

산재보험 장해보상급여의 노후보장 적정성 연구

(Adequacy of Old-Age Benefits in Workers' Compensation Plan when Disabled : Compared by the Equivalent Benefits of Social Security)

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<국문초록>

산재보험의 장해연금은 장해발생시점부터 매년 물가상승률을 반영하여 종신토록 지급하므로 장해를 입은 산재근로자는 임금대체소득 뿐만 아니라 노후 생활비까지 지급받는 것으로 볼 수 있다. 동시에 국민연금 장애에 해당하는 경우 국민연금 장애연금의 1/2 상당액도 함께 지급받게 된다. 따라서 장해근로자가 실제로 받게 되는 연금의 현가는 상실한 수익액 (lost earnings)에 비해 현저히 큰 값이 된다. 본 연구에서는 장해연금의 노후보장효과를 확인하기 위해 장해연금 급여와 노령연금 급여의 크기를 상호 비교해 보았다. 이를 위해 장해근로자가 산재를 입지 않았을 경우 지급받을 수 있었을 노령연금의 현가를 산정한 후 장해근로자가 퇴직 연령에 도달한 이후 시점부터 노후에 지급받게 될 장해연금 현가와 크기를 상호 비교하였다. 분석결과에 의하면 장해근로자가 퇴직연령에 도달한 이후 노후에 지급받게 될 장해연금의 현가가 노령연금의 현가에 비해 현저히 큰 값이 될 것임을 확인하였다. 본 연구의 분석결과는 노후보장을 위해 운영되는 공적연금 급여 간 형평성을 유지하기 위해 향후 장해연금과 노령연금 간 급여수준의 현저한 차이를 줄이는 방향으로 연금급여 지급기준의 개선이 필요함을 시사해 준다.

※ 국문 주제어 : 산업재해, 노령연금, 장해연금, 사회보장효과

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I . Introduction

In Korea, if workers are confirmed to be permanently and totally disabling or permanently and partially disabling due to work-related injuries or illnesses, they can receive disability pension benefits from WC(workers' compensation) program. In addition, disabled workers can receive one half of disability pension benefits from NP(national pension) program. These two kinds of disability pension benefits are paid permanently as a form of life annuity. At the beginning of every year, cost-of-living increases are awarded to the beneficiaries based on CPI index change for entire previous year. As a result, disabled workers can receive living costs for old age as well as wage replacement benefits designed to replace some portion of lost earnings according to the classification of disability.

Several studies confirmed the adequacy of disability pension benefits in WC program. Ma and Kim(2008) compared the present values of disability pension benefits in WC program with those of disabled worker's actual lost earnings. They confirmed that the present values of disability pension benefits in WC program were 1.26~1.92 times larger than those of disabled worker's actual lost earnings. Jung and Song(2008) analyzed the aspect of equity between pension and lump sum payments of disability benefits in WC program and showed that the level of disability pension benefits should be reduced by 50% to maintain equilibrium with lump sum payments. Ma and Synn(2009) showed that the present values of disability pension benefits in WC program were 1.64 ~1.92 times larger than those of disabled worker's lost earnings calculated under the court's criterion. Jung(2011) conducted comparative study about the payment criterion of disability pension benefits in WC program between Korea and other countries and insisted that the wage replacement ratio, which applied to determine the level of disability

pension benefits according to the degree of disabled worker's impairment, should be reduced to 67%~80% from current 90% as of disability Class 1. Rew and Ma(2013) also recommended that the wage replacement ratio should be changed to 76% from current 90% in disability Class 1, it should be changed to 52% from current 61% in disability Class 4, and it should be changed to 32% from current 37% in disability Class 7.

However, until now, there was no discussion about the adequacy of disability pension benefits in the aspect of social security effect for worker's old age after retirement, although there were persistent criticisms about the generous compensation of disability pension benefits in WC program in Korea. So, in this paper, we analyzed the varied social security effect of disability pension benefits for old age according to the influence of disabled workers' ages or the levels of disabled workers' impairment.

We propose that the individual effect of social security for old age will be changed depending on the disabled worker's age or the level of impairment, respectively. To support this statement, we evaluated the present values of old age pensions in NP program under the assumption that there were no work-related injuries or illnesses and then compare the present values of disability pension benefits after retirement age with those of old age pension benefits. From the result of this comparative analysis, we confirmed whether the criterion of current disability pension benefits is proper or not. The analysis can improve the disability pension scheme more reasonably. Hereafter, when there is a discussion about improving the current disability pension schemes, we expect that the results of this analysis can help policy makers' decision making processes to be more reasonably.

This paper is organized as follows. The "Payment Criteria of Pension Benefits" explains payment criteria in WC and NP programs focusing on disability pension benefits and old age pension benefits in NP program. The

“Data and Research Methodology” section provides the models for calculating the present values of pension benefits and explains the data we used in this analysis. The “Result of Analysis” section provides simulation results, and the last section concludes the article.

