ratio of the fifth group over the first group. However, an inequality among quintile groups in pension benefits is much smaller than that of lifetime wage because basic pension is constant regardless of income level. For this reason, net pension transfer, which represents the difference between these two factors, does not have a significant inequality among quintile groups, so the inequality in lifetime income including net pension transfer in lifetime wage is smaller than that of lifetime wage as seen in the ratio of the fifth group over the first group.<sup>11</sup> In this way, pension has income redistribution effect.

In addition, when looking at categories such as gender, academic background or career background, higher income groups have a lower percentage of women, but they tend to see a higher percentage of graduating from university or graduate school, a higher ratio of workers starting their carrier as regular worker, and a higher percentage of workers without job-hopping experiences.

## (2) Distribution for quintile groups incorporating respondents with Category 3 membership

Table 2 illustrates term-specific wage levels and public pension for respondents with membership in KNH born in the 1950s as well as respondents with Category 3 membership by quintile groups based on their lifetime wage level.

The data including respondents with Category 3 membership also show the similar trend to respondents with membership in KNH mentioned in (1) above, but inequalities of term-specific wage levels, lifetime wage and lifetime income among quintile groups are larger than respondents with membership in KNH shown in Table 1, as seen in the ratio of the fifth group over the first group. On the other hand, inequality of lifetime income among quintile groups is much smaller than that of lifetime wage than in the case of Table 1. This is because inclusion of low-wage respondents with Category 3 membership has expanded inequality of lifetime wage among quintile groups, but income redistribution effect of net pension transfer gets stronger due to similar inequality of net

<sup>9</sup> As shown in the following table, matching rate between lifetime wage-based quintile group and term-specific wage-based quintile group takes a low value for wage in their 20's or younger, which stands at a little more than 20% suggesting no correlation, but it rises to approximately 50% for wage in their 30's or older.

Table: matching rate between lifetime wage-based quintile group and term-specific wage-based quintile group (respondents with membership in KNH)

	Group 1	Group 2	Group 3	Group 4	Group 5	average
Wage in their 20's or younger	40%	20%	21%	23%	34%	28%
Wage in their 30's	75%	48%	42%	46%	71%	57%
Wage in their 40's	82%	55%	51%	58%	76%	64%
Wage in their 50's	74%	48%	49%	43%	62%	55%

<sup>10</sup> Based on rank correlation coefficient, Inagaki (2012) also analyzes that ranking of standard compensation is rather immobile on wage level in their 30's or older.

<sup>11</sup> This paper analyzes lifetime income based on lifetime wage quintile group, but analysis on lifetime income-based quintile group will also yield almost the same analytical findings.

pension transfer among quintile groups as seen in Table 1. In this way, if we include respondents with Category 3 membership in respondents with membership in KNH, the pension shows stronger income redistribution effect.<sup>12</sup>

### (3) Change in distribution for quintile groups

Table 3 divides respondents with membership in KNH in two groups (those born in the early 1950s and those born in the late 1950s) and compares their term-specific wage and public pension for lifetime wage quintile groups.

Lifetime wage and term-specific wage do not show a significant difference. As with the all born in the 1950s as mentioned in (1) above, income inequality for both groups is mobile for wage in their 20's or younger, but it gets immobile for wage in their 30's or older. In other words, wage in their 20's or younger might not necessarily increase in line with lifetime wage quintile groups. Inequality among quintile groups is also smaller than lifetime wage inequality. However, wage levels in their 30's, 40's and 50's are rising in line with lifetime wage-based quintile groups. Inequality among quintile groups is also closer to lifetime wage inequality.

On the other hand, as for pension, the latter group (those born in the late 1950) is facing more than 10% drop of net pension transfer. However, when looking at each of quintile groups, a fall of net pension transfer is smaller for lower income groups but larger for higher income groups, suggesting that the inequality among quintile groups gets smaller. In other words, net pension transfer decreases mainly in higher income groups. Rather than bringing about intergenerational inequality, pension enhances income redistribution effect that decreases the inequality among income groups.

