

On the Determination of the Level of Basic Pension Insurance for Urban and Rural Residents and the Adjustment Program

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ABSTRACT

With the increasing aging of the population, the key issue to optimize the basic pension insurance for urban and rural residents is not to bring excessive financial burden while improving the level of treatment level. Starting from three aspects: the dynamic adjustment mechanism of basic pension oriented to meet the needs of survival, the adjustment mechanism of contribution grade, the subsidy mechanism of contribution ratio and the long-term basic pension determination mechanism, this paper designs the optimization scheme of financial subsidy mode, and establishes the actuarial model and the financial moderate burden coefficient model to evaluate the effectiveness and feasibility of the scheme. The calculation results show that the optimization of financial subsidies has significantly improved the ability of urban and rural resident insurance pensions, and the central and local finances have a certain ability to bear the steady increase of basic pensions and contribution subsidies.

KEYWORDS

Basic insurance; Urban and Rural Residents; Fiscal Subsidies; Treatment determination mechanism

1. INTRODUCTION

The basic pension insurance system for urban and rural residents has played a positive role in improving people's livelihood, adjusting income distribution, and helping poverty alleviation. It has become a security system with the largest number of insured people and the widest range of beneficiaries in the world. Since 2014, the basic pension insurance system for urban and rural residents has been increasingly improved. In March 2018, the Ministry of Human Resources and Social Security and the Ministry of Finance issued "the Guiding Opinions on Establishing a Mechanism for the Determination of Basic Pension Benefits for Urban and Rural Residents and the Normal Adjustment of Basic Pension" (hereinafter referred to as "the Guiding Opinions"), requiring the establishment of a mechanism for the determination of pension benefits for urban and rural residents and the normal adjustment of basic pension with effective incentives and constraints, clear financing rights and responsibilities, and appropriate security levels. It provides the research idea and direction for the determination and adjustment of pension benefits.

According to the arrangement of the basic pension insurance system for urban and rural residents, the government finances will pay the basic pension in full, and provide subsidies for personal account contributions. In other words, the financial input covers at least 50% of the pension benefits. Therefore, how to optimize the pension treatment determination and adjustment plan to provide appropriate security for individuals' life after old age and avoid excessive pressure on government finance has become a problem that must be faced to improve the urban and rural residents' pension

insurance system. At present, the basic pension protection function is not clear, and the adjustment method is short-term and arbitrary. The fixed level and subsidy of individual payment and the lack of incentive have seriously restricted the improvement of the guarantee ability of urban and rural residence insurance and the play of the incentive role of payment (Deng Dasong and XianMihua, 2015; Zhu Lili and Chu Fuling, 2016; Wang Min, 2017; Yao Jun, 2018).

On the issue of increasing financial subsidies, the academic circle has made some achievements. He Hui and Yin Baoming (2012) believe that governments at all levels have the financial capacity to pay basic pensions at 15% of farmers' per capita net income in the previous year. Feng Tieying and Dong Xuan (2012) designed the changing trend of pension insurance financing scale under the scenario of individual proportional contribution and dynamic adjustment of basic pension, and proposed that financial support should be strengthened. Wang Lijian and Ye Xiaogang (2015) took Shaanxi Province as an example to design a demand-oriented phased adjustment plan for basic pension, believing that the government finance has the ability to increase basic pension. Jing Peng et al. (2018) calculated the scale of financial subsidies required and the affordability of government finance under the financing model of raising individual proportional contributions and basic pension replacement rate by 1% annually to the target level. Xu ding and Yang zaigui(2023) studied the financial impact of the reform of the financing mechanism and treatment level of urban and rural residents' pension insurance.

According to the existing literature, the increase of basic pension and contribution subsidies will increase the system's demand for financial subsidies, and the adjustment method determines the scale of subsidies, which is in essence the optimization of financial subsidies. Although the existing research results on the level of basic pension and the way of contribution subsidy are based on the perspective of taking into account the reasonable sharing of the responsibility of government financial subsidy and moderate protection, the proposed optimization plan of financial subsidy is either very different from the current policy and difficult to be implemented, or there is no necessary assessment, and the feasibility of the optimization plan needs to be further demonstrated. On the basis of the operation of the current system, this paper re-studies the issue of financial subsidies by constructing the adjustment mechanism of basic pension, the raising mechanism of contribution grade and contribution subsidy, and the calculation formula of basic pension for years, and establishes the actuarial model and the financial moderate burden coefficient model to evaluate the effectiveness of the optimization plan. In order to make a beneficial exploration on the establishment of effective incentives and constraints, clear financing rights and responsibilities, moderate security level of the basic endowment insurance treatment of urban and rural residents and basic pension adjustment mechanism.