II. Payment Criteria of Pension Benefits

1. Disability pension benefits in WC Program

In WC program, wage replacement ratios according to the classification of disabled workers are shown in Table 1.

Table 1. Wage Replacement Ratios According to the Classification of Disabled

Classification of disabled	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
Wage replacement ratios	90%	80%	70%	61%	53%	45%	38%

Note : 1. Claimants in Class 1 through Class 3 can only receive monthly payments. Yet, claimants in Class 4 through Class 7 can choose between lump sum and monthly payments. Besides, claimants in Class 8 through Class 14 can only receive lump sum payments.

2. “Wage replacement ratios” represents ratios against individual worker’s final 3 months average wages.

2. Disability pension benefits in NP Program

In NP program, the levels of initial disability pension benefits at $t=0$ can be determined as in Table 2.

Table 2. Criterion for Paying Disability Pension Benefits in NP program

Class of disabled	Disability pension	Payment type
Class 1	Basic pension 100% + family pension	Monthly payments
Class 2	Basic pension 80% + family pension	Monthly payments
Class 3	Basic pension 60% + family pension	Monthly payments
Class 4	Basic pension 225%	Lump sump

- Note :
1. Basic pension and family pension represent the benefits of old age pension in NP program. In other words, old age pension is comprised of basic and family pension.
 2. In NP program, the degree of disability classified into 4 Classes. The details of Class 1 in NP program are similar to those of Class 1 in WC program. The details of Class 2 in NP program are similar to those of Class 2 through Class 4 in WC program. The details of Class 3 in NP program are similar to those of Class 5 through Class 7 in WC program.
 3. Injured workers who belong to Class 4 can only receive lump sum payment in NP program.
 4. If disabled worker's service period is less than 20 years, the amount of disability pension benefit is calculated under the assumption that the disabled worker's total service period was 20 years.

3. Old Age Pension and Survivor Pension Benefits in NP Program

Table 3 shows the criterion of old age pension and survivor pension benefits in NP program.

Table 3. Criterion of Old Age Pension and Survivor Pension in NP program

	Criterion	Payment type
Old age pension	Basic pension 100% + family pension	Monthly payments
Survivor pension	Basic pension 60% + family pension	Monthly payments

In NP program, old age pension benefit is comprised of basic pension and family pension benefits. The criterion for calculating the amount of basic

pension benefits changes over time until 2028. Table 4 shows each criterion applied differently every year in the calculation of basic pension benefits.

Table 4. Criterion for Calculating Basic Pension Benefits in Old Age Pension

Year	Basic Pension	Year	Basic Pension
1988~1998	$2.4(A+0.75B)$	2012	$1.440(A+B)$
1999~2007	$1.8(A+B)$		
2008	$1.5(A+B)$	2027	$1.215(A+B)$
2009	$1.485(A+B)$	2028	$1.200(A+B)$
2010	$1.470(A+B)$	2029	$1.200(A+B)$
2011	$1.455(A+B)$		

- Note : 1. A : all workers' final 3 years average salary
 2. B : individual worker's average salary during service period
 3. If worker's service period exceeds 20 years, basic pension increases 5% with additional years. In other words, basic pension = $P(1 + 0.05N)$.
 (Where, P represents the value of basic pension applied to the worker who served 20 years. N represents additional years exceedings 20years.)

Related to family pension benefits, we assume two family members including injured worker's spouse in this analysis. According to the data from National Pension Service, if the date of suffering disabled was January 2011, the amount of family pension benefit for spouse is 220,870 won per annum and that for other family is 147,230 won per annum. Table 5 shows mean value of growth rates of A (all workers' final 3 years average salary) and that of family pension benefits.

Table 5. Mean Value of Growth Rates of A and Family Pension Benefits

	g_A	g_{FP}
Mean Value(2001-2010)	3.36%	3.12%

- Note : 1. g_A = average growth rates of A
 2. g_{FP} = average growth rates of family pension benefits

III. Data and Research Methodology

Considering both the disabled worker's age and the impairment rating, we calculated the present values of disability pension benefits in WC program after retirement age and those in NP program. Then, we calculated the present values of old age pension benefits in NP program under the assumption that there were no work-related injuries or illnesses.