As mentioned in (1), pension contribution is proportional to lifetime wage; and inequality among quintile groups is closer to lifetime wage. On the other hand, inequality of pension benefits among quintile groups is much smaller than lifetime wage inequality, with basic pension portion staying the same regardless of wage level. Therefore pension has income redistribution effect. The latter group will face increased pension contribution payments due to higher pension contribution rates, which will decrease net pension transfer. As a drop of net pension transfer is larger for higher wage groups, income redistribution effect gets stronger for the latter group.<sup>13</sup>

<sup>12</sup> This paper assumes that respondents with Category 3 membership would earn their wage at the amount of Category 3 accreditation criteria value in a year when they find a job as mentioned in 2.(2)1), but a lot of respondents with Category 3 membership make lower wage than the Category 3 accreditation criteria amount even if they are working. For this reason, actual lifetime wage for respondents with Category 3 membership is lower than the analysis in this paper, which will result in stronger redistribution effect of public pension.

<sup>13</sup> Put basic pension at  $a$ , multiplying factor for KNH old-age pension benefits (earnings-related portion) at  $b$ , contribution rate at  $r$ , lifetime wage for individuals  $j$  and  $k$  at  $w_j$  and  $w_k$ , supposing  $w_j < w_k$ . Comparison of lifetime income incorporating net pension transfer is expressed as follows:

$$(w_k + a + b w_k - r w_k) / (w_j + a + b w_j - r w_j).$$

If we differentiate this formula with  $r$ , the following formula holds true:

$$a (w_j - w_k) / (w_j + a + b w_j - r w_j)^2 < 0.$$

This means that a higher contribution rate ( $r$ ) will lead to smaller inequality in lifetime income and stronger income redistribution effect of pension.

## 5. Result of measuring immobility of inequality, contribution and redistribution effect

(1) Estimates based on Gini coefficient and quasi-Gini coefficient

1) Immobility of inequality, contribution, and redistribution effect

Table 4 shows measured indicators on immobility of inequality, contribution and redistribution effect on respondents with membership in KNH born in the 1950s based on Gini coefficient and quasi-Gini coefficient as explained in 3.(1) above.

Immobility of term-specific wage inequality in their 20's or younger only plays small roles in lifetime wage, but immobility of wages in their 30's, 40's and 50's stands at a relatively larger value of approximately 0.9. Not only immobility of inequality among quintile groups seen in 4(1) above but also the immobility of inequality indicator incorporating a shift within the same income group are both suggesting that the inequality is mobile for wage in their 20's or younger but it gets immobile for those in their 30's or older. For this reason, wage in their 30's or older are facing much larger quasi-Gini coefficient as well as much higher contribution to lifetime wage inequality than wage in their 20's or younger.

As for public pension, since the inequality in pension benefits is less immobile than pension contribution inequality, the inequality in net pension transfer, a difference between these two factors, is not so immobile. For this reason, quasi-Gini coefficient of pension benefits is smaller than that of pension contributions, leading to smaller quasi-Gini coefficient in net pension transfer. This has resulted from the following reasons: As pension contributions are proportional to lifetime wage, quasi-Gini coefficient is closer to lifetime wage; and quasi-Gini coefficient of pension benefits is much smaller than that of lifetime wage because basic pension is constant regardless of wage level. For this reason, redistribution effect indicator of pension contribution is zero, but that of pension benefits takes a negative value, resulting in a negative value of redistribution effect indicator of net pension transfer, which represents the difference between these two factors. In this way, redistribution effect indicators also suggest pension would serve for decreasing the inequality and have income redistribution effect as seen in the quintile group data in 4.(1).

2) Immobility of inequality, contribution and redistribution effect, when respondents with Category 3 membership are incorporated

Table 5 shows measured indicators on immobility of inequality, contribution and redistribution effect on respondents with membership in KNH born in the 1950s as well as respondents with Category 3 membership based on Gini coefficient and quasi-Gini coefficient.

The data incorporating respondents with Category 3 membership show the same trend as

respondents with membership in KNH mentioned in (1) above, but immobility of term-specific wage inequality is larger than the case for respondents with membership in KNH in Table 4. Due to such larger immobility as well as wider inequality of term-specific wage level (Gini coefficient), contribution to lifetime wage inequality also gets stronger. For this reason, inequalities in lifetime wage and lifetime income are also larger than the case of Table 4.

However, quasi-Gini coefficient of public pension benefits, which even incorporates low-wage respondents with Category 3 membership, does not rise as much as lifetime wage inequality because basic pension is constant regardless of wage levels. On the other hand, quasi-Gini coefficient of pension contributions is rising at the same pace as lifetime wage, as pension contributions are proportional to lifetime wage. For this reason, as for net pension transfer, which represents the difference between these two factors, quasi-Gini coefficient shows a smaller rise than the case of Table 4. Due to these factors, pension contribution has almost no redistribution effect as with the case of Table 4, while pension benefits have stronger negative (absolute value) redistribution effect indicator than Table 4, and redistribution effect indicator of net pension transfer also shows a similar trend. If respondents with Category 3 membership are included in respondents with membership in KNH, in the same manner as quintile group analysis in 4(2) above, pension will pose stronger income redistribution effect.