2. DESIGN OPTIMIZATION SCHEME

Financial subsidies are a strong support for the existence and steady operation of urban and rural residential insurance. The government realizes the guarantee ability and incentive constraints of urban and rural residential insurance by adjusting the basic pension, payment subsidies and basic pension for years. The basic pension reflects fairness, the adjustment principle is to ensure the survival needs of residents, and the lagging adjustment will not ensure people's lives. Payment subsidy reflects efficiency, the principle of adjustment is to realize the effective incentive and constraint of individual payment, adjustment lag will cause adverse selection problem. This paper holds that with the improvement of people's living standards and the extension of life expectancy, the basic pension and payment subsidy should be adjusted simultaneously, the basic pension adjustment mechanism, the contribution subsidy upward mechanism and the old-age basic pension calculation formula should be established, and the financial investment in urban and rural residential security should be increased in a timely and moderate manner. The optimal scheme of financial subsidies is shown in Figure 1.

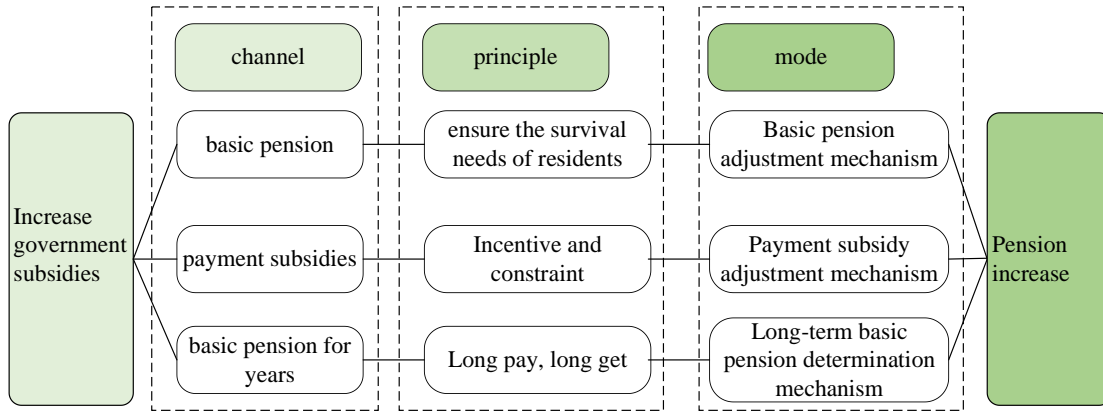


Figure 1. The optimal scheme of financial subsidies

2.1. Basic pension adjustment mechanism

The function positioning of basic pension is to provide survival guarantee for urban and rural residents, which reflects the bottom line fairness. Poverty standard, as the minimum cost of consumer goods and services necessary for basic survival, is the subsistence guarantee line for residents. The basic pension is supposed to match the poverty level. According to the guideline, the adjustment of the basic pension should be increased steadily, rather than in one step.

