Study of Retirement Plan Selection Using Computer Simulation Technology

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Abstract — The application of computer simulation technology in retirement scheme selection is not only the simulation of the pension itself， but also the prediction of the pension system. The design of the pension system is a systematic project, which should not only have a certain integrity, authority, and principle but also have a certain flexibility. In the process of implementation, it is suggested to implement a flexible retirement system. The latest national policy stipulates that female leading cadres and female professional and technical personnel can choose to retire at the age of 55 or 60. The choice of retirement time requires comprehensive consideration of various factors. If employees choose to postpone their retirement, they will have to pay more pension contributions and enjoy their pensions for a shorter period of time, but their pension levels will increase accordingly upon retirement. Using computer simulations, this paper discusses the time required for pensions to reach equilibrium for different years of actual payments, different interest rates, and different investment returns, and compares it with the remaining life expectancy of employees as a reference for selecting retirement options.

Keywords: computer simulation technology; calculation model; old-age pension; retirement plan

1 INTRODUCTION

Retirement age policies involve real stakes for employees and are naturally of concern to all segments of society. Usually， in addition to general regulations, there are also corresponding regulations for special groups. Female leading cadres and female professional and technical personnel are valuable wealth in China's socialist construction cause. The earliest provisions of their retirement age were the Interim Measures on the Retirement of Staff of State Organs issued by the State Council in December 1955, which stipulated that the retirement age of female staff of state organs was 55. The latest national policy stipulates that female leading cadres and female professional and technical personnel can choose to retire at the age of 55 or 60. On the one hand, the delay of retirement age provides more opportunities for female leading cadres and female professional and technical personnel to serve the country and society. On the other hand, they not only have the same opportunities as men in training, promotion, and promotion but also obtain more economic rights and interests. At the same time, the new policy allows female leading cadres and female professional and technical personnel to apply for early retirement when they reach the age of 55, which fully reflects the flexibility of the new policy and respects their right to make their own choices.

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Retiring at 55 or 60 is a choice that people have to make. The decision to retire early is influenced not only by socioeconomic-level factors such as macroeconomic performance, pension system design, and tax policy development but also by personal factors such as family financial burden status, health level, and marital status.

Beginning in the late 1960s, a number of scholars, such as Barfield, began to examine the issue of factors influencing retirement age intentions, and they used the Logistic Regression Principle to analyze and found that expected retirement income was the most important factor influencing the choice of retirement options.[1] Andrew's research further points out that the major economic factor determining the possibility of retirement is not the pension wealth level at exactly a certain point in time, but the growth of pension wealth caused by continuing to work. [2] It can be seen from the current provisions of old-age insurance against organs and institutions that the pension treatment is directly linked to the retirement age, payment level, and payment years. It is thus clear that pensions are an important factor in determining the retirement age of employees. It is easy to see from the current regulations on pension insurance for institutions that pension benefits are directly linked to the retirement age, contribution level, and the number of years of contribution. For every year that an employee delays retirement, his or her pension level after retirement will increase accordingly, but this also means that the employee needs to pay one more year of pension insurance premiums, and the period of enjoying pension benefits is shortened by one year. For the two options of retiring on time at age 60 and retiring early at age 55, this study will compare the number of years it takes to receive equal pensions under the two options with the remaining life of the employee at age 60 based on the pensions and the time they are received, as a reference for retirement option selection.

Research on pension insurance issues currently has two main entry perspectives, macro and micro. Since the early retirement decision of female cadres and senior women is a reflection of their own subjective will, this study takes the "representative workers" among female cadres and senior women as the research object to start the study from the micro perspective.

2 MODEL

China's institutions' pension insurance system adopts the operation mode of combining social coordination accounts and individual accounts. According to the "Decision on the Reform of the Pension Insurance System for Institutional Staff" promulgated by the State Council in January 2015, the pension insurance contribution rates for units and individuals are 20% and 8%, respectively. Corresponding to the social coordination and individual account, the basic pension includes the basic pension and the individual account pension. For " middle-aged people" (employees who joined the workforce before the implementation of the new policy and retired after the implementation), in addition to the basic pension, a transitional pension is also paid based on the number of years of deemed contributions. Meanwhile, the Measures for Occupational Pensions for Public Institutions, announced by the General Office of the State Council in March 2015, stipulates that the occupational pension contribution rates for units and individuals are 8% and 4%, respectively. Employees who joined the workforce after the implementation of the new policy or joined the workforce before the implementation and retired after the implementation with 15 years of contributions, can receive a monthly pension after retirement.