In Korea, old age pension and disability pension in NP program as well as disability pension in WC program provide full protection against inflation. So, if we estimate the amount of monthly payments the disabled workers can receive immediately after retirement age and assume that all workers are alive at the retirement age, we can calculate the present value of each pension benefit using the same equation as follows.

$$PV = \left\{ B \times \sum_{t=j}^L \left[\prod_{\alpha=j}^t \left(\frac{1+i_{\alpha}}{1+r_{\alpha}} \right) \times {}_{t-j}P_{a+j} \right] \right\} \times \frac{1}{\prod_{t=1}^j (1+r_t)} \quad (1)$$

- where
- PV = present value of pension benefits
 - B = amount of pension benefit right after retirement age
 - a = disabled workers' age at $t = 0$
 - j = remaining years until retirement age ($j = 60 - a$)
 - L = life span
 - i_{α} = inflation rate at $t = \alpha$
 - r_{α} = discount rate at $t = \alpha$
 - ${}_tP_a$ = claimant's survival probability

In practice, disabled workers' life span can be shortened compared to those of healthy workers. With consideration to the effects of shortened life span and the stochastic processes of key variables (inflation rate, discount rate, etc.), we calculated the present value of each pension benefits using Monte Carlo

simulation method.

1. Calculating the Amount of Disability Pension in WC Program

In WC program, the amount of disability pension that is adjusted each year reflects the previous year's wage growth rate of all workers until retirement age($a + j$). After retirement age, the amount of disability pension that is adjusted each year reflects the previous year's growth rate of CPI (consumer price index) until death. Thus, the amount of disability pension at retirement age($a + j$) is calculated with the equation shown below.

$$P_{WC,j} = (E_0 \times DR) \prod_{t=1}^j (1 + g_t) \quad (2)$$

where $P_{WC,j}$ = amount of disability pension benefit at retirement age
 E_0 = disabled workers' wage at $t = 0$
 DR = wage replacement ratio by the class of disabled
 g_t = growth rate of wage at time t

Therefore, the present value of disability pension in WC program can be expressed as follows(Lew and Ma(2013)).

$$PV(d)_{WC} = (E_0 \times DR) \left\{ \sum_{t=1}^j \left[\prod_{\alpha=1}^t \left(\frac{1 + g_\alpha}{1 + r_\alpha} \right) \right] \times p_a + \prod_{t=1}^j \left(\frac{1 + g_t}{1 + r_t} \right) \sum_{t=j+1}^L \left[\prod_{\alpha=j+1}^t \left(\frac{1 + i_\alpha}{1 + r_\alpha} \right) \right] \times p_a \right\} \quad (3)$$

where $PV(d)_{WC}$ = PV of disability pension benefits in WC program

If we assume that all disabled workers are alive at retirement age, the present value of disability pension after retirement age can be expressed as follows.

$$PV(d_2)_{WC} = (E_0 \times DR) \prod_{t=1}^j \left(\frac{1 + g_t}{1 + r_t} \right) \sum_{t=j+1}^L \left[\prod_{\alpha=j+1}^t \left(\frac{1 + i_\alpha}{1 + r_\alpha} \right) \right] \times {}_{t-j}p_{a+j} \quad (4)$$

where $PV(d_2)_{WC} =$ PV of disability pension benefits after retirement age

If we assume the time series of net discount ratio $((1+g_\alpha)/(1+r_\alpha)$ or $(1+i_\alpha)/(1+r_\alpha)$) is stationary, we can use a simplified formula using mean value of net discount rate for calculating the present value of disability pension benefits as in equation (5)¹⁾.

$$PV(d_2)_{WC} = (E_0 \times DR) \left(\frac{1}{1+d} \right)^j \sum_{t=j+1}^L \left(\frac{1}{1+d_c} \right)^t \times {}_{t-j}p_{a+j} \quad (5)$$

where $d =$ mean value of net discount rates for wage growth rates
 $d = (r-g)/(1+g)$
 $d_c =$ mean value of net discount rates for inflations
 $d_c = (r-i)/(1+i)$

2. Calculating the Amount of Disability Pension in NP Program

In NP program, the amount of disability pension benefits is adjusted each year reflects the previous year's growth rate of CPI until death. Therefore, the present value of disability pension in NP program can be expressed as follows.

$$PV(d)_{NP} = P_0 \sum_{t=1}^L \left[\prod_{\alpha=1}^t \left(\frac{1+i_\alpha}{1+r_\alpha} \right) \right] \times {}_t p_a \quad (6)$$

where $PV(d)_{NP} =$ present value of disability pension benefits at $t=0$
 $P_0 =$ initial amount of disability pension in NP program

So, the amount of disability pension benefit at retirement age $(a+j)$ in NP program will be as below.