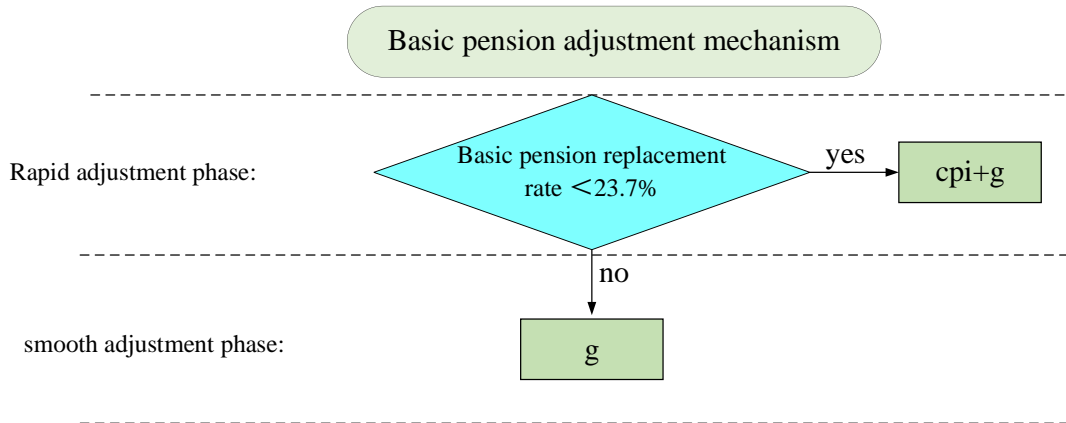


Figure 2. Basic pension adjustment mechanism

The starting point of basic pension adjustment is to improve the level of basic pension for urban and rural residents, and the end point of adjustment is to achieve certain security goals. In this paper, Basic pension adjustment index is divided into two stages (as shown in Figure 2) : rapid adjustment and smooth adjustment. In the rapid adjustment stage, which is also the initial stage of the implementation of urban and rural residence insurance, the basic pension bears most of the pension burden. In order to ensure the basic life of the elderly, the basic pension is adjusted according to the "price index + per capita income growth rate of rural residents". When the basic pension was adjusted to 23.7% of the previous year's rural per capita net income (In recent years, the proportion of poverty standard line in rural per capita net income has remained between 21% and 26%. In this paper, the arithmetic average of the proportion in recent three years is 23.7% as the future poverty line.), it entered a stage of steady adjustment. In the stage of steady adjustment, in order to ensure that the actual level of the basic pension does not fall, the basic pension is adjusted according to the growth rate of the per capita net income of rural residents. The basic pension adjustment index for year t is satisfied $g_{t,jc} = \begin{cases} cpi_{t-1} + g_{t-1} \\ g_{t-1} \end{cases}$, g_t is the growth rate of per capita net income of rural residents in t years.

The basic pension for t years is $JC_t = JC_{t-1} \times (1 + g_{t,jc})$.

2.2. Long-term basic pension determination mechanism

The long-term basic old-age pension has two main goals: encourage the participants to pay continuously and raise the level of pensions. There are quota system and proportional system for the payment of long-paid basic pension, and the quota system is that each additional year of payment, a fixed amount of pension is paid every month. The proportional system is that for each additional year, a certain percentage of the basic pension will be paid each month. Compared with the two schemes, the latter is more flexible and operable. After the normal adjustment of the basic pension, the basic pension of the number of years will also be adjusted at the same time, without annual calculation. At the same time, the proportional system of payment has enhanced the cumulative effect and incentive effect of payment. The longer the payment time, the more pension received, reflecting the "long pay more". In this paper, after the minimum payment period is exceeded, the basic pension will be increased by 1% for each additional year of payment. The formula for calculating the long-term pension is:

$$JFJC_{t_0,t} = 1\% \cdot JC_{t_0} \times (N - \bar{N}) \quad (1)$$

Where, \bar{N} indicated minimum payment period, N indicated the actual period of payment, JC_{t_0} represents the basic pension received at the time of retirement.

2.3. Payment subsidy adjustment mechanism

The adjustment of payment subsidy and the adjustment of payment grade should be closely related. The lack of linkage between payment subsidy and payment grade will weaken the incentive effect of payment subsidy policy. Therefore, the adjustment of payment subsidy should be dependent on the payment grade.

2.3.1. Payment grade adjustment mechanism

The adjustment method of the payment grade standard is subject to the influence of information technology, in the short term, urban and rural residents will still pay cash, and the payment grade should be "100 yuan" as the unit. With the popularization of rural information services and the promotion of rural network infrastructure, residents' payment can be freed from the constraint of "cash payment", and the payment grade can be adjusted in tandem with wage growth in the long run. Taking 2040 as the boundary, it is divided into two stages: the adjustment stage of the payment grade standard with "100 yuan" as the unit and the linkage adjustment stage with the payment grade standard and wage growth. In addition, considering the universality of the payment level setting, and combined with the regulation of the payment level adjustment in some provinces, this paper takes 200 yuan as the minimum standard of the payment level, and increases it by 100 yuan every four years. For the payment grade of 300 yuan and above, starting from 2020, it will be adjusted year by year according to the growth rate of per capita net income of rural residents. The payment grade adjustment mechanism is:

$$JFDC_t = \begin{cases} 100 \times INT(JFDC_0 \times \prod_{i=2022}^{t-1} (1 + g_i) / 100) & 2023 \leq t < 2040 \\ JFDC_{t-1} \times (1 + g_{t-1}) & 2040 \leq t \leq 2060 \end{cases} \quad (2)$$

Where, $JFDC_t$ represents the payment level in year t , $INT(\bullet)$ represents the integer function.

