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Income Redistribution Effect of Raising the Overall Planning Level of Basic Endowment Insurance for Urban Employees in China

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Abstract: It is the focus of social security system reform at this stage in China to promote the transition of basic endowment insurance for urban employees from provincial overall planning level to national overall planning level, which is of great significance to the realization of fair and efficient of economic development. Based on the micro data of China Household Finance Survey 2017 (CHFS2017), this paper first establishes a personal wage prediction model to estimate the distribution of personal lifetime wage income, then designs two pension collection and payment plans of "direct national overall planning" and "indirect national overall planning", and establishes an actuarial model of pension to calculate the present value of personal lifetime contribution, lifetime claim and lifetime real wage income after pension adjustment under different overall planning levels. Finally, the income gap index and net benefit rate index are used to measure the change of the whole income gap and the transfer of pension benefits. The results show that on the whole, the basic endowment insurance for urban employees does have a significant income redistribution effect, and its income adjustment effect is positively related to the overall planning level and intensity of the system. Under the current provincial overall planning level, the income redistribution effects of the system are as follows: the high-income group transfers to the low-income group, the young generation to the elderly generation, the female insured person to the male insured person, and the non-state-owned economic unit to the state-owned economic unit. With the improvement of the overall planning level and strengthening of intensity, there are differences in the changes of benefits among different groups.

Keywords: basic endowment insurance; urban employees; national overall planning; provincial overall planning; income redistribution effect; social security; pension

MSC: 91G80

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1. Introduction

Over the past 40 years of reform and opening up, China's economic development has made remarkable achievements, and the living standards of residents have been significantly improved. In 2019, China's per capita GDP exceeded US $10,000 for the first time, stably ranking among upper middle-income countries, but it is accompanied by China's growing income gap among residents. According to data from the National Bureau of Statistics, the Gini coefficient of China's resident income rose from about 0.3 in 1978 to 0.491 in 2008. Although it has gradually declined since then, it has remained above 0.46, far exceeding the international warning line of 0.4. An excessively high-income gap will lead to wealth polarization, damage social equity and welfare, affect the enthusiasm of low-income

groups, and intensify various social conflicts. Throughout the development of social security in various countries in the world, in the middle-income countries, the positioning of social security is obviously focused on regulating income distribution and pursue the simultaneous improvement of national welfare level and economic development. Pension insurance system is the core content of social security in various countries. Through the link of payment and collection, it can effectively regulate the initial income distribution of residents, give full play to its economic regulator, stabilizer, and booster, and further promote the fair and efficient development of the national economy.

Since the founding of new China, the pension insurance system of urban enterprise employees has been continuously reformed and improved. It has experienced the national overall planning in the planned economy period, the enterprise overall planning in the cultural revolution period, and then the county overall planning level, the city overall planning level and the current provincial overall planning level stage after the 1980s, and the overall planning level has been gradually improved. As of 2018, most regions of China have completed the arrangement of provincial overall planning system but judging from the strict unified income and expenditure standards, only seven provinces have really completed the task, and most other regions still remain at the level of establishing provincial adjustment fund. In addition, affected by the differences in the level of economic development, there is a wide gap in the amount of pension payment and receiving treatment in different regions, and each region will choose to implement the institutional arrangement that is in line with their own interests, which seriously restricts the unity of the system, and it is difficult to play a national allocation of surplus funds in each region, which further aggravates the problems such as the excessive regional difference of pension payment and receiving level, and the fund penetration in some regions. Therefore, in order to solve all kinds of problems caused by the current low level of overall planning, China is making every effort to promote the national overall planning reform of the endowment insurance system. It is expected that through the improvement of the overall planning level, establish a unified national pension income and expenditure standard and system, effectively reduce the regional differences in the level of pension contribution and claim, realize the effective allocation of surplus funds across the country, and make up for the pension fund gap in some regions, so as to gradually narrow the income gap of pension insurance between intra-generational and inter-generational.

With the continuous expansion of the income gap of residents, many scholars have carried on the thorough research to the income redistribution effect of the endowment insurance system. As an important adjustment method in redistribution, endowment insurance has always been considered to have an important income redistribution function (Aaron, 1966; Diamond, 1977) [1,2]. The redistribution of income in the pension insurance system can be understood from the perspective of economic theory: By participating in public pension insurance, individuals can obtain pension rights after retirement and form pension assets. However, under the pay-as-you-go system, the pension insurance contribution rate and pension level are determined by the population growth rate and wage growth rate at various points in time. Therefore, the actuarial present value of the pension received by an individual in his lifetime is not necessarily the same as the actuarial present value of the pension insurance premium paid in his lifetime. The difference is the net benefit of pension reflecting the relationship between the individual's lifetime contribution and benefit, which is the income transfer through the public pension insurance system. If the net benefit of pension is zero, there is no income redistribution. If the net benefit of pension is not zero, then it is considered that there is income redistribution. In this way, as long as the net benefits of different groups under a certain public pension insurance system are estimated, the income transfer status in the pension insurance system can be described, so as to examine the inter-generational and intra-generational income redistribution effects in the pension insurance system.

Under the complete fund accumulation system, the actuarial present value of the pension received by an individual in his lifetime is equal to the actuarial present value

of the pension insurance premium paid in his lifetime; that is, the net benefit of pension is zero, and there is no income redistribution in the pension insurance system. However, under the pay-as-you-go system or partial accumulation system, there may be income redistribution. Theoretically, the income redistribution between the inter-generational and intra-generational in the endowment insurance system may not only change the consumption and labor supply behavior of different generations, but also affect the income level of future generations through capital savings, and may distort the allocation of resources, affect the enthusiasm of individuals to participate in insurance, and thus affect the financial sustainability of the endowment insurance system itself. Therefore, a specific quantitative analysis of income redistribution in a certain endowment insurance system can not only provide essential basic data for investigating the savings effect and labor supply effect of the endowment insurance system, but also provide scientific basis for the academia to discuss the incentive mechanism or financing mode of the endowment insurance system and the determination of future reform direction of the endowment insurance system for decision-making body, which is of great practical significance.

In recent years, some welfare countries fall into financial crisis due to the defects of system design, so how to improve the sustainability of the national welfare system in the pursuit of fairness has become the focus of academic circles. Náñez Alonso (2020) pointed out that the unsustainability of the welfare state lies in the unreasonable conception and design of the system and discussed how to solve the crisis of the welfare state by taking the latest exploration in Sweden as an example [3]. As the most important part of the national welfare system, pension's income redistribution effect and sustainability directly affect the realization of the national welfare goal. As early as the 1980s, there have been literatures that theoretically estimate the income distribution effect of the endowment insurance system or the reform of the endowment insurance system (Hurd and Shoven, 1985; Nelissen, 1987) [4,5]. In recent years, more and more scholars use empirical research methods to measure the income redistribution effect of endowment insurance, Leimer et al. (1992), Feldstein and Liebman (2002) used the methods of pension insurance yield to study the intergenerational income redistribution of American pension insurance [6,7]. Julia Lynn Coronado, Don Fullerton, and Coronado (2002) designed a model with income variable as the core to measure the resource redistribution effect of American pension insurance among different income groups [8]. Borella (2004) discussed the income distribution effect of public pension system reform in Italy [9]. Arza (2006) analyzed the intra generational and inter-generational income redistribution effects of pension in Argentina based on IRR model [10]. Yuh and Yang made an empirical analysis on the income redistribution effect of Korean national pension and pointed out that the system has a significant progressive redistribution effect [11]. On the basis of the research on the overall income redistribution effect of pension, Smith (2017) and other scholars also expanded their vision to the field of gender equality, requiring a more comprehensive reform of pension to achieve a higher level of equity goal, and promoting the continuous improvement of the theoretical research on the income redistribution effect of pension [12]. Of course, in addition to pension, there are many factors that will affect the income redistribution mechanism, such as consumption tax (Getachew and Turnovsky, 2020) [13], which will not be discussed too much in this paper.

Chinese scholars are relatively late in this field, Peng and Shen (2007) used actuarial methods and data to quantitatively analyze the effects of intra-generational redistribution and inter-generational redistribution of China's pension insurance system before and after the reform [14]. He (2007) used the 2002 urban household survey data of the National Bureau of Statistics of China to estimate the net benefits of lifetime pensions of urban insured employees under the 1997 pension insurance system and the latest pension insurance system in 2005 and made a quantitative analysis on the income distribution effect of China's pension insurance system reform from an inter-generational and intra-generational perspective [15]. Wang et al. (2016) pointed out that the current social security system can reduce the income gap in general, but the satisfaction is not high, and even the negative

evaluation of some projects exceeds the positive evaluation, indicating that the achievements of China's system construction are still far from public expectations [16]. Zhang et al. (2019) established a prediction model of remaining life after retirement for the insured in different regions through cross-sectional data, estimated the remaining lives of the insured under different payment bases, and used the internal rate of return index to measure and compare the income redistribution effect of pension insurance for different payment base groups. In addition, there are also some scholars who have studied the necessity of the national overall planning reform and the national planning path design of the basic endowment insurance system [17], relevant literature can be found in Zheng (2015), Shi and Zeng (2019), Jia and Fang (2015), Deng and Xue (2018) [18–21].