### 3) Changes in immobility of inequality, contribution and redistribution effect

Table 6 divides respondents with membership in KNH in two categories (those born in the early 1950s and those born in the late 1950s) and describes their immobility of inequality, contribution and redistribution effect indicators based on Gini coefficient and quasi-Gini coefficient.

When checking out how much term-specific wage inequality is immobile in terms of lifetime wage inequality, the newer group (born in the late 1950s) sees smaller immobility for their wage in their 20's or younger but faces larger immobility for their wage in their 40's and 50's. In this way, the latter group is facing stronger tendency that income inequality is less immobile in their 20's or younger but it gets more immobile in their 30's or older.

As for public pension, the latter group sees much smaller immobility of inequality of net pension transfer, and their quasi-Gini coefficient is also decreasing. For this reason, the latter group has larger stronger negative (absolute value) redistribution effect indicator of net pension transfer, increasing income redistribution effect of pension.

As described in 4.(3), as pension contributions are proportional to lifetime wage but basic pension benefits are constant regardless of wage levels, the pension has an income redistribution effect. The latter group will face increased pension contribution payments due to higher pension contribution rates, which will therefore decrease net pension transfer. As a drop of net pension transfer is larger

for higher wage groups, the income redistribution effect gets stronger for the latter group.

(2) Estimates based on relative variance and quasi-relative variance

1) Contribution of immobility to inequality, and redistribution effect

Table 7 decomposes lifetime wage inequality for respondents with membership in KNH born in the 1950s by term-specific wage inequality's contribution and mutual effect of term-specific wage reflecting immobility of inequality, and shows measured indicators on public pension's redistribution effect.

Mutual effect of term-specific wage levels (i.e., immobility of inequality) is rather small between wage levels in 20's or younger and those in other age brackets, but it gets larger among wage levels in 30's, 40's and 50's. As with the immobility of inequality indicator in (1) above, mutual effect among term-specific wage also suggest that wage inequality in wage levels in their 20's or younger is mobile, but it gets more immobile in wage levels in 30's or older. In addition, term-specific wage inequality makes stronger contributions in 30's or older, but the total mutual effect of term-specific wage levels grows stronger than the total contribution of term-specific wage inequalities, suggesting it is posing strong impacts on lifetime wage inequality.

On the other hand, pension contributions are proportional to wage levels, while the basic pension is constant regardless of wage level. This means that mutual effect of net pension transfer and term-specific wage is small and that net pension transfer makes only marginal contributions to lifetime wage inequalities. For this reason, net pension transfer has negative redistribution indicators. In this way, redistribution effect indicators based on relative variance and quasi-relative variance also suggest that pension serves to decrease the inequality. Pension has income redistribution effect like the redistribution effect indicators based on Gini coefficient and quasi-Gini coefficient as mentioned in (1) above.

2) Contribution of immobility to inequality, and redistribution effect, when respondents with Category 3 membership are incorporated

Table 8 decomposes lifetime wage inequality for respondents with membership in KNH born in the 1950s as well as respondents with Category 3 membership by term-specific wage inequality's contribution and mutual effect of term-specific wage reflecting immobility of inequality, and shows measured indicators on public pension's redistribution effect.

The data including respondents with Category 3 membership also show the same trend as respondents with membership in KNH mentioned in (1) above, but mutual effect among term-specific wage levels (immobility of inequality) is stronger than the case for respondents with membership in KNH in Table 7. Due to such stronger mutual effect as well as intensified

contribution of term-specific wage inequality, inequalities in lifetime wage and lifetime income are also larger than Table 7.

On the other hand, as basic pension is constant regardless of wage levels, mutual effect between net pension transfer and term-specific wage levels as well as net pension transfer's contribution to inequality is not rising as much as lifetime wage inequality, even if low-wage respondents with Category 3 membership are incorporated. For this reason net pension transfer has stronger negative (absolute value) redistribution effect indicators than the case of Table 7. In this way, redistribution effect indicators based on relative variance and quasi-relative variance also suggest that, if respondents with Category 3 membership are incorporated in respondents with membership in KNH, pension has stronger income redistribution effect in the same manner as redistribution effect indicators based on Gini coefficient and quasi-Gini coefficient mentioned in (1) above.