1) Concerning the use of mean value of discount rates in calculating present values of lost earnings, we can refer to Gamber and Sorensen(1994), Haslag et al.(1991), and Ma(2001).

$$P_{NP,j} = P_0 \prod_{t=1}^j (1 + i_\alpha) \quad (7)$$

where PV_{NPj} = disability pension benefits at retirement age

If we assume that all disabled workers are alive at retirement age, the present value of disability pension benefits after retirement age can be expressed as follows.

$$PV(d_2)_{NP} = P_0 \prod_{t=1}^j \left(\frac{1+i_t}{1+r_t} \right) \sum_{t=j+1}^L \left[\prod_{\alpha=j+1}^t \left(\frac{1+i_\alpha}{1+r_\alpha} \right) \right] \times_{t-j} p_{a+j} \quad (8)$$

where $PV(d_2)_{NP}$ = present value of disability pension benefits after retirement age in NP program

We can simplify the equation for calculating the present value of disability pension benefits using mean value of net discount rates for inflation.

$$PV(d_2)_{NP} = P_0 \left(\frac{1}{1+d_c} \right)^j \sum_{t=j+1}^L \left(\frac{1}{1+d_c} \right)^t \times_{t-j} p_{a+j} \quad (9)$$

3. Calculating the Amount of Old Age Pension in NP Program

The present value of old age pension benefits in NP program can be expressed as in equation (10).

$$PV(op) = \left\{ OP_m \times \sum_{t=m+1}^L \left[\prod_{\alpha=m+1}^t \left(\frac{1+i_\alpha}{1+r_\alpha} \right) \times_{t-j} p_{a+j} \right] \right\} \times \prod_{t=1}^m \left(\frac{1}{1+r_t} \right) \quad (10)$$

where $PV(op)$ = PV of old age pension benefits in NP program
 OP_m = initial amount of old age pension benefit ($m > j$)

In NP program, after the death of old age pensioner(or pension

subscriber), old age pensioner's spouse can receive survivor pension benefits. So, the present value of survivor pension benefits in NP program can be expressed as in equation (11).

$$PV(sp) = \left\{ SP_j \times \sum_{t=j+1}^{L^*} \left[\prod_{\alpha=j+1}^t \left(\frac{1+i_\alpha}{1+r_\alpha} \right) \times {}_{t-j}p_{b+j}^* \times (1-{}_{t-j}p_{a+j}) \right] \right\} \times \prod_{t=1}^m \left(\frac{1}{1+r_t} \right) \quad (11)$$

where $PV(sp)$ = PV of survivor pension benefits in NP program
 SP_j = initial amount of survivor pension benefit at age 60
 L^* = survivor's life span
 ${}_{t-j}p_{b+j}^*$ = female survivor rate²⁾

As a result, if we consider the effect of survivor pension benefits, total present value of pension benefits in NP program can be expressed as below.

$$PV(tp) = PV(op) + PV(sp) \quad (12)$$

where $PV(tp)$ = PV of total pension benefits in NP program

Therefore, if we use mean value of net discount rates for inflation(d_c) and mean value of discount rates(r), we can simplify the equation as below.

$$PV(tp) = PV(op) + PV(sp)$$

$$= \left[OP_m \sum_{t=m+1}^L \left(\frac{1}{1+d_c} \right)^t \times {}_{t-j}p_{a+j} \right] \times \left(\frac{1}{1+r} \right)^m$$

$$+ \left[SP_j \sum_{t=j+1}^{L^*} \left(\frac{1}{1+d_c} \right)^t \times {}_{t-j}p_{b+j}^* \times (1-{}_{t-j}p_{a+j}) \right] \times \left(\frac{1}{1+r} \right)^j \quad (13)$$

4. Average Monthly Wage

2) In this paper, we assumed that male is 3 years older than female between each couple($a-b=3$).

The average monthly wage of full time workers from the Ministry of Employment and Labor in 2011 is illustrated in Table 6.

Table 6. Average Monthly Wages in 2011 (unit: 1,000 won)

Age group	Average Wage	Age	Estimated Wage
Total	2,814		
Less than 30 years	2,038		
30-39 years	2,830	30 years	2,434
40-49 years	3,293	40 years	3,061
50-59 years	3,105	50 years	3,199
60 years or more	2,087		

Note : Data from Ministry of Employment and Labor
(<http://laborstat.molab.go.kr>)

Considering average monthly wages by age group in Table 6, we estimated the average monthly wage by age 30, 40, 50 as shown in the right most column of Table 6.

5. Net Discount Rate, Discount Rate, Wage Growth Rate, and Inflation

According to Lew and Ma(2012), mean value of net discount rates for wage growth rates and inflations are confirmed as in Table 7. Table 7 also shows mean value of discount rates(10 year treasury bond yields) and wage growth rates at the same period.

Table 7. Mean Values of Key Variables

	d	d_c	r	g	i
Mean Value	-0.73%	2.17%	5.42%	6.24%	3.19%

Note : Lew and Ma(2012) calculated mean values of net discount rates using annual average growth rates of wage in whole industries, inflation

rates, and yields of 10 year treasury bond during 2001 to 2010.

In this analysis, we used the values of Lew and Ma(2012) to calculate the present values of pension benefits. In addition, we implemented Monte Carlo simulation methods to confirm the effect of volatility due to probable fluctuation of mean value of key variables by passage of time.