From the current study situation, in recent years the academic community has maintained a high degree of concern for the national overall planning of the basic endowment insurance system. It is agreed that the national overall planning reform of the endowment insurance should be carried out. In view of the difficulties faced by the system innovation, the design of implementation path and the arrangement of supporting measures, they put forward their own suggestions, which laid an important foundation for the research content of this paper. However, in the existing discussion on the income redistribution effect of pension insurance, there are few studies with the promotion of overall planning level as the measurement background. Most of the previous relevant literature used qualitative analysis method to discuss the redistribution effect of pension insurance, even some quantitative analysis often used macro data, which could not reflect the characteristics of differences between different individuals. Therefore, based on the actual background demand, this paper combines the income redistribution effect of basic pension insurance with the transition goal of overall planning level from provincial level to national level, and uses the micro data of CHFS2017 to design two pension collection and distribution paths of "direct national overall planning" and "indirect national overall planning". Considering the individual payment method and the receiving method of the basic pension, individual account pension and "middle people" transitional pension, combined with the principle of actuarial method, this paper uses the income gap index and net benefit rate index to systematically analyze the influence of the promotion of overall planning level on the redistribution effect of basic pension insurance for urban workers in China, and puts forward policy suggestions according to the research findings, hoping to provide some reference for the reform decision-making of relevant departments.

The rest of this article is arranged as follows: The second part is the construction of model, including the processing and analysis of sample data, the establishment of a personal wage forecast model, the design of calculation and payment path for a national overall planning, and the establishment of an actuarial model for pension insurance. The third part is the calculation and analysis. The income gap index and net benefit rate index are used to measure the whole income gap change and pension benefit transfer. The fourth part is the conclusions and recommendations. Based on the summary of the main research findings of this article, targeted policy recommendations are put forward.

2. The Construction of Model

2.1. Data Source and Processing

The data used in this paper are from the CHFS2017, China Statistical Yearbook and China Financial Yearbook. CHFS aims to collect relevant information on the micro level of family finance. The fourth round of survey in 2017 covers 29 provinces (autonomous regions and municipalities directly under the central government), 355 counties (districts, county-level cities), and 1428 village committees in China except Xinjiang province and Tibet province. The sample size is 40,011 households. It objectively and comprehensively investigates and reflects the basic situation of family finance in China. It provides the conditions to explore the redistribution effect of basic endowment insurance for urban employees. In addition, this paper also uses the GDP growth rate, the average wage of urban employees, the average wage growth index of urban employees, the life expectancy

data of the sixth census, as well as the consumer price index and the real interest rate of personal savings deposits in China Financial Yearbook (For data information, please visit the website https://chfs.swufe.edu.cn/). According to the research needs, this paper selects the employed individuals who have participated in the basic endowment insurance for urban employees in CHFS2017 database and have complete information such as personal salary, age, starting time of work, gender, qualifications, region, marital status, work unit type, industry, occupation, contract nature, etc. According to the actual situation of employment in China and the current statutory retirement age, this paper selects the sample of employed individuals aged 22–59 at the time of the survey in 2017 and eliminates the observation samples with incomplete information. Finally, the effective sample size is 7881.

2.2. Wage Income Model

2.2.1. Personal Wage Income Model

The standard Mincer equation provides a basic theoretical framework for the study of the impact of human capital on income. It has become an important theoretical model to study the problem of wage income because of its simple and easy to control. Combined with previous studies, wage income is not only affected by education and experience, but also by age, gender, region, marital status, industry, work unit type, occupation, contract type, and so on. Therefore, this paper extends the standard Mincer equation and establishes the following personal wage income model,

$$\ln(Wage_i) = \alpha_0 + \beta_1 Age_i + \beta_2 Age_i^2 + \beta_3 Expr_i + \beta_4 Expr_i^2 + \sum_l \theta_l \cdot DV_{il} + \varepsilon_i,\ i = 1, 2, \ldots \quad (1)$$

where $\ln(Wage_i)$ is the logarithmic form of annual wage of ith individual, and Age_i represents the age of ith individual at the time of the survey in 2017. $Expr_i$ represents work experience of ith individual. DV_{li} represents the lth dummy variable of the ith individual characteristic, including education level, gender, region, marital status, industry, type of work unit, occupation, and type of contract. θ_l and β_k $(k = 1, 2, 3, 4)$ represent the coefficient values of the corresponding variables, respectively, while some unmeasurable factors are included in the residual term ε.

2.2.2. Estimation of Personal Lifetime Wage Income

This paper takes the logarithm of the annual wage income of the interviewees as the explained variables, and sets up 10 explanatory variables, including age, work experience, education level, gender, region, marital status, industry, type of work unit, occupation, and type of contract at the time of interview, and establishes a regression model of personal wage income. Considering that the main research object of this paper is the employees who are participating in the basic endowment insurance for urban employees, according to the actual employment situation, the value range of age variable is 22–59 years old. The variable of work experience is set as 2017 minus the starting year of the respondents, without considering the phenomenon of transient unemployment. See Table 1 for specific variable definition and assignment.

According to the personal wage income function constructed by model (1), this paper uses Stata software to calculate 7881 individual sample data of CHFS in 2017, and the regression results are shown in Table 2.

Table 1. Variable definition and assignment.

Variable	Definition and Assignment	Mean Value	Standard Deviation	Skewness	Kurtosis
Wage	Annual income of the interviewee	58,750	54,445	5.60	62.72
Age	Difference between year 2017 and interviewee's birthday	39.29	9.48	0.18	2.01
Work experience	Difference between year 2017 and starting year of working of interviewee	8.39	7.63	1.18	3.87
Sex	Male = 1, Female = 0	0.56	0.50	−0.22	1.05
Education level	Middle school and below (no attendance of school at all, primary school or middle) (Yes = 1, No = 0)	0.20	0.40	1.48	3.19
	High school and technical secondary school (attendance of high school, technical secondary school or professional high school, junior college or higher vocational school) (Yes = 1, No = 0)	0.44	0.50	0.25	1.06
	Undergraduate and above (undergraduate, master, doctor) (Yes = 1, No = 0)	0.36	0.48	0.59	1.35
Region	Eastern Region (Beijing City, Tianjin City, Hebei Province, Liaoning Province, Shanghai City, Jiangsu Province, Zhejiang Province, Fujian Province, Shandong Province, Guangdong Province, Hainan Province) (Yes = 1, No = 0)	0.47	0.50	0.11	1.01
	Central Region (Shanxi Province, Jilin Province, Heilongjiang Province, Anhui Province, Jiangxi Province, Henan Province, Hubei Province, Hunan Province) (Yes = 1, No = 0)	0.26	0.44	1.08	2.16
	Western Region (Sichuan Province, Chongqing City, Guizhou Province, Yunnan Province, Shaanxi Province, Gansu Province, Qinghai Province, the Ningxia Hui Autonomous Region, the Guangxi Zhuang Autonomous Region, the Inner Mongolia Autonomous Region) (Yes = 1, No = 0)	0.26	0.44	1.07	2.16
Marriage	Married (married, cohabitant, living apart, remarried) = 1 Single (not married, divorced, widowed) = 0	0.82	0.38	−1.68	3.81
Work unit type	Government Organizations/Public institutions (Yes = 1, No = 0)	0.26	0.44	1.11	2.24
	State-owned or state-holding companies (Yes = 1, No = 0)	0.22	0.41	1.35	2.82
	Collective enterprises (Yes = 1, No = 0)	0.04	0.19	4.95	25.48
	Individual business (yes = 1, No = 0)	0.05	0.21	4.31	19.61
	Private business (Yes = 1, No = 0)	0.38	0.49	0.48	1.23
	Enterprises invested by foreign investors, Hong Kong, Macao and Taiwan (Yes = 1, No = 0)	0.06	0.23	3.84	15.78

Table 1. *Cont.*

Variable	Definition and Assignment	Mean Value	Standard Deviation	Skewness	Kurtosis
Industry	Agriculture, forestry, stock raising, fishing (Yes = 1, No = 0)	0.02	0.12	7.85	62.59
	Mining (Yes = 1, No = 0)	0.01	0.11	8.89	80.07
	Manufacture (Yes = 1, No = 0)	0.17	0.38	1.73	4.01
	Electricity, heating power, gas, and water production and supply (Yes = 1, No = 0)	0.04	0.19	4.83	24.30
	Construction industry (Yes = 1, No = 0)	0.05	0.21	4.31	19.57
	Wholesale and retail (Yes = 1, No = 0)	0.08	0.27	3.16	11.00
	Transportation, storage, mail business (Yes = 1, No = 0)	0.07	0.26	3.28	11.76
	Hotel and catering industry (Yes = 1, No = 0)	0.03	0.17	5.37	29.80
	Information transmission, software, information technology service (Yes = 1, No = 0)	0.06	0.23	3.84	15.72
	Finance (Yes = 1, No = 0)	0.06	0.24	3.72	14.83
	Real estate (Yes = 1, No = 0)	0.02	0.14	6.65	45.20
	Lease and commercial service (Yes = 1, No = 0)	0.02	0.12	7.92	63.67
	Scientific research and technology service (Yes = 1, No = 0)	0.01	0.12	8.45	72.33
	Hydraulic, environment, infrastructure management (Yes = 1, No = 0)	0.02	0.13	7.36	55.10
	Residence service, fixing, and other service (Yes = 1, No = 0)	0.10	0.30	2.67	8.15
	Education (Yes = 1, No = 0)	0.08	0.27	3.16	11.00
	Sanitization and social work (Yes = 1, No = 0)	0.07	0.25	3.51	13.34
	Culture, sports, entertainment (Yes = 1, No = 0)	0.02	0.14	6.69	45.77
	Public administration, social welfare, social organization (Yes = 1, No = 0)	0.09	0.28	2.95	9.73
	International organization (Yes = 1, No = 0)	0.00	0.01	88.74	7876.00
Occupation	Principal of party affiliated institutional units, national institutional units, alliance and social organization, enterprise and public institution (Yes = 1, No = 0)	0.05	0.22	4.17	18.36
	Special technicist (Yes = 1, No = 0)	0.31	0.46	0.82	1.68
	Clerks and related personnel (Yes = 1, No = 0)	0.36	0.48	0.57	1.33
	Social production and life service personnel (Yes = 1, No = 0)	0.17	0.38	1.76	4.09
	Agriculture, forestry, stock raising, fishing and auxiliary personnel (Yes = 1, No = 0)	0.01	0.07	13.59	185.65
	Production manufacture and related personnel (Yes = 1, No = 0)	0.10	0.30	2.62	7.84
	Military (Yes = 1, No = 0)	0.00	0.02	51.23	2625.00

Table 1. *Cont.*

Variable	Definition and Assignment	Mean Value	Standard Deviation	Skewness	Kurtosis
Contract nature	No fixed term contract (fixed employee) (Yes = 1, No = 0)	0.20	0.40	1.47	3.17
	Long-term contract (1 year and above) (Yes = 1, No = 0)	0.58	0.49	−0.34	1.12
	Short-term or temporary contract (1 year and below) (Yes = 1, No = 0)	0.10	0.30	2.66	8.10
	No contract (Yes = 1, No = 0)	0.11	0.31	2.47	7.08

Note: Data information was collected by the author according to CHFS2017 micro database.