### 3) Changes in contribution of immobility to inequality and redistribution effect

Table 9 divides respondents with membership in KNH in two categories (those born in the early 1950s and those born in the late 1950s) and decomposes their lifetime wage inequality by term-specific wage inequality's contribution and mutual effect of term-specific wage levels reflecting immobility of inequality, and shows measured indicators on public pension's redistribution effect.

Mutual effect of term-specific wage levels (i.e., immobility of inequality) is rather small between wage levels in 20's or younger and that in wage levels in their 30's, but it gets larger for wage levels among their 30's, 40's and 50's. In this way, the latter group is seeing stronger tendency that wage inequality is mobile for wage levels in their 20's or younger but it gets immobile for wage levels in 30's and thereafter.

As for pension, the latter group is seeing weaker mutual effect between net pension transfer and term-specific wage levels, which stands at almost zero. This enhances more negative (absolute value) redistribution effect indicator of net pension transfer, increasing pension's income redistribution effect as with the case in (1)3) above.

In addition, quasi-relative variance is decomposed by intra-generational factor and inter-generational factor.<sup>14</sup> If we measure the redistribution effect indicator of net pension transfer between respondents born in the early 1950s and the late 1950s based on this decomposition, it shows a positive number. This means intergenerational inequality will expand by pension, but it only takes a small value of 0.00001. Rather, Table 9 shows redistribution effect indicator of intra-generational net pension transfer for those born in the late 1950s has changed from those born in the early 1950s by -0.00058, whose absolute value is much larger than the above 0.00001. In this way, as with analysis among quintile groups as mentioned in 4(3) above, net pension transfer enhances income redistribution effect to reduce intra-generational income inequality, rather than bringing about intergenerational inequality.

## 6. Conclusion

The inequality in lifetime income mainly results from the inequality in annual income as well as from immobility of inequality, including unlikeliness to change income ranking on the time series basis. Identifying immobility of income inequality requires collection of panel data by continually surveying the same persons, but panel data surveys in Japan are not long enough to cover lifetime income. On the other hand, “The Japanese Longitudinal Survey on Employment and Fertility

<sup>14</sup> Quasi-relative variance ( $V_m$ ) is decomposed by its constituent groups, such as cohort groups (As constituent groups are not divided in line with income ranking, such as lifetime wage, quasi-Gini coefficient is not applicable to the inequality between these constituent groups). If samples are dividable into K constituent groups based on their cohort, quasi-relative variance of each group ( $W_{km}$ ;  $k=1-K$ ) and quasi-relative variance between groups ( $B_m$ ) are expressed as follows:

$$W_{km} = 1/n_k \sum_{i=1}^{n_k} (Y_{im} - u_{km})(Y_i - u_k) / u_{km} u_k$$

$$B_m = 1/n \sum_{k=1}^K n_k (u_{km} - u_m)(u_k - u) / u_m u,$$

where  $Y_i$ : lifetime wage of the  $i$ th member;  $u$ : average of  $Y_i$ ;  $n$ : the number of people;  $Y_{im}$ : Value of component  $m$  for the  $i$ th member;  $u_m$ : Average of  $Y_{im}$ ; and  $n_k, u_{km}, u_k$ : the number of people, average of component  $m$ , and average lifetime wage in the  $k$ th group.

Therefore, if we multiply quasi-relative variance within an group ( $W_{km}$ ) by the percentage of group average to the overall average  $u_{km}/u_m, u_k/u$ , and by the percentage of the number of people ( $n_k/n$ ), and sum it up and then add the quasi-relative variance between groups ( $B_m$ ), then it is expressed as follows:

$$\begin{aligned} & \sum_{k=1}^K (n_k/n \times u_{km}/u_m \times u_k/u \times W_{km}) + B_m \\ &= 1/n \sum_{k=1}^K \sum_{i=1}^{n_k} \{ (Y_{im} - u_{km})(Y_i - u_k) + (u_{km} - u_m)(u_k - u) \} / u_m u \\ &= 1/n \sum_{k=1}^K \sum_{i=1}^{n_k} \{ (Y_{im} Y_i - u_{km} u_k) + (u_{km} u_k - u_m u) \} / u_m u \\ &= 1/n \sum_{k=1}^K \sum_{i=1}^{n_k} (Y_{im} - u_m)(Y_i - u) / u_m u \\ &= V_m \end{aligned}$$

This means quasi-relative variance ( $V_m$ ) is decomposed by intra-generational and inter-generational factors. Therefore, the redistribution effect indicator ( $u_r/u_d \times (V_r - V)$ ) mentioned in 3.(2)2) is also decomposed by intra-generational and inter-generational factors.

