

The Debt Actuarial Model and Its Application of China's Implicit Pension

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Abstract: With the development of the times, the improvement of living standards and the extended average expected life, the pension insurance systems of countries have suffered from varying degrees of crisis, and reform actively. In this era background and trend, in 1997, China's basic pension system was accumulated by the current payment to social coordination and individual accounts. The revolutionary cost left in the old system has formed a huge implicit debt. To achieve the realization of the system transition, the key is to properly measure the size of the implicit debt and find the appropriate repayment pathway. Whether the pension system transformation is successfully correlated with the accurate calculated IPD amount and reasonable solutions. China is no exception to face IPD issues. This paper uses personal cost statement, combined with China's pension system and its operation, and establishes a implicit pension debt calculation model, and then uses statistics to measure China's IPD quantity. Finally, this paper proposes that the government increases the legal retirement age, reducing the replacement rate of pension, expanding the coverage of pension insurance, and improving the investment yield of pension funds to compensate for China's IPD.

Keywords: Recessive Pension Debt; Mathematical Analysis; Actuarial Model; Basic Pension Insurance System

1. Introduction

What is IPD? Buwenberg describes IPD as pension to employees and retirees to a pension plan. Robert Hallman believes that IPD is the feasibility of the government's response lacks the most powerful financing support. Most scholars believe that IPD is a responsibility. IPD is the service personnel of enterprise employee basic pension insurance system in China to the traditional pension system to make pension retirees and employees attended the service personnel of the pension system. When paying, it is a new public pension system mode. Such debts require financial support from the central government to bring additional pressure to China's public finance.

At present, the research on IPD is mainly concentrated in measurement, ensuring its size and makes up their losses. In 1997, experts from the World Bank A found that China IPD is equivalent to half of China's GDP in 1994, and the net present value of China IPD is 1917.6 billion yuan. An expert refers to the basic endowment of IPD employees in Chinese enterprises to 360.9 billion yuan in 1997. China Labor and Social Experts Securities Exchange completed IPDs for 57.22 billion yuan. There is a huge difference between these results, and the reason is different measurement methods, different measurement cycles, different assumptions, different measurement standards, different definitions of IPD, and more.

2. Significance of related research

Realistic Significance: With the increase of aging in China, the significant increase in living standards has greatly increased the expenditure of pension. Therefore, the social pension insurance system under the presence of the current reception is facing the increasingly severe financial crisis, which has brought a huge burden to China's finance. By the late 1990s, the basic achievement is converted from a completely current collection to social coordination and personal accounts. But this shift has also produced pension insurance recessive debt (IPD) issues. This issue has become the main obstacle to the operation of the pension fund, and the growth rate

is quite amazing. In addition, with the acceleration of aging processes, the implicit debt has also brought a huge burden to the national finance. Repairing implicit debt is the key to the success of social basic pension insurance systems. So the first study to be carried out is the main factors of the implicit debt affecting the size of the implicit debt. This is the research content of this article.

Theoretical significance: The volume of IPD depends on many factors, and many uncertain factors make the complicated or error of the implicit debt. Therefore, it is necessary to introduce further research on this problem into more accurate actuarial methods. To solve the implicit liability, the primary issue is to calculate it.

(1) Finding the size of my country's recessive debt, which is conducive to the formulation of repayment plans

The dominant liability of huge implicit liabilities is a long-term process, which will not immediately appear. There is a need to pay gradually. This creates a series of questions: The annual payment should be made to make the financial funds sufficient to take expenses in this regard; how many years are more appropriate; what kind of repayment method is made. The total IPD debt scale is measured, which is conducive to developing a suitable repayment plan, the most effective resolution of implicit liabilities and its implicit dangers and crises.

(2) Predicting the scale of implicit debt, which is conducive to formulating suitable pension payment policies

Retirement age, pension replacement rate, and pension salary growth adjustment proportion have the significant relationship with implicit negative debts, which are the important parameter while calculating IPD scale. Raising retirement age can reduce recessive liabilities, and if there is a serious advance retirement problem, it is possible to be difficult to pay for implicit liabilities. But raising the retirement age will also cause employment issues and the consequences of degradation of labor marginal efficiency. In the process of calculating IPD, it is also possible to develop the best retirement age, and how to gradually improve the retirement age without affecting employment.