Table 2. Regression results of individual wage income function.

Explanatory Variable	Coefficient (Standard Error)	Explanatory Variable	Coefficient (Standard Error)
Age	0.0479 ***	Industry (hotel and catering)	0.0799
	(0.0061)		(0.0622)
Square of age	−0.0006 ***	Industry (information transmission, software, information technology service)	0.2872 ***
	(0.0001)		(0.0583)
Work Year	0.0026	Industry (finance)	0.2961 ***
	(0.0024)		(0.0578)
Square of work year	0.0001	Industry (real estate)	0.3162 ***
	(0.0001)		(0.0656)
Sex (male)	0.1924 ***	Industry (lease and commercial service)	0.2177 **
	(0.0119)		(0.0700)
Education level (middle school and below)	-	Industry (scientific research and technology service)	0.2893 ***
	-		(0.0714)
Education level (high school and technical secondary school)	0.1688 ***	Industry (hydraulic, environment, infrastructure management)	0.0356
	(0.0162)		(0.0672)
Education level (undergraduate and above)	0.5697 ***	Industry (Residence service, fixing, and other service)	−0.0328
	(0.0162)		(0.0558)
Region (eastern)	−0.0050	Industry (education)	0.1027
	(0.0136)		(0.0570)
Region (central)	−0.0181	Industry (sanitization and social work)	0.0909
	(0.0132)		(0.0571)
Region (western)	-	Industry (culture, sports, entertainment)	0.2721 ***
	-		(0.0652)
Marriage (married)	0.1345 ***	Industry (public administration, social welfare, social organization)	−0.0524
	(0.0174)		(0.0566)
Work unit type (Government Organizations and public institution)	-	Occupation (international organization)	0.1119
	-		(0.4970)
Work unit type (state-owned and state-holding company)	0.0848 ***	Occupation (principal of party affiliated institutional units, national institutional units, alliance and social organization, enterprise and public institution)	-
	(0.0203)		-
Work unit type (collective enterprise)	0.0762 *	Occupation (special technicist)	−0.1396 ***
	(0.0332)		(0.0285)
Work unit type (individual business)	0.1049 **	Occupation (clerks and relevant personnel)	−0.2710 ***
	(0.0325)		(0.0274)

Table 2. *Cont.*

Explanatory Variable	Coefficient (Standard Error)	Explanatory Variable	Coefficient (Standard Error)
Work unit type (private business)	0.2174 ***	Occupation (social production and life service personnel)	−0.3433 ***
	(0.0195)		(0.0304)
Work unit type (foreign capital, investment enterprise from Hong Kong, Macaw, and Taiwan)	0.4314 ***	Occupation (agriculture, forestry, stock raising, fishing and auxiliary personnel)	−0.4787 ***
	(0.0298)		0.0935
Industry (agriculture, forestry, stock raising, fishing)	-	Occupation (production manufacture and auxiliary personnel)	−0.3150 ***
	-		(0.0347)
Industry (mining)	−0.1090	Occupation (military)	0.2602
	(0.0732)		(0.2862)
Industry (manufacture)	0.0653	Contract nature (fixed term contract (fixed employee)	-
	(0.0553)		-
Industry (electricity, heating power, gas, water production and supply)	0.0356	Contract nature (long-term contract (1 year and above)	0.0063
	(0.0601)		(0.0148)
Industry (construction)	0.1901 **	Contract nature (short-term or temporary contract (1 year and below)	−0.1716 ***
	(0.0590)		(0.0227)
Industry (wholesale and retail)	0.0813	Contract nature (no contract)	−0.1688 ***
	(0.0572)		(0.0225)
Industry (transportation, storage, mail business)	0.1471 **	Constant	9.4017 ***
	(0.0567)		(0.1325)
Observations		7881	
R-squared		0.3779	

Note: ***, **, * represent 1%, 5%, 10% significance level respectively.

According to the regression results in Table 2, the variables that significantly affect individual wage income are age, square of age, gender, education level, marital status, type of work unit, as well as some industries, occupations, and contract nature. These variables account for 37.79% of individual wage changes. From the analysis of age variables, the regression coefficient shows that the wage income will change with the growth of age in an inverted U-shape, there is a maximum value, and then it will decline with the exponential type, which is in line with the law of the relationship between age and wage income in human capital. From the perspective of gender, the average employment wage of men is 19.24% higher than that of women because of the advantages of their physical strength and social treatment. In terms of educational level, the average wage income of "high school and technical secondary school" is 16.88% higher than that of "middle school and below", and that of "undergraduate and above" is 56.97% higher than that of "middle school and below". It shows that the higher the educational background, the stronger the comprehensive competitiveness, the higher the salary will be, which proves that the elements of education investment in human capital are significant. Different types of work units, industries, occupations, and the nature of contracts have different effects on individual wage income.

This paper assumes that the variables of gender, education level, marital status, work unit type, industry, occupation, and contract nature will not change in the whole life, and taking into account the increase of social average wage, the wage income model of the ith individual at t years old is obtained as follows:

$$Wage_{i.(t)} = Wage_{i.(2017)} \times e^{0.0479 \times \Delta Age - 0.0006 \times \Delta Age^2} \times GR_{i.(t)} \quad (2)$$

where $Wage_{2017}$ represents the annual wage income of the ith individual in 2017, and ΔAge and ΔAge^2 represent the age difference and the square difference of the age of the ith individual in the year of t and 2017, respectively. $GR_{i.(t)}$ represents the growth rate of the

*i*th individual's average social wage at the age of t compared with that in 2017. The specific algorithm is as follows:

$$GR_{i.(t)} = \frac{\prod_{y=starting-1}^{t-1}(1+g_{i.(y)})}{\prod_{y=starting-1}^{Age_{i.(2016)}}(1+g_{i.(y)})} \quad (3)$$

where *starting* is the age at which the *i*th individual starts work. $Age_{i.(2016)}$ represents the age of the *i*th individual in 2016. $g_{i.(y)}$ represents the average annual wage growth rate of local employees at the age of y. For $g_{i.(y)}$, before 2018, the actual wage growth rate of urban employees in all provinces (autonomous regions and municipalities directly under the central government) published by the National Bureau of statistics is used. After 2018, according to the report "China in 2030" issued by the world bank in 2012, the wage growth rate of urban employees is determined by the predicted potential GDP growth rate of China.

Finally, the present value model of the *i*th individual's lifetime wage income in 2017 is

$$LTW_i = \sum_{t=starting}^{\omega-1} Wage_{i.(t)} \times DR_{i.(t)} \quad (4)$$

where ω represents the retirement age of the *i*th individual. In order to facilitate the calculation, this paper does not distinguish the difference between gender and type of work and calculates it according to the normal retirement age of male cadres and workers at 60 years old. $DR_{i.(t)}$ represents the value of the *i*th individual's 1 unit wage income discounted or accumulated to 2017 at the age of t. The specific algorithm is as follows:

$$DR_{i.(t)} = \frac{\prod_{y=starting-1}^{t-1}\left(\frac{1}{1+r_{i.(y)}}\right)}{\prod_{y=starting-1}^{Age_{i.(2016)}}\left(\frac{1}{1+r_{i.(y)}}\right)} \quad (5)$$

where $r_{i.(y)}$ is the discount rate of the *i*th individual at the age of t. This paper uses the real interest rate of one-year personal savings deposit. Among them, the data before 2020 are collected from the 1996, 1998, and 1999 volumes of China Financial Yearbook and the official website of the people's Bank of China. With the deepening of the reform of interest rate marketization, this paper assumes that the real interest rate of personal savings deposits after 2020 is equal to the real average wage growth rate of urban employees.

2.3. Actuarial Model of Endowment Insurance

2.3.1. Present Value of Individual Lifetime Contribution of Pension

According to the document "decision of the State Council on improving the basic endowment insurance system for enterprise employees" in 2005, the unit contribution rate is 20% of the employee's salary, which is transferred into the social pooling account, and the individual contribution proportion is 8% of the employee's salary, which is transferred into the individual account. Considering that the part of unit payment is still borne by employees in essence, this paper calculates the amount of individual pension payment by 28%. At the same time, according to the regulations, the upper limit of individual payment base is 300% of the average wage of local employees in the previous year, and the lower limit is 60% of the average wage of local employees in the previous year.

When the pension stays in the provincial overall planning stage, we use the superscript s to uniformly express the calculation formula of payment of the provincial overall planning stage, then the payment base of the ith individual is as follows:

$$W^s_{i.(t)} = \begin{cases} 0.6 \times \overline{W}^s_{i.(t-1)}, & Wage_{i.(t)} < 0.6 \times \overline{W}^s_{i.(t-1)} \\ Wage_{i.(t)}, & 0.6 \times \overline{W}^s_{i.(t-1)} \le Wage_{i.(t)} \le 3.0 \times \overline{W}^s_{i.(t-1)} \\ 3.0 \times \overline{W}^s_{i.(t-1)}, & Wage_{i.(t)} > 3.0 \times \overline{W}^s_{i.(t-1)} \end{cases} \quad (6)$$

where $W^s_{i.(t)}$ represents the payment base of the ith individual at the age of t. $\overline{W}^s_{i.(t-1)}$ represents the average wage of local urban employees in the previous year when the ith individual is t years old.