(LOSEF)” as seen in Takayama, Inagaki and Oshio (2012) is a retrospective survey but provides highly correct data because respondents are supposed to transcribe their data from their Social Security Statements, which are sent to public pension plan participants. For this reason, analysts are able to estimate lifetime wage for respondents with membership in KNH (Kosei-Nenkin-Hoken, employees’ pension). They are also able to calculate lifetime income from the said estimated lifetime wage as well as from transcribed data on pension benefits and pension contributions (a deductible item).

Based on the data from “The Japanese Longitudinal Survey on Employment and Fertility (LOSEF),” this paper recognizes the income ranking consistency indicator, as seen in Toyoda (2005a, 2005b), would serve as an income immobility of inequality indicator and monitors how much income inequality is immobile as well as how much immobility contributes to lifetime income inequality, with focus put on respondents with membership in KNH born in the 1950s. In addition, this paper also estimates the redistribution effect of the public pension program. Based on these findings, this paper analyzes how much immobility of inequality, its contribution to lifetime income inequality, and redistribution effect of public pension program would change between those born in the early 1950s and those born in the late 1950s, and whether intergenerational inequality exists between these two groups. In addition, by incorporating respondents with Category 3 membership born in the 1950s into respondents with membership in KNH, this paper also analyzes any difference in terms of income inequality, immobility and pension program’s redistribution effects.

According to analytical findings on respondents with membership in KNH, wage inequality is mobile in their 20’s or younger, but it gets immobile in their 30’s or older. The sum of mutual effect of term-specific wage levels, which reflects inequality immobility, is larger than the sum of contribution of term-specific wage inequalities, and poses significant impacts on lifetime wage inequality. As for pension, because inequality immobility of pension benefits is lower than that of pension contributions, inequality immobility of net pension transfer, which represents the difference between these two factors, is small. This is because of the following facts: As pension contributions are proportional to lifetime wage, the resultant inequality is also close to lifetime wage inequality; and as basic pension benefits are constant regardless of wage levels, inequality of pension benefits is much smaller than lifetime wage. For this reason, net pension transfer, which represents the difference of these two factors, serves to decrease the inequality, so the pension has income redistribution effect.

These findings also hold true, even if respondents with Category 3 membership are incorporated with respondents with membership in KNH. However, in this case, wage inequality is more immobile, and term-specific wage inequality also gets larger. This has led to larger inequalities in lifetime wage and lifetime income than the case of respondents with membership in KNH. However, as the pension contribution is proportional to lifetime wage but the basic pension is constant

regardless of wage level, mutual effect between net pension transfer and term-specific wage levels (immobility) as well as the inequality of net pension transfer does not rise as much as lifetime wage inequality, even if low-wage respondents with Category 3 membership are incorporated. For this reason, inclusion of respondents with Category 3 membership with respondents with membership in KNH will enhance income redistribution effect of the pension.

In addition, if respondents with membership in KNH are divided into two groups (those born in the early 1950s and those born in the late 1950s) to check out how much wage inequality immobility would change, the latter group sees stronger tendency that wage inequality is mobile for wage levels in their 20's or younger, but it gets immobile in wage levels in their 30's and older. As for pension, the latter group is seeing smaller net pension transfer. However, net pension transfer decreases mainly in high-income groups. Rather than bringing about intergenerational inequality, pension has a stronger income redistribution effect to reduce the intra-generational income inequality. Pension contribution is proportional to lifetime wage, but basic pension benefits are constant regardless of wage level. Therefore pension has an income redistribution effect. The latter group will face an increased pension contribution due to higher pension contribution rates, which will therefore decrease net pension transfer. As a drop of net pension transfer is larger for higher wage groups, income redistribution effect gets stronger for the latter group.