6. Worker's Profile

We assume that the beginning of January 2011 as the start date of worker's disability due to work related injuries or illnesses and the disabled workers' age as 30 years, 40 years, 50 years respectively. The disabled workers are assumed to be male married workers and their ages(a) are three years older than their wives(b).

We assumed that worker's retirement age($a + j$) is 60 years. The pension subscriber can receive the initial old age pension benefit at age 65 ($a + m$) in the case of worker's age 30 or 40. Yet, the workers age is now 50 can receive the initial old age pension benefit at age 63. Table 8 shows the years that workers become age 60 or 65 according to their age groups in 2011.

Table 8. The Years Workers Become Age 60 or 65

Age	Service period	Years become age 60	Years become age 65
30	4 years	2041	2046
40	14 years	2031	2036
50	24 years	2021	2026

Note : All workers were assumed that they got their job at the beginning of age 26.

7. Survival Probability

In this analysis, to calculate the present values of each pension benefits,

we generated 2021, 2031, 2041 survival rates for both male and female respectively. To do this, we used the mortality rates from 2010 to 2060 estimated by Statistics Korea. Because mortality rates from Statistics Korea are aggregated into 5-year age intervals, we used Hodrick-Prescott(HP) filters to obtain single year values for these 5-year intervals. Figure 1 shows mortality rates and HP trends in 2010 and 2060.

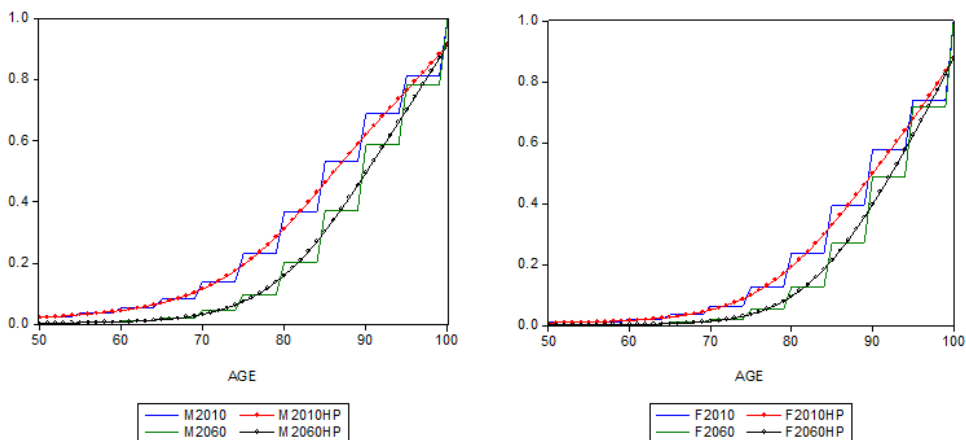


Figure 1. Mortality rate and HP trend
(M: mortality rate for male, F: mortality rate for female, HP: HP trend)

Using 2010 HP trend and 2060 HP trend, we generated mortality improvement factor (mif) as in equation (14).

$$mif_a = 1 - \left(\frac{q_a^{2060}}{q_a^{2010}} \right)^{\frac{1}{(2060-2010)}} \quad (14)$$

where mif_a = mortality improvement factor at age a
 q_a = mortality rate at age a

And then, using mif_a and actual 2010 single-year age interval mortality

rates in 2010 Life Table, we generated survival rates for both male and female in 2011, 2021, 2031, 2041 as in Figure 2. (In Figure 2, pm: survival rate for male, pf: survival rate for female)

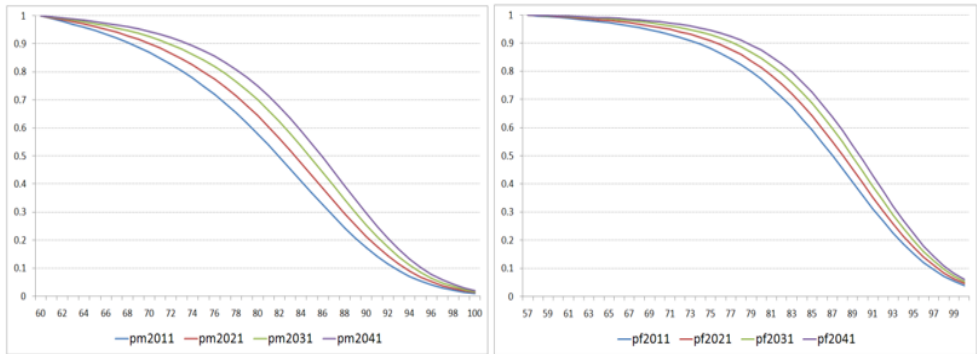


Figure 2. Estimated Survival Rates for both Male and Female

8. Assumption of Key Variable's Variability

To confirm the effect of fluctuation of key variables by passage of time, we assumed the mean value of these variables can change 50% from the basic mean values(basic mean values $\times (1\pm 50\%)$). We applied the range of mean values under these assumptions when conducting Monte Carlo simulations. Table 9 shows the variation range of basic mean values we used in this analysis.