Taking 2017 as the calculation time point, the present value of payment of the ith individual at the age of t is as follows:

$$LTF^s_{i.(t)} = (C_1 + C_2) \times W^s_{i.(t)} \times DR_{i.(t)} \quad (7)$$

where C_1 represents enterprise payment rate, C_2 stands for individual payment rate. This paper still refers to the relevant documents and sets the enterprise payment rate as 20% and the individual payment rate as 8%.

The present value of lifetime contribution of the ith individual is as follows:

$$LTF^s_i = \sum_{t=starting}^{\omega-1} LTF^s_{i.(t)} \quad (8)$$

According to the regulations, if the accumulated payment years of the insured after retirement are less than 15 years, they need to make up the payment according to 15 years, and then they can receive the pension after completing the payment. Therefore, for individuals with insufficient payment years, the present value of lifetime pension payment is calculated as 15 times of the average payment present value over the years, which is regarded as one-time supplementary payment.

In the national overall planning stage, the inspiration of the method of receiving Jia and Fang (2015) [20], considering the actual background, combined with the strategic goal of "comprehensively realizing the provincial overall planning of basic pension by 2020", this paper abandons the "most progressive" path including prefecture level data, and sets up two more reasonable payment schemes "indirect national overall planning" and "direct national overall planning ".

The "direct national overall planning" payment method is still based on the provincial overall planning payment formula. When calculating the payment base, the reference "average wage of local employees in the previous year" is replaced by "the average wage of the national employees in the previous year", which is the highest level and strongest payment method. In this paper, we use the superscript q and q^z to express the national data and the calculation formula of payment of "direct national overall planning", respectively, then the present value of contribution of the ith individual at t years old $LTF^{q^z}_{i.(t)}$ and the present value of lifetime contribution of the ith individual $LTF^{q^z}_i$ are as follows:

$$W^q_{i.(t)} = \begin{cases} 0.6 \times \overline{W}^q_{i.(t-1)}, & Wage_{i.(t)} < 0.6 \times \overline{W}^q_{i.(t-1)} \\ Wage_{i.(t)}, & 0.6 \times \overline{W}^q_{i.(t-1)} \le Wage_{i.(t)} \le 3.0 \times \overline{W}^q_{i.(t-1)} \\ 3.0 \times \overline{W}^q_{i.(t-1)}, & Wage_{i.(t)} > 3.0 \times \overline{W}^q_{i.(t-1)} \end{cases} \quad (9)$$

$$LTF^{q^z}_{i.(t)} = (C_1 + C_2) \times W^q_{i.(t)} \times DR_{i.(t)} \quad (10)$$

$$LTF^{q^z}_i = \sum_{t=starting}^{\omega-1} LTF^{q^z}_{i.(t)} \quad (11)$$

The "indirect national overall planning" payment method is based on the "direct type" and considers the necessity of gradual transition. In the calculation of individual payment base, the average value of provincial overall planning payment base and direct national overall planning payment base is used to ease the impact of "direct type". We use the superscript q^j to express the calculation formula of payment of "indirect national overall planning" and the meaning of other parameters remains unchanged, then the present value of contribution of the ith individual at t years old $LTF_{i.(t)}^{q^j}$ and the present value of lifetime contribution of the ith individual $LTF_i^{q^j}$ are as follows:

$$LTF_{i.(t)}^{q^j} = (C_1 + C_2) \times \frac{W_{i.(t)}^q + W_{i.(t)}^s}{2} \times DR_{i.(t)} \tag{12}$$

$$LTF_i^{q^j} = \sum_{t=starting}^{\omega-1} LTF_{i.(t)}^{q^j} \tag{13}$$

2.3.2. Calculation of Present Value of Individual Lifetime Claim

According to the requirements of "decision of the State Council on establishing a unified basic endowment insurance system for enterprise employees" in 1997, various regions have promoted a series of reforms of basic endowment insurance system, and spawned three groups of "old people", "middle people", and "new people", among which employees who retired before the reform were classified as "old people ", and pensions were paid according to the old standards before the reform. Employees who participated in the work but did not retire before the reform are classified as "middle people". After retirement, the basic pension and personal account pension will be issued in accordance with the "combination of social planning and individual account" model, and an extra "transitional pension" will also be issued. Employees who participate in the work after the reform are classified as "new people", and it is stipulated that after retirement, the accumulated payment period of 15 years can receive basic pension and personal account pension. In order to facilitate the calculation, the retirement age in this paper is calculated according to the normal retirement age of male cadres and workers, regardless of gender and type of work. It is assumed that employees have been participating in the basic endowment insurance before retirement, and there is no halfway out. With reference to the above provisions, assuming that individuals start to work after the age of 22, then in 2017, individuals over 80 years old are "old people", individuals aged 42–79 are "middle people", and individuals aged 22–41 are "new people". As the sample selected in this paper is 22–59 years old employed individuals in 2017, it does not include "old people", only qualified "new" and "middle people". In the pension calculation and payment method, this paper still refers to the relevant documents to calculate the basic pension, personal account pension and "middle people" transitional pension.

(1) Present value of basic pension for individual lifetime claim

Since the calculation and payment methods of basic pension for "middle people" and "new people" are consistent, the unified formula is adopted, and no distinction is made. Then, in the provincial planning stage, taking 2017 as the measurement time point, the present value of the basic pension of the ith individual at the age of t is as follows:

$$LTBP_{i.(t)}^s = \frac{\overline{W}_{i.(\omega-1)}^s + \overline{W}_{i.(\overline{I}_i^s)}^s}{2} \times Y_i \times 1\% \times \prod_{t=(\omega-1)}^{t-1} (1 + \rho g_{i.(t)}^s) \times DR_{i.(t)} \tag{14}$$

where $\overline{W}_{i.(R-1)}^s$ represents the average wage of the local employees of the ith individual in the year before retirement, $\overline{W}_{i.(\overline{I}_i^s)}^s$ is the index average contribution wage of the ith individual, $\overline{I}_i^s$ represents the average contribution wage index of the ith individual over the years. Y_i refers to the accumulated payment period of an individual. If it is less than

15 years, it shall be set as 15 years and calculated according to one-time supplement. ρ is the pension adjustment proportion, which means that the basic pension is adjusted according to the average wage growth rate of local employees in the previous year, which is set as 100% in this paper. $g^s_{i.(t)}$ represents the average annual wage growth rate of local employees at the age of t.

Present value of basic pension for the ith individual lifetime claim is as follows:

$$LTBP^s_i = \sum_{t=\omega}^{\tau} LTBP^s_{i.(t)} \tag{15}$$

where τ is the age of death. This paper refers to the life expectancy model of Chinese population predicted by the sixth population census data of Zhang and Wei (2016) [22]. The median birth year of the sample individual is 1977, and the average is 1977.24. The corresponding age of the sixth population census prediction model is 33 years old, and the life expectancy is 77.82 years old. In order to simplify the calculation, 78 years old is used as the expected age of death.

The index average contribution wage of the ith individual $\overline{W}^s_{i.(\overline{I}^s_i)}$ is as follows:

$$\overline{I}^s_i = \frac{\sum_{t=starting}^{\omega-1}\left(\frac{W_{i.(t)}}{\overline{W}^s_{i.(t-1)}}\right)}{\omega\text{-}starting} \tag{16}$$

$$\overline{W}^s_{i.(\overline{I}^s_i)} = \overline{W}^s_{i.(\omega-1)} \times \overline{I}^s_i \tag{17}$$

Similarly, under the path of "direct national overall planning", referring to the idea of Formula (10), when calculating the "average wage of local on-the-job employees" and "the average wage growth rate of local on-the-job employees", they are replaced by "the average wage of national on-the-job employees" and "the average wage growth rate of national on-the-job employees", then the present value of basic pension for the ith individual claim at t years old $LTBP^{q^z}_{i.(t)}$ and the present value of basic pension for the ith individual lifetime claim $LTBP^{q^z}_i$ are as follows:

$$\overline{I}^q_i = \frac{\sum_{t=starting}^{\omega-1}\left(\frac{W_{i.(t)}}{\overline{W}^q_{i.(t-1)}}\right)}{\omega\text{-}starting} \tag{18}$$

$$\overline{W}^q_{i.(\overline{I}^q_i)} = \overline{W}^q_{i.(\omega-1)} \times \overline{I}^q_i \tag{19}$$

$$LTBP^{q^z}_{i.(t)} = \frac{\overline{W}^q_{i.(\omega-1)} + \overline{W}^q_{i.(\overline{I}^q_i)}}{2} \times Y_i \times 1\% \times \prod_{t=(\omega-1)}^{t-1}(1+\rho g^q_{i.(t)}) \times DR_{i.(t)} \tag{20}$$

$$LTBP^{q^z}_i = \sum_{t=\omega}^{\tau} LTBP^{q^z}_{i.(t)} \tag{21}$$

Under the path of "indirect national overall planning", referring to the idea of Formula (12), when calculating the "average wage of local on-the-job employees" and "the average wage growth rate of local on-the-job employees", they are replaced by the data of "the mean value of average wage of national on-the-job employees and average wage of local on-the-job employees" and "average wage growth rate of national on-the-job employees" respectively, then the present value of basic pension for the ith individual claim at t years old $LTBP^{q^j}_{i.(t)}$ and the present value of basic pension for the ith individual lifetime claim $LTBP^{q^j}_i$ are as follows:

$$LTBP_{i.(t)}^{q^j} = \frac{1}{2} \times \left(\frac{\overline{W}_{i.(\omega-1)}^{q} + \overline{W}_{i.(\omega-1)}^{s}}{2} + \frac{\overline{W}_{i.(\overline{I}_i^q)}^{q} + \overline{W}_{i.(\overline{I}_i^s)}^{s}}{2} \right) \times Y_i \times 1\% \times \prod_{t=(\omega-1)}^{t-1} (1 + \rho g_{i.(t)}^{q}) \times DR_{i.(t)} \quad (22)$$

$$LTBP_i^{q^j} = \sum_{t=\omega}^{\tau} LTBP_{i.(t)}^{q^j} \quad (23)$$

(2) Present value of personal account pension for individual lifetime claim

The calculation and payment standard of the personal account part is the individual account savings deposits divided by the number of calculation and payment months. Then, in the provincial overall planning stage, taking 2017 as the measurement time point, the present value of individual account pension for the *i*th individual claim at the age of *t* is as follows:

$$LTPP_{i.(t)}^{s} = \frac{\sum_{t=starting}^{\omega-1} \left[C_2 \times W_{i.(t)}^{s} \times (1 + I_r)^{(\omega-1-t)} \right] \times DR_{i.(t)}}{n} \quad (24)$$