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Table 1: Lifetime wage for quintile groups (respondents with membership in KNH)

	(in ¥10,000)						(Multiplying factor)
	Average	Group 1	Group 2	Group 3	Group 4	Group 5	Group5/Group 1
Wage in their 20's or younger	2696	2068	2678	2817	2685	3226	1.56
Wage in their 30's	5563	3160	4991	5730	6369	7553	2.39
Wage in their 40's	6676	3598	5884	6979	8114	8790	2.44
Wage in their 50's	6764	3463	5516	7232	8546	9044	2.61
Lifetime wage	21699	12289	19070	22757	25714	28614	2.33
Net pension transfer	1450	1391	1330	1307	1513	1709	1.23
Pension benefit	2514	1985	2241	2420	2804	3119	1.57
Pension contribution	1064	594	911	1114	1291	1410	2.37
Lifetime income	23150	13680	20400	24064	27227	30323	2.22
Percentage	100%	20%	20%	20%	20%	20%	
Percentage of women	11%	44%	7%	1%	1%	2%	
Percentage of university (graduate school) graduates	70%	39%	69%	75%	85%	80%	
Percentage of workers starting their career as full-time worker	94%	85%	94%	94%	99%	97%	
Percentage of workers without job-hopping experiences	25%	8%	17%	26%	31%	43%	

(Notes) 1. Lifetime income: Lifetime wage + Net pension transfer  
 2. Respondents with membership in KNH: Workers insured with the welfare pension program for 20 years or longer

Table 2: Lifetime wage for quintile groups (respondents with membership in KNH and respondents with Category 3 membership )

	(in ¥10,000)						(Multiplying factor)
	Average	Group 1	Group 2	Group 3	Group 4	Group 5	Group5/Group 1
Wage in their 20's or younger	2295	1078	2004	2559	2726	3105	2.9
Wage in their 30's	3847	64	1229	4786	5931	7214	112.5
Wage in their 40's	4644	97	1633	5499	7331	8644	89.1
Wage in their 50's	4709	101	1653	5169	7661	8946	88.4
Lifetime wage	15496	1340	6520	18013	23649	27910	20.8
Net pension transfer	1403	1251	1409	1332	1308	1714	1.4
Pension benefit	2142	1289	1647	2197	2474	3100	2.4
Pension contribution	739	39	239	865	1166	1386	36.0
Lifetime income	16899	2591	7929	19345	24956	29624	11.4
Percentage	100%	20%	20%	20%	20%	20%	
Percentage of women	39%	100%	84%	10%	1%	1%	
Percentage of university (graduate school) graduates	57%	37%	24%	63%	79%	82%	
Percentage of workers starting their career as full-time worker	91%	80%	87%	93%	95%	98%	
Percentage of workers without job-hopping experiences	29%	33%	28%	15%	25%	42%	

(Notes) 1. Lifetime income: Lifetime wage + Net pension transfer  
 2. Respondents with membership in KNH: Workers insured with the welfare pension program for 20 years or longer  
 Respondents with Category 3 membership : Persons classified as Class 3 for 20 years or longer

Table 3: Change in lifetime wage for quintile groups (respondents with membership in KNH)

	(in ¥10,000)					(Multiplying factor)	
Born in the early 1950s	Average	Group 1	Group 2	Group 3	Group 4	Group 5	Group5/Group 1
Wage in their 20's or younger	2700	1940	2767	2741	2728	3313	1.71
Wage in their 30's	5584	2993	5083	5770	6544	7502	2.51
Wage in their 40's	6800	3755	6055	7253	8233	8671	2.31
Wage in their 50's	6670	3485	5320	7082	8481	8946	2.57
Lifetime wage	21754	12174	19225	22845	25987	28432	2.34
Net pension transfer	1582	1433	1489	1329	1702	1955	1.36
Pension benefit	2566	1993	2322	2323	2921	3265	1.64
Pension contribution	984	561	833	994	1219	1310	2.34
Lifetime income	23336	13606	20714	24174	27689	30387	2.23

Born in the late 1950s	Average	Group 1	Group 2	Group 3	Group 4	Group 5	Group5/Group 1
Wage in their 20's or younger	2692	2287	2507	2863	2642	3155	1.38
Wage in their 30's	5545	3295	4933	5714	6209	7551	2.29
Wage in their 40's	6568	3458	5703	6782	7982	8885	2.57
Wage in their 50's	6847	3381	5741	7317	8610	9156	2.71
Lifetime wage	21651	12421	18884	22676	25444	28747	2.31
Net pension transfer	1334	1368	1203	1265	1340	1492	1.09
Pension benefit	2469	1976	2211	2455	2695	3000	1.52
Pension contribution	1135	608	1008	1190	1355	1508	2.48
Lifetime income	22985	13789	20087	23941	26784	30239	2.19