2.3.2. Payment subsidy adjustment mechanism

Personal account payment subsidies have different goals in different stages of system implementation. The initial implementation of the system was to expand the coverage of urban and rural areas of the system and attract residents to participate in the insurance through matching subsidies. In the implementation of the system into the perfect stage, the payment subsidy is to encourage residents to

raise the payment grade and extend the payment period. At present, it is in the second stage, in order to give full play to the incentive effect of the payment subsidy mechanism, we must widen the gap between the financial subsidies of different payment grades, and set up reasonable payment subsidy incentive mechanism.

Generally speaking, most of the groups that choose to pay higher fees are those with higher family income. If the high financial subsidies are given to the higher fees, it will not be able to achieve the incentive effect of "paying more and getting more" at the same time, it may exacerbate the wealth gap between urban and rural residents. Therefore, this paper divides the payment level into three groups: 200 yuan(Lowest grade); 300 yuan -1000 yuan(Incentive constraint level); 1500 yuan and above three groups (Higher grade) , and in this way redesigned the payment subsidy mechanism. Detailed payment levels and corresponding payment subsidies are shown in Table 1.

Table 1. Payment levels and corresponding payment subsidies

Lowest grade	Payment levels	200yuan				
	Payment subsidy	20%				
Incentive constraint level	payment levels	300yuan	400 yuan	500 yuan	600 yuan	700~1000 yuan
	Payment subsidy	16%	16%	17%	17%	18%
Higher grade	payment levels	1500 yuan	2000 yuan	3000 yuan		
	Payment subsidy	15%	12%	11%		

3. EVALUATION MODEL AND RELATED PARAMETERS

3.1. Evaluation model

3.1.1. Treatment level evaluation model

In this paper, the target substitution rate is used to measure the level of old-age insurance for urban and rural residents, that is, the ratio of the pension received by insured residents when they reach the receiving age to the per capita net income of farmers in the year before they start receiving pensions. The calculation formula is:

$$RR_{t,x} = \frac{JC_t + JFJC_{t,x} + 12 \cdot GZ_x}{Y_{t-1}} \quad (3)$$

Where, $RR_{t,x}$ represents Basic pension replacement in year t; Y represents Per capita net income of rural residents; GZ stands for Individual account pension. According to the regulations, when the contribution period is less than 15 years, the supplementary 15 years, the personal account pension calculation formula is (In 2012, the social endowment insurance system for rural residents and the social endowment insurance system for urban residents were merged)

$$GZ_{2012+k}^1 = \left\{ \sum_{j=1}^k [(JF_{2011+j} + BT_{2011+j}) \cdot \prod_{i=j}^k (1+r_i)] + (15-k) \times (1+r_{2011+k}) \times JF_{2011+k} \right\} / R \quad (4)$$

When the payment period exceeds 15 years, the calculation formula is:

$$GZ_{2012+k}^2 = \left\{ \sum_{j=1}^k [(JF_{2011+j} + BT_{2011+j}) \cdot \prod_{i=j}^k (1+r_i)] \right\} / R \quad (5)$$

Where, JF represents the payment levels; BT represents payment subsidy; R stands for Number of issuing months. r stands for bookkeeping interest rate.

3.1.2. Government financial burden model

The operation of the basic pension adjustment mechanism, the contribution subsidy adjustment mechanism and the long-term pension determination mechanism depends on the increase of fiscal subsidies by governments at all levels, and the increase of fiscal subsidies is limited by the financial affordability. If the financial input exceeds the appropriate burden level, it will reduce the financial input to other recipients and restrict social and economic development. According to Bian Shu and Sun Yana (2015), the formula for measuring the level of appropriate financial burden is as follows:

$$\alpha_t = SS_t \times YY_t \times \frac{PP_t}{OP_t} \quad (6)$$

Where, α_t represents the level of appropriate financial burden in year t ; SS_t represents the proportion of social security expenditure in year t ; YY_t represents the proportion of pension insurance in social security in year t ; PP_t represents the number of people enrolled in year t ; OP_t represents the number of recipients in year t ;

(1) Scale of central government subsidies

Central government subsidies include full subsidies to the central and western regions according to the minimum basic pension standards determined by the central government, and 50 percent subsidies to the eastern regions. The calculation model is as follows:

$$ZGS_t = \sum_{x=l}^{\omega} [(0.5 \cdot P_t^e(x) + P_t^{mw}(x)) \times JC_t^z] \quad (7)$$

$$\delta_t = \frac{ZGS_t}{ZCR_t} \quad (8)$$

Where, ZGS_t represents the scale of central government subsidies in year t ; $P_t^e(x)$ represents the number of insured persons in the eastern region; JC_t^z represents the minimum basic pension in year t ; δ_t represents the central financial burden coefficient in year t ; ZCR_t represents the central government revenue in year t .