The present value of personal account pension for the *i*th individual claim is as follows:

$$LTPP_i^{s} = \sum_{t=\omega}^{\tau} LTPP_{i.(t)}^{s} \quad (25)$$

where I_r stands for personal account interest rate, which is set at 4% by referring to the deposit interest rate of banks in the same period. n is the number of years of pension calculation and payment in personal account. This paper calculates the number of months of retirement at the age of 60 according to relevant documents.

In the same way, under the "direct national overall planning", the present value of individual account pension for the *i*th individual claim at *t* years old $LTPP_{i.(t)}^{q^z}$ and the present value of individual account pension for the *i*th individual lifetime claim $LTPP_i^{q^z}$ are as follows:

$$LTPP_{i.(t)}^{q^z} = \frac{\sum_{t=starting}^{\omega-1} \left[C_2 \times W_{i.(t)}^{q} \times (1 + I_r)^{(\omega-1-t)} \right] \times DR_{i.(t)}}{n} \quad (26)$$

$$LTPP_i^{q^z} = \sum_{t=\omega}^{\tau} LTPP_{i.(t)}^{q^z} \quad (27)$$

Under the "indirect national overall planning", the present value of individual account pension for the *i*th individual claim at *t* years old $LTPP_{i.(t)}^{q^j}$ and the present value of individual account pension for the *i*th individual lifetime claim $LTPP_i^{q^j}$ are as follows:

$$LTPP_{i.(t)}^{q^j} = \frac{\sum_{t=starting}^{\omega-1} \left[C_2 \times \frac{W_{i.(t)}^{q} + W_{i.(t)}^{s}}{2} \times (1 + I_r)^{(\omega-1-t)} \right] \times DR_{i.(t)}}{n} \quad (28)$$

$$LTPP_i^{q^j} = \sum_{t=\omega}^{\tau} LTPP_{i.(t)}^{q^j} \quad (29)$$

(3) Present value of transitional pension for "middle people" claim

According to the regulations, the amount of transitional pension received by "middle people" is the product of "calculation and payment coefficient of local transitional pension", "continuous working years before reform", "average wage of local on-the-job employees

in the year before retirement", and "individual average contribution wage index over the years". Then, under the provincial overall planning, taking 2017 as the measurement time point, the present value of transitional pension of the ith "middle people" claim at the age of t is as follows:

$$LTTP^{s}_{i.(t)} = \delta_i \times T_i \times \overline{W}^{s}_{i.(\omega-1)} \times \overline{I}^{s}_{i} \times DR_{i.(t)} \tag{30}$$

where δ_i represents the calculation and payment coefficient of transitional pension, which is set at 1.3% of the national average. T_i represents the number of consecutive working years of the ith individual from the time he started work until 1997.

The present value of transitional pension of the ith "middle people" lifetime claim is as follows:

$$LTTP^{s}_{i} = \sum_{t=\omega}^{\tau} LTTP^{s}_{i.(t)} \tag{31}$$

Similarly, under the "direct national overall planning", the present value of transitional pension for the ith "middle people" claim at t years old $LTTP^{q^z}_{i.(t)}$ and the present value of transitional pension for the ith "middle people" lifetime claim $LTTP^{q^z}_{i}$ are as follows:

$$LTTP^{q^z}_{i.(t)} = \delta_i \times T_i \times \overline{W}^{q}_{i.(\omega-1)} \times \overline{I}^{q}_{i} \times DR_{i.(t)} \tag{32}$$

$$LTTP^{q^z}_{i} = \sum_{t=\omega}^{\tau} LTTP^{q^z}_{i.(t)} \tag{33}$$

Under the "indirect national overall planning", the present value of transitional pension for the ith "middle people" claim at t years old $LTTP^{q^j}_{i.(t)}$ and the present value of transitional pension for the ith "middle people" lifetime claim $LTTP^{q^j}_{i}$ are as follows:

$$LTTP^{q^j}_{i.(t)} = \delta_i \times T_i \times \frac{\overline{W}^{s}_{i.(\omega-1)} + \overline{W}^{q}_{i.(\omega-1)}}{2} \times \frac{\overline{I}^{s}_{i} + \overline{I}^{q}_{i}}{2} \times DR_{i.(t)} \tag{34}$$

$$LTTP^{q^j}_{i} = \sum_{t=\omega}^{\tau} LTTP^{q^j}_{i.(t)} \tag{35}$$

2.3.3. The Present Value of Personal Real Wage Income for Lifetime After Pension Adjustment

To sum up, we can get the present value of personal real wage income for lifetime after adjustment of three calculation and payment paths, namely, provincial overall planning, direct national overall planning, and indirect national overall planning,

$$LTAW^{s}_{i} = LTW_i - LTF^{s}_{i} + LTBP^{s}_{i} + LTPP^{s}_{i} + LTTP^{s}_{i} \tag{36}$$

$$LTAW^{q^z}_{i} = LTW_i - LTF^{q^z}_{i} + LTBP^{q^z}_{i} + LTPP^{q^z}_{i} + LTTP^{q^z}_{i} \tag{37}$$

$$LTAW^{q^j}_{i} = LTW_i - LTF^{q^j}_{i} + LTBP^{q^j}_{i} + LTPP^{q^j}_{i} + LTTP^{q^j}_{i} \tag{38}$$

3. Measurement and Analysis

In order to study the change of income redistribution in raising the overall level of basic endowment insurance, we should first consider the change of the whole adjustment effect on individual wages. Combined with the existing research, this paper selects five indicators, namely, the dispersion coefficient, the Gini coefficient, the Kuznets index, the Ahluwalia index, and the income bad index, to measure the change degree of macro overall income gap after the adjustment of basic endowment insurance. Secondly, we can analyze the internal transfer direction and degree of pension benefits by using the indicators of net benefit amount and net benefit rate from a micro perspective, and measure and analyze the

income redistribution effect within intra-generational, intergenerational, different regions, gender, and unit nature.

3.1. Income Gap Index

3.1.1. Index Introduction

(1) Dispersion coefficient

Dispersion coefficient is an important index to measure the discrete degree of data, which eliminates the influence of dimension. Generally speaking, the larger the value of dispersion coefficient, the higher the degree of dispersion. Let C_V denote the coefficient of dispersion, σ denote the standard deviation, and μ denote the average value, then

$$C_V = \frac{\sigma}{\mu} \times 100\% \tag{39}$$

(2) Gini coefficient

The Gini coefficient is an indicator proposed by the Italian economist Gini at the beginning of the 20th century to measure the fairness of distribution, which is based on the idea of the Lorenz curve. It takes the value of the area A, enclosed by the actual Lorenz curve, and the absolute fairness line in the proportion of the area A+B between the absolute fairness line and the absolute unfairness line, and the value is between 0 and 1, as shown in Figure 1.

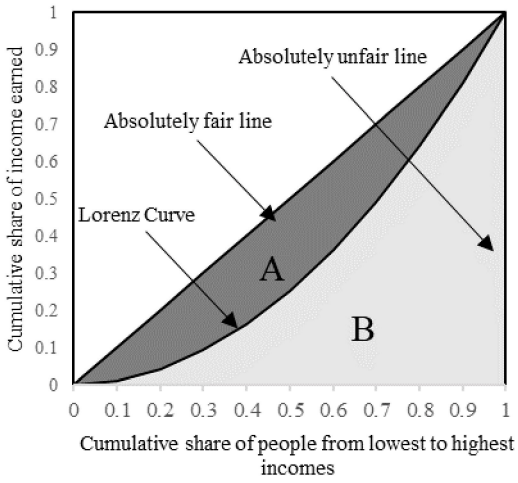


Figure 1. Lorenz curve.

The formula of Gini coefficient is as follows:

$$Gini = \frac{A}{A+B} \tag{40}$$

Gini coefficient solves the problem that Lorentz curve can only reflect the income gap roughly. It is a common index to measure the equality of social income distribution. In practical use, the following formula is often used to calculate the Gini coefficient:

$$Gini = \sum_{k=1}^{N} \xi_k \eta_k + 2 \sum_{k=1}^{N-1} \xi_k (1 - V_k) - 1 \tag{41}$$

where N is the number of groups according to income, ξ_k is the proportion of the population grouped by income to the total population, η_k is the proportion of income owned by each group of population to the total income after grouping by income and $V_k = \eta_1 + \eta_2 + \cdots + \eta_k$.

(3) Kuznets index

The Kuznets index refers to the share of the income of the 20% population with the highest income in the total income, and its lowest value is 0.2. The higher the index, the greater the income gap.

(4) Aluwalia index

The Aluwalia index is the share of the income of the 40% population with the poorest income in the total income, and its highest value is 0.4. The lower the index, the greater the income gap.