- (Notes) 1. Lifetime income: Lifetime wage + Net pension transfer  
 2. Respondents with membership in KNH: Workers insured with the welfare pension program for 20 years or longer

Table 4: Lifetime wage inequality decomposition (Gini coefficient) (respondents with membership in KNH)

	Contribution	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Wage in their 20's or younger	0.009	0.124	0.073	0.360	0.203
Wage in their 30's	0.039	0.256	0.153	0.883	0.174
Wage in their 40's	0.048	0.308	0.157	0.934	0.168
Wage in their 50's	0.054	0.312	0.174	0.894	0.195
Lifetime wage		1.000	0.151	1.000	0.151

	Redistribution effect	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Net pension transfer	-0.007	0.063	0.044	0.197	0.224
Pension benefit	-0.006	0.109	0.092	0.546	0.169
Pension contribution	0.000	-0.046	0.158	0.847	0.187
Lifetime income		1.000	0.144	0.994	0.145

- (Notes) 1. Contribution = Quasi-Gini coefficient × Percentage  
 2. Sum of contributions = Gini coefficient of lifetime wage  
 3. Redistribution effect = (Quasi-Gini coefficient – Lifetime wage's Gini coefficient) × Percentage  
 4. Lifetime wage's Gini coefficient + Sum of redistribution effect = Lifetime wage's quasi-Gini coefficient  
 5. Immobility = Quasi-Gini coefficient ÷ Gini coefficient

Table 5: Lifetime wage inequality decomposition (Gini coefficient) (respondents with membership in KNH and respondents with Category 3 membership)

	Contribution	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Wage in their 20's or younger	0.026	0.148	0.174	0.625	0.279
Wage in their 30's	0.101	0.248	0.409	0.964	0.424
Wage in their 40's	0.122	0.300	0.406	0.979	0.414
Wage in their 50's	0.126	0.304	0.416	0.965	0.431
Lifetime wage		1.000	0.375	1.000	0.375

	Redistribution effect	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Net pension transfer	-0.027	0.083	0.047	0.232	0.204
Pension benefit	-0.026	0.127	0.171	0.758	0.225
Pension contribution	-0.001	-0.044	0.405	0.952	0.425
Lifetime income		1.000	0.348	0.998	0.349

- (Notes) 1. Contribution = Quasi-Gini coefficient × Percentage  
 2. Sum of contributions = Gini coefficient of lifetime wage  
 3. Redistribution effect = (Quasi-Gini coefficient – Lifetime wage's Gini coefficient) × Percentage  
 4. Lifetime wage's Gini coefficient + Sum of redistribution effect = Lifetime wage's quasi-Gini coefficient  
 5. Immobility = Quasi-Gini coefficient ÷ Gini coefficient

Table 6: Lifetime wage inequality decomposition and change (Gini coefficient) (respondents with membership in KNH)

Born in the early 1950s	Contribution	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Wage in their 20's or younger	0.010	0.124	0.082	0.375	0.219
Wage in their 30's	0.040	0.257	0.157	0.887	0.177
Wage in their 40's	0.045	0.313	0.145	0.921	0.158
Wage in their 50's	0.053	0.307	0.173	0.864	0.200
Lifetime wage		1.000	0.149	1.000	0.149

Born in the early 1950s	Redistribution effect	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Net pension transfer	-0.006	0.068	0.061	0.327	0.188
Pension benefit	-0.006	0.110	0.098	0.606	0.163
Pension contribution	0.000	-0.042	0.158	0.893	0.177
Lifetime income		1.000	0.143	0.995	0.144

Born in the late 1950s	Contribution	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Wage in their 20's or younger	0.008	0.124	0.062	0.335	0.186
Wage in their 30's	0.038	0.256	0.148	0.880	0.168
Wage in their 40's	0.050	0.303	0.165	0.948	0.174
Wage in their 50's	0.055	0.316	0.173	0.924	0.187
Lifetime wage		1.000	0.150	1.000	0.150

Born in the late 1950s	Redistribution effect	Percentage	Quasi-Gini coefficient	Immobility	Gini coefficient
Net pension transfer	-0.007	0.058	0.022	0.088	0.248
Pension benefit	-0.007	0.107	0.084	0.489	0.172
Pension contribution	0.000	-0.049	0.157	0.858	0.183
Lifetime income		1.000	0.143	0.994	0.144