Table 9. Variation Range of Mean Values

	d	d_c	r	g	i	g_A	g_{FP}
Mean*1.5	-1.10%	3.26%	8.13%	9.36%	4.79%	5.04%	4.68%
Mean	-0.73%	2.17%	5.42%	6.24%	3.19%	3.36%	3.12%
Mean*0.5	-0.37%	1.09%	2.71%	3.12%	1.60%	1.68%	1.56%

IV. Results of Analysis

1. Evaluating Present Values of Each Pensions

First of all, we confirmed the present values of disability pension benefits in WC and NP program after retirement age, old age pension benefits in NP program, and survival pension benefits in NP program. Table 10 shows present values of disability pension benefits after retirement age in WC program³⁾.

Table 10. PV of Disability Pension Benefits in WC ($PV(d_2)_{WC}$) (Unit: 1,000 won)

		Age 30	Age 40	Age 50
Class 1	Upper	685,068	756,001	691,044
	Mean	603,356	679,739	629,794
	Lower	533,200	610,011	573,869
Class 4	Upper	464,324	512,400	468,374
	Mean	410,195	460,712	426,860
	Lower	361,391	413,452	388,956
Class 7	Upper	289,251	319,200	291,774
	Mean	255,531	287,001	265,913
	Lower	225,128	257,560	242,300

Note: $PV(d_2)_{WC} = (E_0 \times DR) \left(\frac{1}{1+d} \right)^j \sum_{t=j+1}^L \left(\frac{1}{1+d_c} \right)^t \times {}_{t-j}p_{a+j}$

Table 11 shows present value of disability pension benefits after retirement age in NP program.

3) Numbers of "Lower" and "Upper" in this paper show the values on probability distribution under 95% of certainty.

Table 11. PV of Disability Pension Benefits in NP($PV(d_2)_{NP}$) (Unit: 1,000 won)

		Age 30	Age 40	Age 50
Class 1	Upper	93,218	131,536	178,124
	Mean	68,572	103,943	151,510
	Lower	49,256	81,148	128,381
Class 2	Upper	75,558	106,313	143,685
	Mean	55,581	84,011	122,217
	Lower	39,925	65,588	103,559
Class 3	Upper	57,898	81,091	109,247
	Mean	42,590	64,080	92,924
	Lower	30,593	50,027	78,738

Note : $PV(d_2)_{NP} = P_0 \left(\frac{1}{1+d_c} \right)^j \sum_{t=j+1}^L \left(\frac{1}{1+d_c} \right)^t \times {}_{t-j}p_{a+j}$

If there was no work-related injuries or illnesses, the workers could have received old age pension benefits when they reached the predetermined age for receiving the benefits. In addition, after old age pensioners or pension subscribers die, old age pensioners or pension subscriber's spouse can receive survivor pension benefits. Table 12 shows present values of old age pension benefits plus survival pension benefits in NP program under the assumption that there was no work-related injuries or illnesses.

Table 12. Present Values of $PV(tp) = PV(op) + PV(sp)$ (Unit: 1,000 won)

	Age 30	Age 40	Age 50
Upper	440,322	449,528	381,277
Mean	203,241	253,801	279,087
Lower	78,394	130,761	199,657

Note : $PV(tp) = PV(op) + PV(sp)$

$$= \left[OP_m \sum_{t=m+1}^L \left(\frac{1}{1+d_c} \right)^t \times {}_{t-j}p_{a+j} \right] \times \left(\frac{1}{1+r} \right)^m$$

$$+ \left[SP_j \sum_{t=j+1}^{L^*} \left(\frac{1}{1+d_c} \right)^t \times {}_{t-j}p_{b+j}^* \times (1 - {}_{t-j}p_{a+j}) \right] \times \left(\frac{1}{1+r} \right)^j$$

2. Confirming Social Security Effect of Disability Pension Benefits

After evaluating the present values of each pension benefits, we evaluated the ratios of $PV(d_2)_{WC}$ to $PV(tp)$ to confirm the social security effect of disability pension benefits in WC program. Table 13 shows the ratios of $PV(d_2)_{WC}$ to $PV(tp)$.

Table 13. Ratios of $PV(d_2)_{WC}$ to $PV(tp)$

		Age 30	Age 40	Age 50
Class 1	Upper	7.72	5.16	3.11
	Mean	3.63	2.96	2.31
	Lower	1.38	1.52	1.68
Class 4	Upper	5.23	3.50	2.10
	Mean	2.46	2.00	1.57
	Lower	0.93	1.03	1.14
Class 7	Upper	3.26	2.18	1.31
	Mean	1.53	1.25	0.98
	Lower	0.58	0.64	0.71

As we can see in Table 13, all values of $PV(d_2)_{WC}$ are considerably larger than those of $PV(tp)$ except for disability Class 7 at age 50 which was evaluated on the basis of mean values in the probability distribution of the ratios.