(5) Bad income index

The bad income index is expressed as the ratio of the income of the 20% population with the highest income to the income of the 20% population with the poorest income.

3.1.2. Calculation Results

This paper first calculates the present value of individual lifetime wage income without pension adjustment through Formula (4), and then uses five income gap measurement indicators to calculate, and the results are shown in Table 3.

Table 3. The income gap index of the present value for personal lifetime net wage income.

Measurement Index	Dispersion Coefficient	Gini Coefficient	Kuznets Index	Ahluwalia Index	Bad Income Index
Net wage income	101.95%	0.466962	0.504311	0.119676	13.857254

Note: the data in the table are calculated and sorted out by the author.

Secondly, according to the corresponding calculation and payment paths of different pension overall planning levels, the present value of individual lifetime wage income adjusted by pension is calculated by Formulas (36)–(38) and use measurement index of income gap to calculate respectively, and the numerical changes of various indicators compared with Table 3 are given. The specific results are shown in Table 4.

Table 4. The index of income gap and its changes under different pension overall planning levels.

	Provincial Overall Planning Level		Indirect National Overall Planning Level		Direct National Overall Planning Level	
	Value	Change	Value	Change	Value	Change
Dispersion coefficient	96.91%	−5.04%	96.65%	−5.30%	96.40%	−5.55%
Gini coefficient	0.437855	−6.23%	0.436982	−6.42%	0.436189	−6.59%
Kuznets Index	0.482937	−4.24%	0.482133	−4.40%	0.481382	−4.55%
Ahluwalia Index	0.13687	14.37%	0.137197	14.64%	0.137485	14.88%
Bad income index	11.654832	−15.89%	11.590546	−16.36%	11.538606	−16.73%

Note: the data in the table are calculated and sorted out by the author.

It can be seen that after the adjustment of the basic endowment insurance, the values of the dispersion coefficient, Gini coefficient, Kuznets index, and poor income index have all decreased significantly under different overall planning levels, while the Aluwalia index has also risen sharply, which shows that the basic endowment insurance system has effectively narrowed the income gap and has a significant redistribution effect. Further analysis shows that under the three different ways of calculation and payment paths, the current calculation and payment method of provincial overall planning level has the weakest effect on the adjustment of whole income gap, while the calculation and payment method of direct national overall planning level has the strongest effect. Therefore, in order to achieve a higher degree of redistribution effect as a whole, the overall planning level of basic endowment insurance should be promoted to transition from the provincial level to the national level.

Then, we analyze the change of the income gap in different regions. In this paper, we use the dispersion coefficient index to calculate, and give the change of the dispersion

coefficient of different regions under different overall planning levels and calculation and payment paths compared with the pure wage income. The specific values are shown in Table 5.

Table 5. The change of dispersion coefficient of individual real wage income in different regions under different pension overall planning levels.

	Pure Wage Income	Provincial Overall Planning Level	Indirect National Overall Planning Level	Direct National Overall Planning Level
	Dispersion Coefficient	Change of Dispersion Coefficient	Change of Dispersion Coefficient	Change of Dispersion Coefficient
Beijing	92.01%	−9.76%	−7.83%	−5.75%
Tianjin	95.10%	−6.49%	−5.77%	−5.03%
Hebei	104.54%	−4.30%	−5.10%	−5.89%
Liaoning	95.82%	−3.48%	−4.34%	−5.18%
Shanghai	96.11%	−9.83%	−8.20%	−6.43%
Jiangsu	87.96%	−5.50%	−5.46%	−5.41%
Zhejiang	103.47%	−5.66%	−5.35%	−5.04%
Fujian	101.06%	−5.83%	−6.39%	−6.93%
Shandong	114.74%	−3.57%	−4.22%	−4.85%
Guangdong	105.70%	−5.40%	−5.16%	−4.92%
Hainan	107.79%	−3.72%	−4.07%	−4.42%
Shanxi	87.94%	−4.83%	−5.76%	−6.68%
Jilin	90.53%	−5.15%	−5.92%	−6.67%
Heilongjiang	104.38%	−4.14%	−5.51%	−6.84%
Anhui	117.85%	−2.78%	−3.23%	−3.68%
Jiangxi	104.87%	−3.83%	−4.62%	−5.41%
Henan	92.55%	−3.24%	−4.43%	−5.61%
Hubei	86.80%	−4.70%	−5.04%	−5.38%
Hunan	120.85%	−3.22%	−3.97%	−4.71%
Sichuan	88.60%	−6.38%	−6.54%	−6.70%
Chongqing	114.08%	−6.67%	−6.84%	−7.01%
Guizhou	91.52%	−5.15%	−5.25%	−5.35%
Yunnan	100.64%	−5.66%	−5.86%	−6.06%
Shanxi	89.15%	−5.80%	−6.21%	−6.62%
Gansu	107.09%	−4.21%	−4.90%	−5.58%
Qinghai	97.76%	−5.83%	−5.68%	−5.57%
Ningxia	120.21%	−4.32%	−4.50%	−4.68%
Guangxi	113.32%	−3.60%	−4.30%	−4.99%
Inner Mongolia	104.27%	−4.74%	−5.36%	−5.97%
Mean value	101.27%	−5.10%	−5.37%	−5.63%
Intra group difference	34.05%	7.05%	4.97%	3.33%

Note: the data in the table are calculated and sorted out by the author.

As shown in Table 5, all the variation values of dispersion coefficients are negative. In the Figures 2–4 below, the darker the color of a region is, the greater the absolute value of the variation value of the dispersion coefficient is, which means that the income redistribution effect of pension in the region is stronger. Under different overall planning levels and calculation and payment paths, the variation value of the dispersion coefficient of each region will change. Correspondingly, the color displayed in the figure in each region may also change, symbolizing the transition and change of the level of pension income redistribution effect.

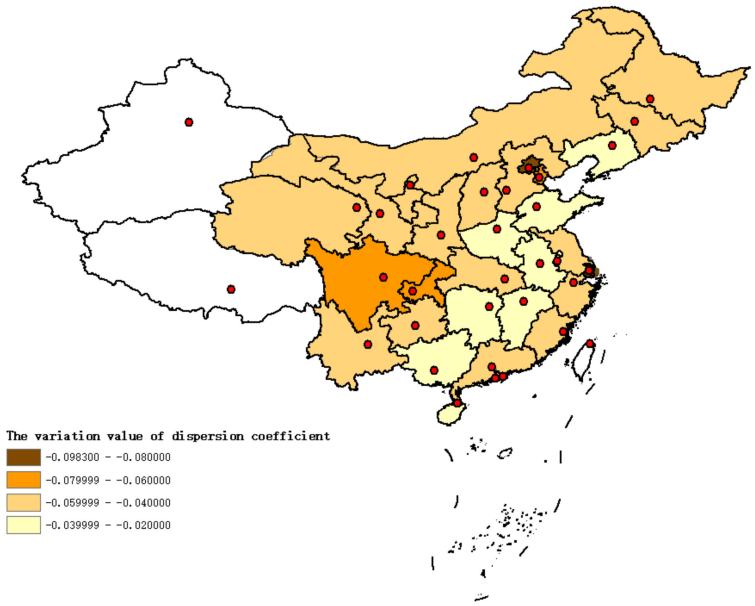


Figure 2. The distribution figure of the change between the dispersion coefficient value of individual real wage income and the pure wage income under the provincial overall planning of pension.

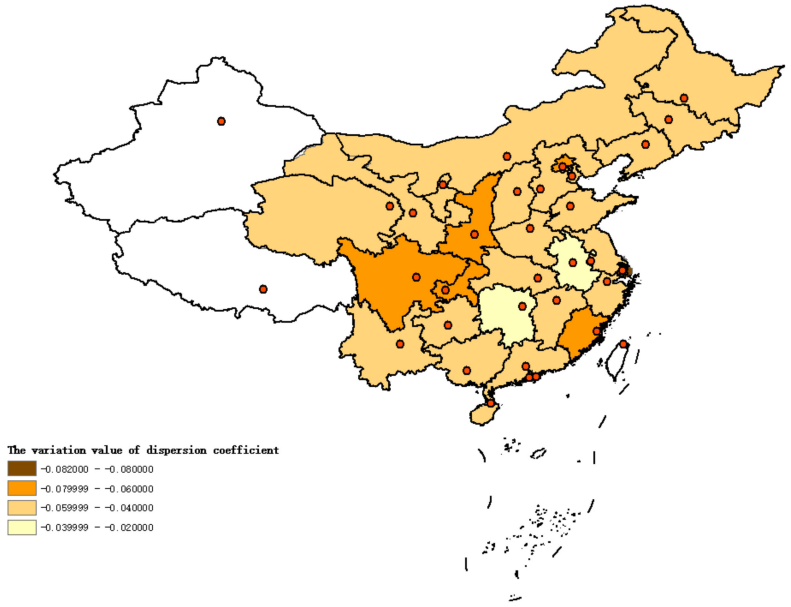


Figure 3. The distribution figure of the change between the dispersion coefficient value of individual real wage income and the pure wage income under the direct national overall planning level of pension.