(2) Scale of local government subsidies

Local financial subsidies mainly include five parts: increased basic pension (30% of the minimum standard); Personal account payment subsidy; 50% of the basic pension in the eastern region; Personal account pension after the number of months accrued; Basic pension with additional years. The calculation model is as follows:

$$DGS_t = \sum_{x=l}^{\omega} (P_t(x) \times JC_t^d) + \sum_{x=a}^{l-1} (P_t(x) \times BT_t) + \sum_{x=l}^{\omega} (0.5 \cdot P_t^e(x) \times JC_t^z) \\ + 12 \cdot \sum_{x=l+INT(R/12)+1}^{\omega} (P_t(x) \times GZ_{t,x}) + f \times P_t(l + INT(R/12)) \times GZ_{t,l+INT(R/12)} \quad (9)$$

$$+ \sum_{x=l}^{\omega} (P_t(x) \cdot JFJC_{t,x})$$

$$\lambda_t = \frac{DGS_t}{DCR_t} \quad (10)$$

Where, DGS_t represents the scale of local government subsidies in year t ; $P_t(x)$ represents the number of insured persons; JC_t^d represents the increased basic pension in year t ; f indicates the number of extra months; λ_t represents the local financial burden coefficient in year t ; DCR_t represents the local government revenue in year t .

3.2. Related parameters

(1) The insured persons. In this paper, the insured persons are rural residents and urban residents between 20 and 60 years old, and urban residents do not participate in the basic old-age insurance for employees.

(2) Growth rate of per capita net income. This paper assumes that it will remain at 6.5% from 2024 to 2030, 5.5% from 2031 to 2040, and 4.5% from 2041 to 2060.

(3) Interest rates on personal accounts. According to the "Guiding Opinions" to carry out the entrusted investment of the basic pension insurance fund for urban and rural residents, set the accounting rate of individual accounts at 3% during the forecast period(2024-2060).

(4) Fiscal revenue. According to the linear regression analysis between fiscal revenue and GDP, found $fiscal\ revenue = -7516.142 + 0.2276GDP$. In this paper, the average annual growth rate of China's GDP is set at 6% in 2024-2030, 5% in 2030-2040, and 4.5% in 2040-2060. The ratio of local government revenue to central government revenue was 1.13:1. The proportion of social security expenditure is 40%. The proportion of pension insurance in social security is 30%.

4. RESULTS AND ANALYSIS

With the promotion of economic development and urbanization, the total number of urban and rural residents insured has dropped from 534.67 million in 2022 to 366.73 million in 2060. The total number of recipients experienced an increase and then a decline, peaking at 26033 million in 2035 and falling to 179.69 million in 2060. Under the influence of the new urbanization, a large number of young rural labor force has left the country, and the number of rural insurance participants and the number of people who pay fees have dropped sharply. In 2031, the number of beneficiaries will exceed the number of contributors. The situation of urban residents participating in the insurance is relatively stable.

4.1. The treatment level

The minimum living security standard in rural areas is determined in accordance with the costs of food, clothing, water and electricity necessary to maintain the basic life of local rural residents throughout the year, so as to provide basic living security for residents. The old-age insurance for urban and rural residents aims to guarantee the basic old life of urban and rural residents, and the basic pension is comparable to the minimum living security to a certain extent (Qiu Dong et al. (1999); Yang Cuiying and Guo Guangzhi (2012)). In this paper, the lower limit of the basic pension replacement rate for urban and rural residents is set at 35%.

According to the basic pension adjustment mechanism and parameter assignment designed above, the minimum basic pension standard determined by the central government and the basic pension raised by local governments are calculated in each year, and the change trend of basic pension is shown in Figure 3. The basic pension has increased from 114.4 yuan per person per month in 2019 to 2124.5 yuan per person per month in 2060, which is a significant increase in the basic pension. Among them, the basic pension set by the central government will be raised from 88 yuan per person per month to 1634.2 yuan per person per month. The basic pension for local governments will be raised from 26.4 yuan per person per month to 490.3 yuan per person per month. The basic pension replacement rate rose from 9.98% to 21.58%, and the basic pension replacement rate did not reach the guarantee target of 23.7% during the forecast period, that is, the basic pension still needs to be adjusted according to the "cpi+g".