As we mentioned above, disabled workers who belong to disability Class 1 through Class 7 in WC program can additionally receive 50% of disability pension benefits in NP program. In WC program, the degree of disabilities are classified into 14 classes, and the workers who belong to Class 1 through Class 7 can receive disability pension benefits. Yet, in NP program, the degree of disabilities are classified into 4 classes, and who belong to Class 1 to Class 3 can receive disability pension benefits. Table 14 shows the relationship between WC and NP program in disability classification.

Table 14. Matching Disability Classification between WC and NP Program

	NP: Class 1	NP: Class 2	NP: Class 3
WC : Class 1	√		
WC : Class 2 ~4		√	
WC : Class 5 ~7			√

Therefore, the workers who belong to disability Class 1 in WC program can also receive 50% of disability pension benefits paid to disability Class 1 in NP program. The workers who belong to disability Class 4 in WC program can also receive 50% of disability pension benefits paid to disability Class 2 in NP program. And the workers who belong to disability Class 7 in WC program can also receive 50% of disability pension benefits paid to disability Class 3 in NP program. Table 15 shows total social security effect of disability pension benefits due to benefits from NP program as well as WC program at the same time.

Table 15. Ratios of $[PV(d_2)_{WC} + PV(d_2)_{NP}/2]$ to $PV(tp)$

		Age 30	Age 40	Age 50
$PV(d_2)_{WC(Class1)} + \frac{PV(d_2)_{NP(Class1)}}{2}$	Upper	8.15	5.55	3.48
	Mean	3.85	3.20	2.60
	Lower	1.46	1.64	1.88
$PV(d_2)_{WC(Class4)} + \frac{PV(d_2)_{NP(Class2)}}{2}$	Upper	5.58	3.81	2.40
	Mean	2.62	2.19	1.79
	Lower	1.00	1.13	1.30
$PV(d_2)_{WC(Class7)} + \frac{PV(d_2)_{NP(Class3)}}{2}$	Upper	3.53	2.42	1.54
	Mean	1.66	1.39	1.15
	Lower	0.63	0.71	0.83

When we consider the effect of disability pension benefits in NP program at the same time, we found that all ratios of $[PV(d_2)_{WC} + PV(d_2)_{NP}/2]$ to $PV(tp)$ are considerably larger than 1.0 when evaluated on the basis of mean values⁴⁾.

4) When disability pensioners who also have the right to receive old age pension benefits can select receiving old age pension benefits after retirement age if the amount is greater than

Furthermore, we considered the effects of shortened life span. For example, disabled workers who belong to Class 1 case may have shorter life spans due to body conditions. Table 16 shows the ratios when we assume that the Class 1 worker's life span was shortened 50% compare to normal people.

Table 16. 50% Shorten Effect of Life Span in Class 1 case

		Age 30	Age 40	Age 50
$PV(d_2)_{WC(Class1)} + \frac{PV(d_2)_{NP(Class1)}}{2}$	Upper	4.96	3.47	2.09
	Mean	2.34	2.00	1.55
	Lower	0.89	1.02	1.12

Although we assumed that the Class 1 worker's life span was shortened 50% compare to normal people, the values of ratios are still considerably larger than 1.0. Figure 3 shows probability distribution of ratios of $[PV(d_2)_{WC} + PV(d_2)_{NP}/2]$ to $PV(tp)$ in disability Class 1 (Figure below shows probability distribution of ratios when worker's life span was shortened 50% compare to normal people).

disability pension benefits in NP program. In this analysis, for the convenience of discussion, we assumed that disabled workers select only disability pension benefits continuously. However, we think that this assumption does not affect the interpretation of our analysis because the selection of old age pension benefits only occurs in the situation that the amount of old age pension benefits is greater than disability pension benefits.