Here, assuming that the employee retires at age k with a payout period of t_k. According to the pension system, the basic pension for retired employees is based on the average of the average salary of local employees on duty in the previous year and the indexed average contribution salary at the time of retirement, and 1% is paid for each full year of contribution; the transitional pension is related to the index of deemed contribution, the number of years of deemed contribution and the transition factor, and the transitional pension is obtained by multiplying the average salary of local employees on duty in the previous year with these three indexed values at the time of retirement. The basic pension and transitional pension for the employees at the time of retirement at age k are as follows：

$$P_k^1 = \frac{W_0}{12}(1+g)^{t_k} \times t_k\% \tag{1}$$

In the above formula, W_0 denotes the average wage of local employees on duty in 2014, and g denotes the growth rate of wages. The accumulation values of personal accounts and occupational annuity accounts of "representative workers" are as follows：

$$P_k^2 = c_1 W_0 \sum_{j=1}^{t_k}(1+g)^{j-1}(1+n)^{t_k-j+1} \tag{2}$$

$$P_k^3 = (c_2+c_3) W_0 \sum_{j=1}^{t_k}(1+g)^{j-1}(1+r)^{t_k-j+1} \tag{3}$$

In the above formula, c_1 is the payment proportion of the individual account, c_2 is the payment proportion of the individual occupational pension, c_3 is the payment proportion of career annuity for the business unit, n is the investment income of individual accounts, and r is the investment income of occupational annuity. The amount in the individual account cannot be withdrawn earlier than the specified time and is exempt from interest tax. The employee's personal account pension after retirement is the amount of the personal account deposit divided by the time of payment according to the regulations (the number of calculation and issuance months corresponding to the retirement of 55 and 60 years old is 170 and 139 respectively). Of course, if the individual account fund has run out of money to pay, it will continue to be paid by the pooled account payments to give payments. The pension payments corresponding to the two retirement plan scenarios over time are shown in Figure 1.

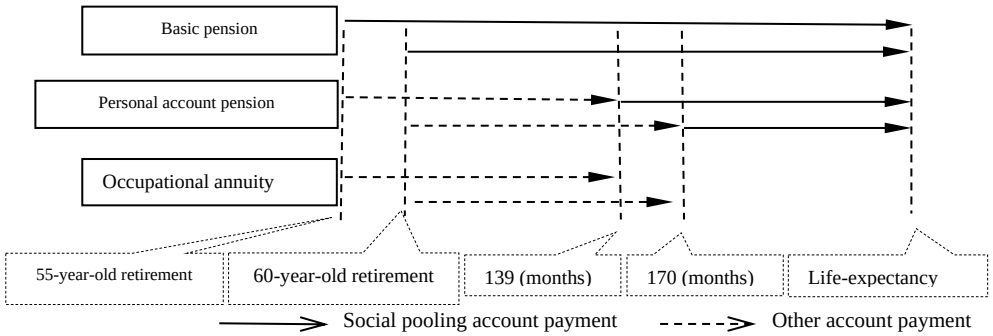

Figure 1 The pension payments for two retirement options

Here, q_k represents the remaining life (unit: month) of "representative employees" from the age of k to the expected life (unit: month), m_k represents the number of months in which the individual account pension is calculated and issued. Assume that the monthly growth rate of

pension during retirement is basically the same as the monthly discount rate. Thus, the sum of all pensions received by the employee during one of his or her life cycles is

1) If $0 \leq q_k \leq m_k$, then $P_k = q_k P_k^1 + P_k^2 + P_k^3$

2) If $m_k \leq q_k$, then $P_k = q_k P_k^1 + \frac{q_k}{m_k} P_k^2 + P_k^3$

3 SIMULATION

3.1 Parameter Setting

We use the employees who retire at age 60 as a representative group and calculate the value of the pension received under the two schemes at the base time as the basis for choosing early retirement. Assume that when the employee is 55 years old, he can receive a pension for a period of 30 years. Over the past 10 years, China's economy has entered a medium-to-high-speed development phase, and many research institutions indicate that China's GDP growth rate will remain at around 7% for some time to come. China's social insurance law clearly stipulates that the interest rate credited to individual accounts shall not be lower than the interest rate of bank time deposits [3]. Therefore, the fluctuation range of the investment return of the occupational annuity is 3 percentage points above the one-year deposit rate.[4] From 1999 to the present, the fluctuation range of the one-year deposit rate is 1. 5% to 4. 14%, and this study will conduct various studies in the range of interest rate changes from 2% to 4%. At the same time, the transitional pension accrual factor is set between 1% and 1.4%.[5]

3.2 Results

Figure 2 shows the evolution of pensions received by employees as they progress through retirement time. The graph shows that the amount of pension received is positively correlated with the number of months received after age 60. For each type of retired employee, the pension growth rate for employees who retire at the age of 60 is higher than that of the employees who retire early. The balance time between the two retirement plans needs about 120 months.