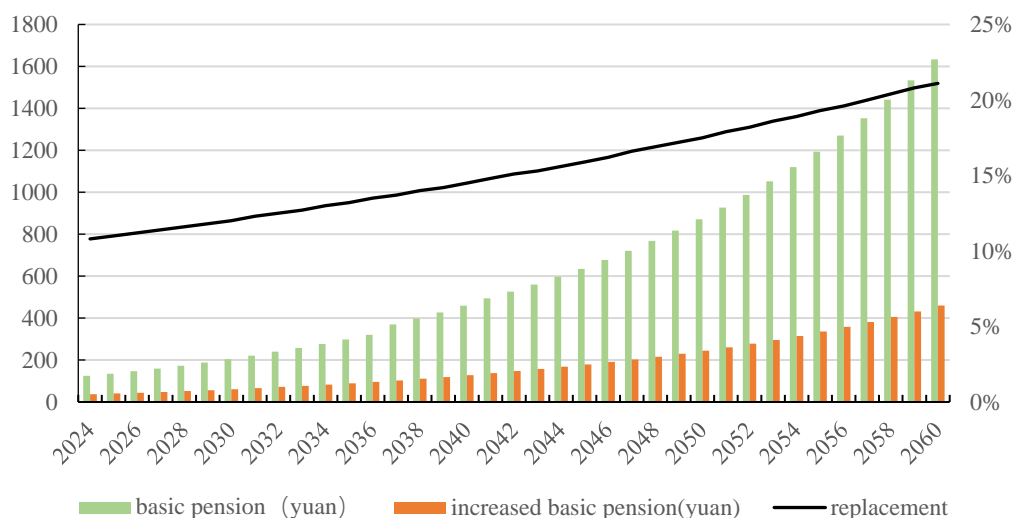


Figure 3. The basic pension trend

Based on the above Settings, this paper calculates the personal account pension and long-term pension under different insurance ages and payment levels. Table 2 lists the replacement rates of individual account pensions and long-term basic pensions obtained by participants at different contribution levels for 15 years (age 45), 25 years (age 35), 35 years (age 25) and 42 years (age 18). From the point of view of the contribution years, under the same contribution level, for the insured who join in the same year, the longer the contribution years (the younger the age), the more the accumulated personal account pension, the more the pension received by the age of receiving.

Table 2. Replacement rate of basic pension for different payment periods (%)

Year	2012				2014	2016	2018
	15 years	25 years	35 years	42 years	42 years	42 years	42 years
200 yuan	1.88	2.83	3.67	4.16	4.12	4.09	4.06
300 yuan	2.59	3.71	5.00	5.91	5.94	5.99	6.05
400 yuan	3.47	4.97	6.71	7.93	7.97	8.04	8.12
500 yuan	4.39	6.32	8.50	10.03	10.09	10.17	10.28
600 yuan	5.28	7.62	10.24	12.07	12.14	12.24	12.38
700 yuan	6.25	9.01	12.08	14.24	14.32	14.45	14.61
800 yuan	7.17	10.37	13.89	16.34	16.44	16.58	16.76
900 yuan	8.05	11.73	15.67	18.43	18.54	18.70	18.90
1000 yuan	8.91	12.89	17.29	20.37	20.50	20.68	20.91
1500 yuan	13.26	19.14	25.58	30.04	30.22	30.47	30.80
2000 yuan	17.26	24.91	33.23	39.03	39.24	39.55	39.96
3000 yuan	25.88	37.33	49.69	58.28	58.57	59.02	59.62
Long-term	0.00	1.40	3.37	5.20	5.60	5.82	6.04
1000 yuan	7.23	7.95	8.15	8.12	7.44	6.81	6.23

Taking the 500 yuan contribution level as an example, the total pension replacement rate and long-term basic pension replacement rate of the insured at the age of 18 are 15.23%, the insured at the age of 25 is 11.87%, the insured at the age of 35 is 7.72%, and the insured at the age of 45 is bound by the contribution period. Only 4.39% can receive a personal account pension. From the point of view

of the contribution level, for the insured of the same age, the higher the contribution level, the more pension. Taking those who have paid for 35 years as an example, the 300 yuan payment grade can get 5%, the 600 yuan payment grade can get 10.24%, the 1000 yuan payment grade can get 17.29%, the 2000 yuan payment grade can get 33.23%, and the 3000 yuan payment grade can get 49.69%. For long-term basic pensions, the longer the contribution period, the more pension you will receive.