- (Notes)
1. Contribution = Quasi-Gini coefficient × Percentage
  2. Sum of contributions = Gini coefficient of lifetime wage
  3. Redistribution effect = (Quasi-Gini coefficient – Lifetime wage's Gini coefficient) × Percentage
  4. Lifetime wage's Gini coefficient + Sum of redistribution effect = Lifetime wage's quasi-Gini coefficient
  5. Immobility = Quasi-Gini coefficient ÷ Gini coefficient

Table 7: Lifetime wage inequality decomposition (relative variance) (respondents with membership in KNH)

	Inequality contribution	Contribution of immobility of inequality (mutual effect)			
		Wage in their 20's or younger	Wage in their 30's	Wage in their 40's	Wage in their 50's
Wage in their 20's or younger	0.002				
Wage in their 30's	0.007	0.003			
Wage in their 40's	0.009	0.001	0.012		
Wage in their 50's	0.012	0.001	0.011	0.017	
Total mutual effect of wage	0.044	0.005	0.023	0.017	
Relative variance of lifetime wage	0.074				
Net pension transfer	0.001				
Mutual effect with wage	0.002	0.000	0.001	0.001	0.001

Redistribution effect of net pension transfer	-0.004
Quasi-relative variance of lifetime income	0.070

- (Notes)
1. Redistribution effect = (Quasi-relative variance – relative variance of lifetime wage) × Percentage
  2. Relative disperse of lifetime wage + Redistribution effect = Quasi-relative variance of lifetime income

Table 8: Lifetime wage inequality decomposition (relative variance) (respondents with membership in KNH and respondents with Category 3 membership)

	Inequality contribution	Contribution of immobility of inequality (mutual effect)			
		Wage in their 20's or younger	Wage in their 30's	Wage in their 40's	Wage in their 50's
Wage in their 20's or younger	0.006				
Wage in their 30's	0.035	0.016			
Wage in their 40's	0.049	0.016	0.077		
Wage in their 50's	0.054	0.016	0.077	0.096	
Total mutual effect of wage	0.298	0.048	0.154	0.096	
Relative variance of lifetime wage	0.441				
Net pension transfer	0.001				
Mutual effect with wage	0.008	0.001	0.002	0.002	0.003

Redistribution effect of net pension transfer	-0.033
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Quasi-relative variance of lifetime income	0.408
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- (Notes) 1. Redistribution effect = (Quasi-relative variance – relative variance of lifetime wage) × Percentage  
2. Relative disperse of lifetime wage + Redistribution effect = Quasi-relative variance of lifetime income

Table 9: Lifetime wage inequality decomposition (relative variance) (respondents with membership in KNH and Respondents with Category 3 membership)

Born in the early 1950s	Inequality contribution	Contribution of immobility of inequality (mutual effect)			
		Wage in their 20's or younger	Wage in their 30's	Wage in their 40's	Wage in their 50's
Wage in their 20's or younger	0.003				
Wage in their 30's	0.007	0.003			
Wage in their 40's	0.009	0.001	0.012		
Wage in their 50's	0.012	0.001	0.010	0.016	
Total mutual effect of wage	0.043	0.005	0.022	0.016	
Relative variance of lifetime wage	0.074				
Net pension transfer	0.001				
Mutual effect with wage	0.004	0.001	0.001	0.001	0.001

Redistribution effect of net pension transfer	-0.003
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Quasi-relative variance of lifetime income	0.071
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Born in the late 1950s	Inequality contribution	Contribution of immobility of inequality (mutual effect)			
		Wage in their 20's or younger	Wage in their 30's	Wage in their 40's	Wage in their 50's
Wage in their 20's or younger	0.002				
Wage in their 30's	0.006	0.002			
Wage in their 40's	0.009	0.001	0.012		
Wage in their 50's	0.012	0.001	0.011	0.018	
Total mutual effect of wage	0.045	0.004	0.023	0.018	
Relative variance of lifetime wage	0.074				
Net pension transfer	0.001				
Mutual effect with wage	0.001	0.000	0.000	0.000	0.000

Redistribution effect of net pension transfer	-0.004
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Quasi-relative variance of lifetime income	0.070
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- (Notes) 1. Redistribution effect = (Quasi-relative variance – relative variance of lifetime wage) × Percentage  
2. Relative disperse of lifetime wage + Redistribution effect = Quasi-relative variance of lifetime income