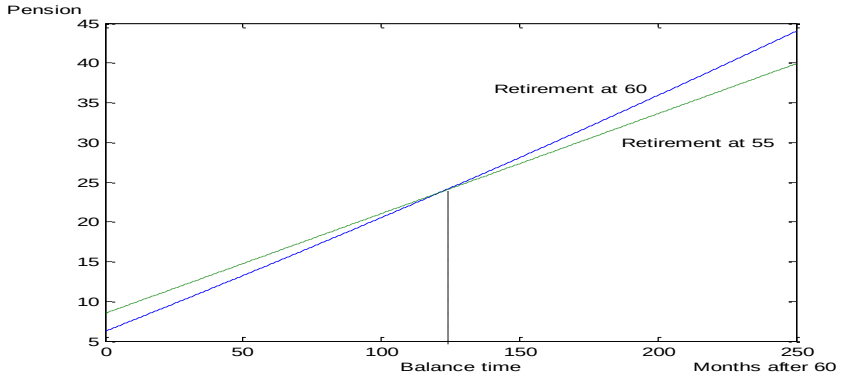

Figure 2 The balance time diagram

Table 1 gives the retired employees who have paid for 30 years at the age of 55, and the time when the pension of the two retirement schemes reaches balance under different actual payment years, different interest rates, and different investment varieties. Meanwhile, the equilibrium time for employees to receive pensions under both retirement scenarios is negatively correlated with the number of years of actual payments and the investment income but positively correlated with the one-year deposit rate. At the age of 55, the more years of actual payment, the earlier the employees will reach the balance time. For each additional year of the actual payment period, the equilibrium time will be about 3 months in advance; Changes in one-year interest rates have a significant impact on the timing of equilibrium, bringing fluctuations in the range of 20 to 30 months. For occupational pensions, each percentage point increase in investment returns will advance the equilibrium of pension receipt by about three months or so.

Table 1 The time to balance pensions for two retirement options

Annual interest rate		2%			3%			4%		
Personal account interest rate		3%			4%			5%		
Individual annuity account interest rate		2%	3%	4%	3%	4%	5%	4%	5%	6%
Years	**5**	99	97	94	123	120	116	154	151	148
	6	97	95	92	121	117	113	152	149	146
	7	95	92	89	118	114	109	150	147	143
	8	93	90	86	115	110	105	149	145	141
	9	91	87	83	112	107	102	147	143	137

4 CONCLUSION

In the course of this paper, the assumptions made by different scholars in the study of pension insurance were reviewed, and a model for calculating pensions is developed. The relationship between the number of monthly pensions received by retired employees and the time remaining in their lives are analyzed and discussed, and the equilibrium time under different interest rates and different ROIs are given to provide a reference for decision-making for specific female leaders and female professionals. On the contrary, the work ethic that these retired workers have developed over the years has led them to want to remain valuable to society and not to fully enjoy their leisure time. In the relevant pension operations conducted in our country, the life expectancy for women is given as 83.7 years. Apparently, most retired workers receive pensions to reach an equilibrium of only 30% to 50% of their remaining survival life expectancy after age 60. That is, for 50% to 70% of the retirement time, the pension received for timely retirement is greater than the pension received for early retirement, and the gap between the two grows larger as time passes. At the same time, the equilibrium time is negatively correlated with the actual number of years of contributions, and the more years of actual contributions at age 55, the greater the likelihood that such "representative workers" will forgo the option of early retirement.

The implementation of the policy of retirement to 60 years of age for all types of personnel is of great significance in optimizing the allocation of human resources and improving the motivation of personnel working in institutions. In order for the policy to be implemented, the abandonment of the early retirement option should be actively guided. The very clear conclusion is that improving the investment efficiency of annuities can lead to much earlier equilibrium times. [6] As a result, relevant government departments should take effective measures to actively and steadily make investments to ensure that annuity investments earn stable returns in the long term.

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