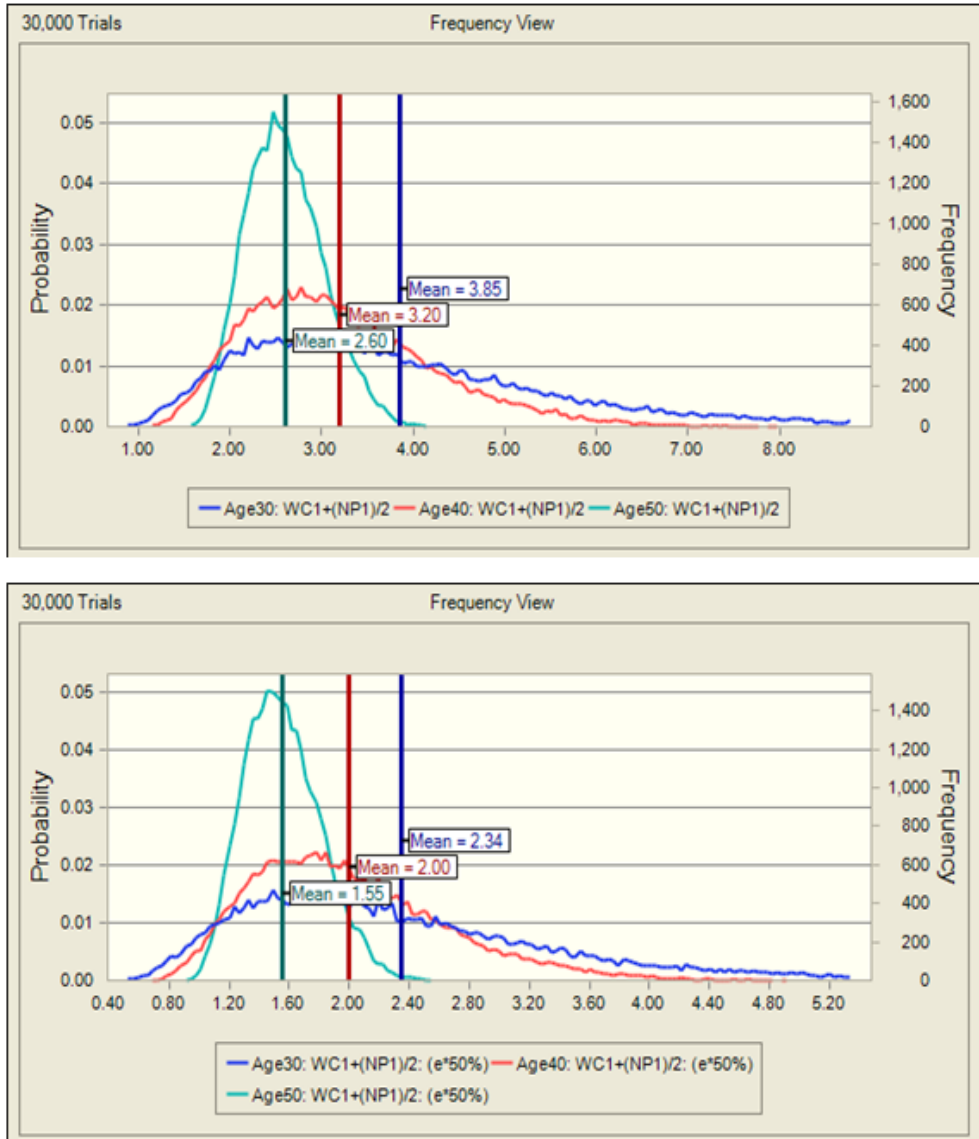


Figure 3. Probability Distribution of Ratios of $[PV(d_2)_{WC} + PV(d_2)_{NP}/2]$ to $PV(tp)$ in Disability Class 1

V. Conclusion

In the work-related injuries or illnesses, disabled workers can receive living costs for old age as well as wage replacement benefits. According to the rate of impairment, disability pensions are paid permanently as a form of life annuity and provide full protection against inflation. As a result, the present values of disability pension benefits are considerably larger than the injured workers' actual lost wages. Thus, the amount that exceeds workers' actual lost wages can be considered as the benefits of social security for worker's old age.

We analyzed the adequacy of disability pension benefits by analyzing social security effect for worker's old age. To do this, we calculated the present values of disability pension benefits in WC and NP program after retirement age and old age pension and survivor pension benefits in NP program. Then, we compared the present values of disability pension benefits in WC and NP program with those of old age pension and survivor pension benefits in NP program. As a result, we confirmed the benefit level of disability pension is significantly higher than that of old age pension benefits. From the results of this comparative study, we illustrate the need to narrow the gap of benefit level between disability pension and old age pension to maintain the fairness between public pension benefits. Hereafter, when there is a discussion about improving the current disability pension schemes, we expect that the results of this analysis to assist policy makers' decisions.

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Abstract

Under the Workers' Compensation System (WC) in Korea, disabled workers receive lifetime disability pension benefits which provide full protection against inflation. As a result, the present values of disability pension benefits covers more than their lost earnings. In this analysis, we evaluated the differences of benefit levels between disability pension in WC and old age pension in National Pension System(NP) to confirm social security effect of disability pension benefits after retirement age in WC, with considering the disabled workers' age group and the classification of disability. To do this, we calculated the present values of old age pensions in NP under the assumption that there were no work-related injuries or illnesses and then compared the values with those of disability pension benefits after retirement age in WC. From the results of this comparative study, we found that the disability pension benefits in WC after retirement age would pay more than old age pension benefits in NP. Therefore, it is necessary to narrow the benefit gap between disability pension benefits in WC and old age pension benefits in NP to maintain the fairness in public pension benefits.

※ Key words : work-related injuries or illnesses, old age pension, disability pension, social security effect