Compared with the pure wage income without pension adjustment, the dispersion coefficient of Shanghai, Beijing, Chongqing, Tianjin, and Sichuan has fallen the fastest with an average of more than 7.83% in the provincial overall planning stage of basic endowment insurance, and the income gap has narrowed the most. While in Shandong, Liaoning, Henan, Hunan, and Anhui, the dispersion coefficient declined the slowest with an average drop of 3.26%, and the effect of income equalization was the weakest. Under the indirect national overall planning method, the dispersion coefficient of Shanghai, Beijing, Chongqing, Sichuan, and Fujian declined the fastest. Compared with the pure wage income, the dispersion coefficient dropped by 7.16% on average, and the effect of income equalization was the most significant. The five regions of Guangxi, Shandong, Hainan, Hunan, and Anhui have the slowest decline in the dispersion coefficient, with an average

decline of 3.96%, and the redistribution effect is the weakest. If the direct national overall planning is adopted, the dispersion coefficient values of Chongqing, Fujian, Heilongjiang, Sichuan, and Shanxi will drop by 6.83% on average. These are the five regions with the most significant redistribution effect of basic endowment insurance on personal wages, while Shandong, Hunan, Ningxia, Hainan, and Anhui had an average decrease of 4.00%, which were the five regions with the weakest redistribution effect. From the perspective of the overall adjustment effect of the whole country, the intra group difference of each region where the dispersion coefficient in the provincial overall planning stage decreased was 7.05%, the intra group difference of the indirect national overall planning is reduced to 4.97%, and the direct national overall planning is further reduced to 3.33%. It shows that the promotion of the overall planning level and the strengthening of the intensity can effectively reduce the regional differences in the adjustment effect of basic endowment insurance on individual wage income.

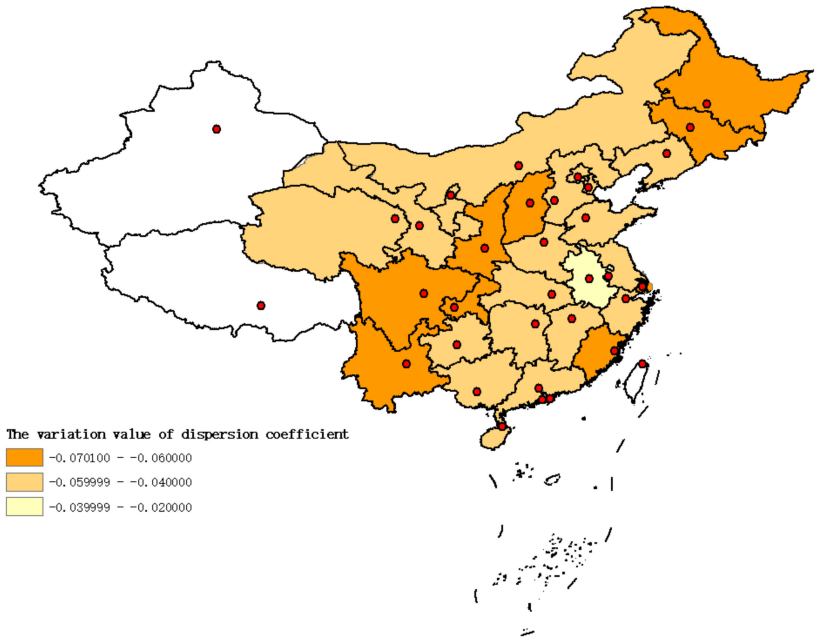


Figure 4. The distribution figure of the change between the dispersion coefficient value of individual real wage income and the pure wage income under the indirect national overall planning level of pension.

It can be found that there are differences in income redistribution effect of different pension overall planning levels and calculation and payment methods in different regions. Generally speaking, in areas with high average wage income (such as Beijing, Shanghai, Jiangsu, etc.), the higher the overall planning level and the stronger the intensity of calculation and payment, the weaker the redistribution effect. This phenomenon is mainly affected by the change of regional average wage income.

According to the above data analysis, in areas with high per capita wage income, under the promotion of the overall planning level, the "local social average wage" index value in the basic endowment insurance payment and receipt formula will decline, resulting in the payment amount of part of the insured (the group whose payment wage is beyond the scope of payment base), as well as the basic pension for all insured persons and transitional pension receiving value of "middle people" will be reduced. Therefore, in the process of raising the overall planning level, the pension insurance system of the region will continue to weaken the adjustment role of personal wage income. Similarly, in areas with low average wage income, the higher the level of overall planning and the stronger the intensity of calculation and payment, the stronger the redistribution effect will be. In summary, in the process of raising the overall planning level and strengthening of the intensity, the size of

the income redistribution effect of the basic endowment insurance system is negatively correlated with the level of the average wage income in the region.

3.2. Benefit Transfer Measures Index

3.2.1. Index Introduction

(1) Lifetime net benefit of pension

The lifetime net benefit amount of an individual's pension is the present value of the basic pension's lifetime receipt plus the present value of the personal account pension's lifetime receipt plus the present value of transitional pension's lifetime receipt of "middle people", and finally minus the present value of the personal pension's lifetime payment, and its formula is expressed as:

$$LTE_i = LTBP_i + LTPP_i + LTTP_i - LTF_i \tag{42}$$

(2) Lifetime net benefit rate of pension

The lifetime net benefit rate of a personal pension is the lifetime net benefit of the pension divided by the present value of the pension's lifetime payment, and its formula is expressed as:

$$LTER_i = \frac{LTE_i}{LTF_i} \times 100\% \tag{43}$$

If the individual's lifetime benefit amount and lifetime benefit rate are greater than or equal to 0, the individual is considered to be the welfare inflow side of the pension insurance system, and if it is less than 0, it is considered to be the welfare outflow side of the system.

3.2.2. Calculation Results

According to the wage income of the respondents in 2017, the respondents are grouped in the order from low to high. The first group, the fifth group and the ninth group represent the lowest, middle, and highest wage groups, respectively, see Table 6.

From the perspective of various income groups, it can be found that the individual's wage income and the lifetime net benefit rate of pensions have a reverse relationship. Individuals with lower income tend to have a higher lifetime net benefit rate of pensions, which is generally greater than 0, indicating that they are welfare inflows of the basic endowment insurance system. The lifetime net benefit rate of pensions for individuals with higher income is generally lower, and the value is often less than 0, indicating that they belong to the welfare outflow of the system. This phenomenon once again confirms that the basic endowment insurance system can realize the secondary distribution of social resources, so that the welfare of high-income groups can flow to low-income groups to a certain extent, thereby narrowing the whole income gap in society and giving full play to the "regulator" role of the system. At the same time, the calculation results show that the largest gap of intra-group in the net benefit rate is the middle-income group, which means that under the current provincial overall planning level, the distribution equalization of pension benefits for middle-income groups in China is the lowest, rather than the highest or lowest income group, this is mainly due to the effect that the upper and lower limits of the payment base effectively smoothed the fluctuations of extreme values.

From the perspective of each region, Shanghai, Chongqing, Beijing, Qinghai, and Yunnan have the highest lifetime net benefit rate of pensions, with an average of 0.184, while Jiangxi, Inner Mongolia, Shanxi, Liaoning, and Henan have the lowest lifetime net benefit rates of pensions, with an average of 0.039. It can be found that regions with a high lifetime net benefit rate tend to have higher per capita wage income, while regions with a low lifetime net benefit rate have lower per capita wage income. Combined with the "social average wage of the year before retirement" in the calculation and payment formula of basic pension, it can be inferred that under the current provincial overall planning level,

the size of the lifetime net benefit rate of the regional average pension is positively related to the level of the average wage in the region.

Table 6. The lifetime net benefit rate of pension in different regions under the provincial overall planning.

Income Grouping	1 (Low)	2	3	4	5 (Middle)	6	7	8	9 (High)	Mean Value
Beijing	0.227	0.465	0.254	0.274	0.190	0.206	0.103	0.069	−0.030	0.197
Tianjin	0.162	0.154	0.262	0.183	0.134	0.138	−0.040	−0.044	−0.069	0.104
Hebei	0.290	0.235	0.172	0.088	0.064	−0.044	−0.029	−0.084	−0.121	0.097
Liaoning	0.189	0.192	0.108	0.169	−0.032	−0.024	−0.081	−0.140	−0.239	0.027
Shanghai	0.322	0.214	0.248	0.270	0.368	0.314	0.281	0.102	−0.046	0.244
Jiangsu	0.326	0.157	0.182	0.345	0.018	0.043	−0.014	−0.046	−0.253	0.084
Zhejiang	0.210	0.222	0.110	0.139	0.146	0.230	0.126	−0.112	−0.157	0.117
Fujian	0.311	0.263	0.176	0.167	0.088	0.030	−0.051	−0.031	−0.217	0.109
Shandong	0.293	0.318	0.099	0.206	0.155	−0.012	0.026	−0.076	−0.220	0.097
Guangdong	0.334	0.270	0.230	0.192	0.031	0.051	−0.032	−0.032	−0.205	0.118
Hainan	0.202	0.196	0.180	0.285	−0.069	0.119	−0.012	−0.074	−0.084	0.099
Shanxi	0.209	0.188	0.123	0.026	0.062	−0.074	−0.058	−0.137	−0.282	0.037
Jilin	0.328	0.360	0.091	0.116	0.021	0.008	−0.086	−0.128	−0.207	0.083
Heilongjiang	0.269	0.089	0.157	0.056	0.075	0.070	−0.150	0.093	−0.213	0.084
Anhui	0.298	0.238	0.173	0.295	0.230	−0.118	−0.149	−0.115	−0.173	0.105
Jiangxi	0.301	0.137	0.227	0.283	0.215	−0.043	−0.077	−0.088	−0.250	0.068
Henan	0.243	0.368	0.035	−0.072	0.119	−0.159	−0.207	−0.177	−0.181	0.008
Hubei	0.332	0.262	0.155	0.097	0.046	−0.061	−0.030	−0.052	−0.124	0.089
Hunan	0.286	0.211	0.289	0.419	0.091	0.073	−0.130	−0.189	−0.289	0.123
Sichuan	0.225	0.299	0.173	0.326	0.119	0.097	−0.082	−0.051	−0.231	0.116
Chongqing	0.297	0.315	0.212	0.346	0.425	0.148	0.040	0.144	−0.257	0.206
Guizhou	0.165	0.116	0.274	0.198	0.060	0.230	−0.136	−0.045	−0.171	0.084
Yunnan	0.378	0.313	0.183	0.132	0.145	0.150	−0.014	0.131	−0.281	0.133
Shanxi	0.255	0.254	0.202	−0.099	0.127	0.062	−0.078	−0.018	−0.234	0.094
Gansu	0.274	0.247	0.272	0.153	0.135	−0.107	−0.058	−0.271	−0.215	0.091
Qinghai	0.471	0.291	0.268	0.105	0.036	0.061	0.039	0.126	−0.262	0.139
Ningxia	0.249	0.229	0.050	0.265	0.468	0.054	−0.031	−0.117	−0.229	0.123
Guangxi	0.407	0.123	0.116	0.222	0.066	0.103	−0.035	−0.059	−0.233	0.092
Inner Mongolia	0.256	0.227	0.135	0.157	0.193	0.091	−0.232	−0.141	−0.299	0.057
Mean value	0.280	0.240	0.178	0.184	0.128	0.056	−0.041	−0.054	−0.199	0.104
Intra group difference	0.309	0.376	0.254	0.518	0.537	0.473	0.513	0.415	0.269	0.236

Note: the data in the table are calculated and sorted out by the author.