(3) There is a theoretical research significance for the calculation of recessive liabilities

Population aging is a world problem. The reform of my China's pension insurance policy is in line with internationally, most countries in the world are facing implicit liabilities. Therefore, the estimation of IPD scale has not only a practical significance. You can give a reference, and develop the theory of annuity and social security system.

3. IPD actuarial model

The personal cost method is for calculating the non-payment pension of the elderly and middleman. They get IPD quantity. Compared with the pension calculation cost method and payment agreement, the impact of personal cost method can reflect the impact of pension system is full and different. It will accurately explain the gender, age, etc.

$L_{O_x, t}$ represents the number of old people in t year. Q represents the total, g for the growth rate of social average salary and k for the pension adjustment factor. The letter " z " represents the basic endowment insurance system of the enterprise, " r " for the retirement age and ω for the maximum age. the letter " v " represents for the discount rate and W_0 for the social average sewage in t_0 years. λ is for the object of pension problem, ϵ for the experience factor of additional pension metastasis. T_{ix} represents the the payment time, β for the average payment index. γ presents the adjusted pensions, $LMZ(x, t)$ for the number of people working in t years. d_0 presents the current pension value of the X -year old man. Combined with the basic endowment insurance system and corporation employee policies in China, we can get the following conclusion:

$$d_0 = \sum_{i=0}^{\omega-x} Q(1+kg)^i v^i p_x$$

Make IPD_0 represent the number of old people's IPD, we can get

$$LO_{x,t} \cdot IPD_0 = \sum_{x=r}^{\omega} Q(1+kg)^i v^i p_x$$

For the intermediary IPD, we use dz_1 , dz_2 , dz_3 to indicate the present value of the basic pension, the transition pension, and the

middle-aged to adjust the pension, we have gotten,

$$d_{Z1} = \frac{x - (a + t - z)}{L} W_0 (1 + g)^{r-x} p_x v^{r-x} \sum_{i=0}^{\omega-r-1} [i p_r (1 + g)^i v^i] \quad (3)$$

$$d_{Z2} = c T l_x \beta \bar{W}_0 (1 + g)^{r-x} p_x v^{r-x} a_{\cdot r} \quad (4)$$

$$d_{Z3} = \sum_{x=a+t-z}^{o x} T l_x v^i p_x$$

= r - x

Then make IPD_{mz}, IPD_{mt}, IPD represent the workload of the intermediary IPD, the number of IPDs in retirement and the number of IPDs, we have gotten,

$$\begin{aligned} IPD_{mz} = & \sum_{x=a+t-z}^{r-1} LM_{Z(x,t)} \left\{ \frac{x - (a + t - z)}{L} \right. \\ & \times \lambda \bar{W}_0 (1 + g)^{r-x} p_x v^{r-x} \sum_{i=0}^{\omega-r-1} [i p_r (1 + g)^i v^i] \\ & \left. + \varepsilon T l_x \beta \bar{W}_0 (1 + g)^{r-x} p_x v^{r-x} \ddot{a}_r + \sum_{i=r-x}^{\omega-x-1} \gamma T l_x v^i p_x \right\} \quad (6) \end{aligned}$$

$$\begin{aligned} IPD_{mt} = & \sum_{x=b}^{r+t-z-1} LM_{T(x,t)} \left\{ \frac{x - (a + t - z)}{L} \lambda \bar{W}_0 \right. \\ & \times \sum_{i=0}^{\omega-x-1} [(1 + g)^i v^i p_x] \\ & \left. + \varepsilon \beta T l_x \bar{W}_0 \ddot{a}_x + \sum_{i=0}^{\omega-x-1} \gamma T l_x v^i p_x \right\} \quad (7) \end{aligned}$$