4.2. The financial burden

In general, the increase in the level of basic pensions and contributions, as well as the proportional payment of basic pensions, has led to an increase in the scale of central and local fiscal expenditures year by year. The central government's financial burden will increase from 171.42 billion yuan in 2024 to 2,746.16 billion yuan in 2060. The burden of local governments with payment grade of 500 yuan, 1,000 yuan and 2,000 yuan will increase from 148.75 billion yuan, 194.94 billion yuan and 217.79 billion yuan, respectively, to 2,7718.0 yuan, 3,328.69 billion yuan and 4,167.38 billion yuan in 2060. The higher the payment grade, the larger the scale of local financial subsidies required.

The actual burden coefficient of central finance showed an "inverted U-shaped" trend, rising first and then declining (as shown in Figure 4). The burden coefficient of central finance was 1.69% in 2019, reached an extreme value of 4.05% in 2052, and then dropped to 3.80%. This shows that before 2052, the increase in the number of recipients and the increase in the basic pension will make the scale of central fiscal subsidies grow faster than the central fiscal revenue. After 2052, the decrease in the number of beneficiaries and the steady growth of basic pensions make the impact of population aging on the central financial burden offset by urbanization, and the growth of the scale of fiscal burden slows down. It can be found that the central financial subsidy burden coefficient is always smaller than the moderate burden coefficient during the forecast period, and the central financial department has the ability to support the continuous increase of the basic pension.

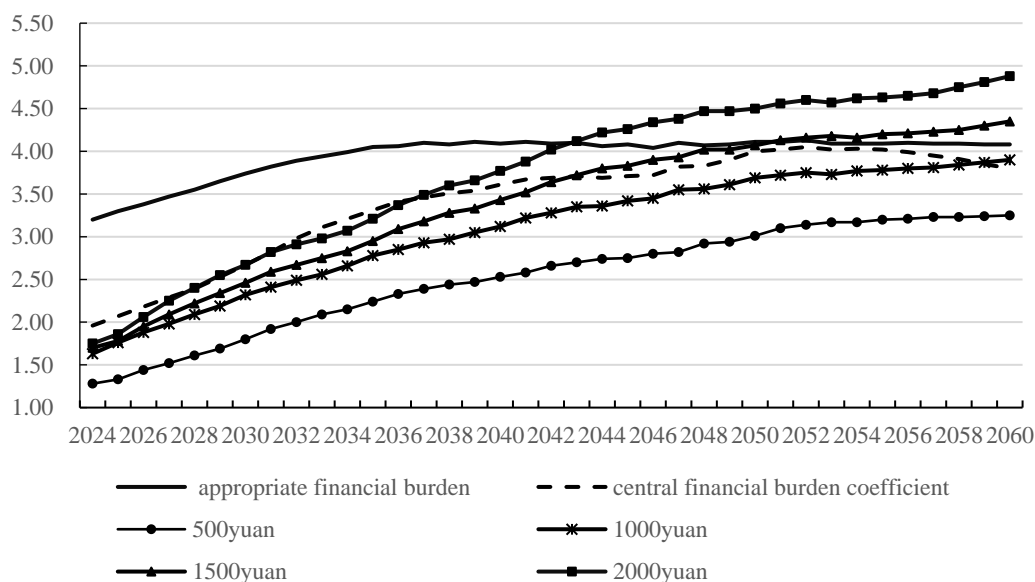


Figure 4. Central and local financial burden coefficient

As for the actual burden coefficient of local finance, the trend change of local finance burden coefficient is related to the payment grade. The lower the payment grade is, the local financial burden coefficient is basically stable at the end of the forecast period, and the higher the payment grade is, the local financial burden coefficient is increasing at the end of the forecast period. This is because the decrease in the number of beneficiaries did not offset the increase in local fiscal subsidies caused by the extension of the time for high-contribution participants to receive their personal accounts pension. Therefore, at the end of the forecast period, the growth rate of local fiscal subsidies with

high payment grade is still higher than local fiscal revenue, making the actual burden coefficient of local finance increase.

In terms of each payment grade, the actual financial burden coefficient of the local finance in the payment grade of 1000 yuan or less is smaller than the financial moderate burden coefficient, indicating that the local finance has the ability to afford all the participants to choose the payment grade of 1000 yuan. The local financial burden coefficient of the 1,500 yuan contribution grade exceeds the appropriate financial burden coefficient in 2050, and the 2,000 yuan contribution grade is in 2034, indicating that in the long run, the local finance cannot afford the increase of the 1,500 yuan and above contribution subsidies and basic pensions. However, taking into account the income of urban and rural residents, the probability of all enrollees choosing the payment level of 1500 yuan and above is small. Therefore, the local government finance has a certain ability to support the basic pension and the upgrading of the contribution grade

5. CONCLUSION AND SUGGESTION

Financial subsidies are the strong support for the existence and steady operation of urban and rural residents' pension insurance. How to optimize the financial subsidies to provide appropriate security for individuals' life after old age and avoid excessive pressure on government finance is a problem that must be solved to improve urban and rural residents' pension insurance. In the context of the realization of full coverage of urban and rural residents' pension insurance, it is of great practical significance to establish a basic pension adjustment mechanism and payment subsidy adjustment mechanism, as well as a long-term basic pension calculation formula.

Based on the "Guiding Opinions" and on the basis of the current system, this paper establishes a dynamic adjustment mechanism of the basic pension of "rapid adjustment stage and steady adjustment stage", and a proportional subsidy mechanism of the contribution level adjustment mechanism that is suitable for the adjustment stage of the contribution level standard based on "100 yuan" and the linkage adjustment stage of the contribution level standard and wage growth. And long-term basic pension calculation formula of the financial subsidy method optimization scheme. The actuarial calculation results show that after optimizing the financial subsidy method, the basic pension protection ability has been significantly improved, and the basic pension replacement rate has increased from 9.98% to 21.58%. The adjustment mechanism of payment grade and payment subsidy reflects the incentive and constraint effect of "paying more and paying more and paying more for a long time". Young participants can choose to pay at a low level, while those with an older age should appropriately raise the payment grade to avoid receiving pensions that cannot guarantee the basic life of the old age. For those who signed up for insurance in 2012, 19-year-old enrollees can choose the 600 yuan contribution level, get 35% of net income pension at the age of 60, and 27-year-old enrollees need to choose the 1,000 yuan contribution level. According to the calculation of the financial subsidy burden coefficient, the government has a certain ability to support the steady increase of basic pension and contribution subsidies. The moderation coefficient of central financial subsidies showed an "inverted U-shape", indicating that the central finance has the ability to support the basic pension increase. The moderate coefficient of local financial subsidies is affected by the grade of payment, and it supports all the insured to choose the grade standard payment of 1000 yuan or less.

Based on the above conclusions, this paper puts forward three suggestions:

The first is to determine the central and local fiscal subsidy responsibilities, and accelerate the implementation of the basic pension adjustment mechanism. In the initial stage of the implementation of the old-age insurance for urban and rural residents, the pensions received by residents are mainly basic pensions, and the lagging adjustment of basic pensions will not meet the basic survival needs of urban and rural residents. In order to improve the ability to guarantee basic pensions, the annual level of basic pensions can be determined according to the price index and the growth of net income.

The central government provides the minimum standard of basic pensions nationwide according to the elderly security needs of urban and rural residents and the financial affordability, and the remaining part is made up by local governments. The second is to establish the payment grade adjustment mechanism, that is, the corresponding payment subsidy mechanism. In view of the problems such as low payment level and insufficient payment incentive, the establishment of payment grade adjustment mechanism can realize the improvement of payment level from the inside of the system. Changing quota subsidy to proportional subsidy can improve the linkage between payment subsidy and payment grade, and better play the incentive effect of payment subsidy mechanism. The third is to increase the per capita income of urban and rural residents. The income level determines the actual payment ability of the insured. Only by realizing the continuous increase of the income of urban and rural residents can residents be guaranteed to have the ability of "long payment and more payment". Therefore, the government should take a multi-pronged approach to explore the channels for increasing the income of urban and rural residents, including education and training for farmers and urban low-income groups to improve their knowledge level and enhance their ability to increase income. Give full play to the supporting role of the government and the blood transfusion role of rural financial institutions, and provide them with financial support through multiple channels and ways. At the same time, vigorously promote the "Internet + agriculture" model to promote farmers to continue to increase income.

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