When we can make

$$IPD = IPD_0 + IPD_{mz} + IPD_{mt}$$

we have gotten,

$$\begin{aligned}
IPD = & \sum_{x=r+t-z}^{\omega-1} LO_{x,t} \sum_{i=0}^{\omega-x-1} Q(1+kg)^i v^i p_x \\
& + \sum_{x=a+t-z}^{r-1} LM_{Z(x,t)} \left\{ \frac{x-(a+t-z)}{L} \lambda \bar{W}_0 (1+g)^{r-x} \right. \\
& \times p_x v^{r-x} \sum_{i=0}^{\omega-r-1} [i p_r (1+g)^i v^i] \\
& + \left. \varepsilon T I_x \beta \bar{W}_0 (1+g)^{r-x} p_x v^{r-x} \ddot{a}_r + \sum_{i=r-x}^{\omega-x-1} \gamma T I_x v^i p_x \right\} \\
& + \sum_{x=b}^{r+t-z-1} LM_{T(x,t)} \left\{ \frac{x-(a+t-z)}{L} \lambda \bar{W}_0 \right. \\
& \times \sum_{i=0}^{\omega-x-1} [(1+g)^i v^i p_x] \\
& + \left. \varepsilon \beta T I_x \bar{W}_0 \ddot{a}_x + \sum_{i=0}^{\omega-x-1} \gamma T I_x v^i p_x \right\} \tag{9}
\end{aligned}$$

4. Empirical analysis

4.1 Data Collection

The latest node time for the China Social Security System has been in 2050, and according to the age constitutes trend, the number of middlemen and the elderly will be reduced to 0, so we set the T time period [2013, 2050].

(1) According to the Labor Law of the People's Republic of China, China Labor Power Statistics 2012 Yearbook and the Life Table of the People's Republic of China, we set the average allowable age of basic empowerment, and the insurance system of business employees is 21, and the male retirement age is 60. The male retirement age is 60 years old. The female retirement age is 55 years old. The average working life of male is 40 years, and the average working period is 35 years, and the highest age is 90 years old.

(2) We can obtain social average wages from China Statistical Yearbook, and the average salary of 1996- 120 shows that the social average wage growth rate is 13.08%, concerning about 2.05% personal factors and a social factor of 11.30%. We can predict how the social average salary growth rate is.

4.2 Actual measurement results

We get Table 1 and Equation 9 on the basis of data collection and data collection.

As can be seen from Table 1, the IPD in 2013-2050 declined. The average annual IPD is 39.44 billion yuan, the maximum is 1850.53 billion yuan in 2022. The minimum is 0.15 billion yuan in 2050. IPD will decrease over time to 0, and the old man and the middleman will gradually disappear. IPDs are expected to growing during the period 2013-2020, from 119.787 billion yuan to 149.7337 billion yuan, an annual growth rate of 7.06%.

5. IPD compensation

Like China, many other countries face IPD issues as part of them reform the pension insurance system. Different countries have different economic and political conditions, so they take different ways to solve this problem. In any case, there are two main solutions. One is the government assumes all debts and pays them to individual payments. The other is a long-term repayment debt and pays in a series of ways. Foreign scholars have spent a lot of money for long-term research on pension security, but IPD research has just begun, because there is no IPD before Chile began to reform. As for China's IPD, the International Labor Organization (ILO) has released a report, which pointed out that China is impossible to repay IPD funds as planned. However, the report did not give a substantive solution.

In 1952, the ILO issued a minimum of social security, and through this practice, the pension replacement rate was 55%, so China's pension replacement rate can be reduced, and then IPD will decrease significantly. In order to increase the source of our pension fund, we can primarily start from the following aspects:

- (1) Expanding the coverage of pension insurance and increasing fund raising efforts
- (2) Strictly implying retirement policies to improve pension rate burden
- (3) Removing debt to ensure the retention and increasing in funds
- (4) Improving the investment yield of the pension fund and strengthening the fund in a good situation

6. Conclusion

On the basis of defining the relevant concepts, this paper constructs a budget model of the implicit debt scale to quantify the scale of the implicit debt scale. This is an exploit and innovation based on the predecessors. The author is widely appreciated and collected by the related article. After a series of processes of the collected data, the annual implicit debt are used to calculate the simulation measurement of the implicit debt and the scale of the annual recessive pension debt. Accurately calculates that the implicit liabilities are the premise of repaying implicit liabilities, and it is also the key to the completion of the social security system.

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