Table 7 shows the calculation results of the quantity distribution of the welfare inflows and outflow. It can be seen that with the improvement of the pension overall planning level and the strengthening of the intensity, the number and proportion of the "individuals of welfare inflow" are rising, and the "individuals of welfare outflow" is decreasing. It shows that raising the overall planning level of the pension insurance can effectively increase the number of "individuals of welfare inflow" and expand the benefits of the system and play a greater role in social welfare.

Table 7. Distribution of number of people for system welfare inflows and outflow under different pension overall planning level.

	Provincial Overall Planning Level		Indirect National Overall Planning Level		Direct National Overall Planning Level	
	Number	Proportion	Number	Proportion	Number	Proportion
System welfare inflows	4110	52.15%	4200	53.29%	4272	54.21%
System welfare outflow	3771	47.85%	3681	46.71%	3609	45.79%

Note: the data in the table are calculated and sorted out by the author.

According to Figures 3–5, the horizontal axis of the coordinate represents the age of the insured in 2017, and the vertical axis represents the lifetime net benefit rate of the pension. The curve describes the corresponding relationship between the age of the insured and the lifetime net benefit rate of the pension. It can be seen that the three curves intersect the horizontal axis at about 38 years old, which means that the present value of lifetime contribution and the present value of receipt of pension for the insured group aged 38 or so in 2017 are basically equal, while the insured group under 38 years old is the welfare outflow of the system. It can be seen that 1–20% of their wage income will be transferred to the insured group of previous generation through the basic endowment insurance system. At the same time, the insured over 38 years old can often get 1–140% pension benefits in their lifetime. With the improvement of the overall planning level and the strengthening of the intensity of the pension, the curve is moving upward, which indicates that the pension net benefit rate of the on-the-job insured groups of all ages will be improved. At the same time, it also makes the age coordinate of the curve crossing the horizontal axis move forward, which means that the age group with negative net benefit rate is shrinking continuously. It shows that compared with the current provincial overall planning, the reform of national overall planning will reduce the number of young people suffering from welfare damage. Therefore, raising the overall planning level of basic endowment insurance can not only benefit the whole age group, but also protect the pension benefits of more young generation of insured.

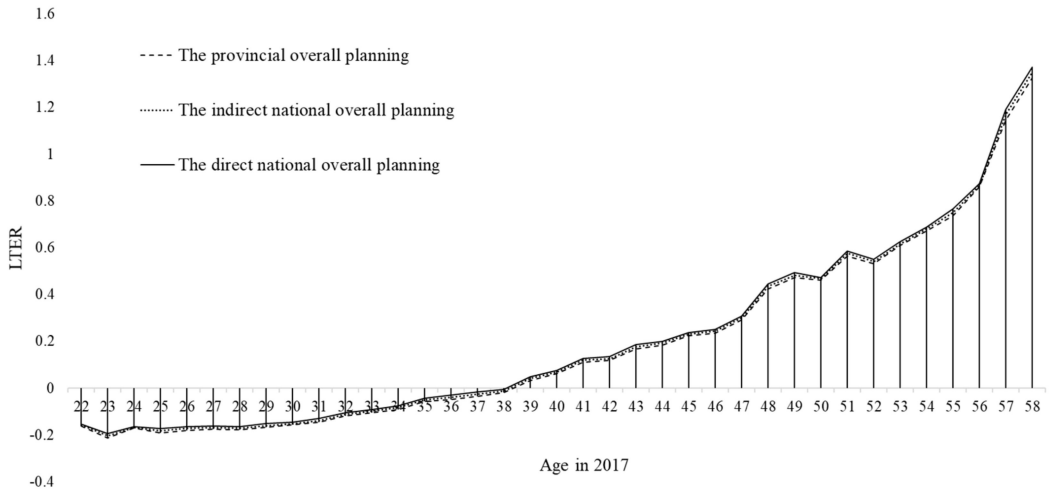


Figure 5. Distribution of lifetime net benefit rate of pension in different age groups.

In order to analyze the impact of the promotion of the overall planning level on the redistribution effect of different gender insured groups, this paper calculates the net benefit rates of male and female employees under different calculation and payment methods, as shown in Table 8. It can be seen that under the current provincial overall planning level, the per capita net benefit rates of male and female insured groups are both positive, and they are the beneficiaries of the system as a whole. However, the net benefit rate of more high-income groups among women is negative, and the value is lower than that of men with the same income level, which shows that women in high-income groups play more roles as a contributor of the system. Therefore, the effect of system redistribution under gender differences is reflected in the shift from women to men. With the improvement of the overall planning level and the strengthening of intensity, the net benefit rate of both men and women has increased. At the same time, more female insured will turn from welfare contributors to welfare beneficiaries of the system. This shows that compared with male groups, the reform of national overall planning of basic endowment insurance will increase the number of system welfare beneficiaries for female insured groups.

Table 8. The lifetime net benefit rate of pensions at all overall planning levels under gender differences.

Income Grouping	Male			Female		
	Provincial Overall Planning Level	Indirect National Overall Planning Level	Direct National Overall Planning Level	Provincial Overall Planning Level	Indirect National Overall Planning Level	Direct National Overall Planning Level
1 (Low)	0.375	0.380	0.384	0.211	0.213	0.216
2	0.317	0.325	0.331	0.193	0.202	0.211
3	0.230	0.243	0.255	0.117	0.132	0.147
4	0.268	0.282	0.295	0.068	0.079	0.089
5 (Mddle)	0.167	0.179	0.190	0.038	0.049	0.058
6	0.094	0.107	0.119	−0.014	−0.006	0.001
7	0.019	0.028	0.037	−0.118	−0.113	−0.109
8	0.001	0.006	0.011	−0.138	−0.137	−0.137
9 (High)	−0.186	−0.185	−0.184	−0.235	−0.234	−0.233
Summation	0.139	0.148	0.156	0.061	0.069	0.076

Note: the data in the table are calculated and sorted out by the author.

Table 9 shows the distribution of lifetime net benefit rate of pension at all overall planning levels of state-owned and non-state-owned economic units, where, "government organizations/institutions" and "state-owned and state holding enterprises" are classified as state-owned economic units, while "collective enterprises", "individual industrial and commercial households", "private enterprises", and "enterprises invested by foreign investors, Hong Kong, Macao, and Taiwan" are classified as non-state-owned economic units. It can be seen that under the three methods of calculation and payment, the average net benefit rate of non-state-owned economic units is significantly lower than that of state-owned economic units, and the net benefit rate of more income groups is negative, indicating that a larger proportion of employees in this type of unit play the role of "contributor" in the basic endowment insurance system. Although the improvement of pension overall planning level and the strengthening of the intensity will increase the average net benefit rate of non-state-owned economic units and reduce the damage degree of the group's welfare, it cannot effectively narrow the gap in pension benefits between non-state-owned and state-owned economic units, and the actual self-adjusting effect of the system is very small. Policy makers need to consider giving more direct subsidies or indirect benefits tilt.

Table 9. The lifetime net benefit rate of pension of different levels under the difference of unit nature.

Income Grouping	State Owned Economic Unit			Non State Owned Economic Unit		
	Provincial Overall Planning Level	Indirect National Overall Planning Level	Direct National Overall Planning Level	Provincial Overall Planning Level	Indirect National Overall Planning Level	Direct National Overall Planning Level
1 (low)	0.311	0.314	0.318	0.248	0.251	0.254
2	0.290	0.297	0.305	0.216	0.224	0.233
3	0.228	0.241	0.254	0.133	0.147	0.160
4	0.286	0.298	0.309	0.094	0.107	0.119
5 (middle)	0.236	0.251	0.265	0.002	0.010	0.018
6	0.154	0.169	0.184	−0.046	−0.039	−0.033
7	0.065	0.071	0.077	−0.143	−0.134	−0.125
8	0.085	0.092	0.097	−0.181	−0.181	−0.181
9 (high)	−0.103	−0.101	−0.099	−0.267	−0.267	−0.268
Mean value	0.189	0.198	0.207	0.028	0.035	0.042

Note: the data in the table are calculated and sorted out by the author.

In order to further consider the relationship between the changes in the redistribution effect of the increase in pension overall planning levels and the number of payment years, we calculated and obtained Table 10. According to the current methods of receiving basic pension insurance, the insured must meet the condition of "cumulative payment period of 15 years" after retirement to receive the pension. If the payment period is less than 15 years, the pension can be made up one time at the time of retirement. Therefore, in this paper, individuals whose cumulative working years are less than 15 years are treated as 15 years of payment. Because the starting working age of the statistical sample is set at 22 years old, according to the retirement age of 60 years, the maximum number of years of payment for statistical samples is 38 years. As shown in Figure 6, with the improvement of the overall planning level and the strengthening of the intensity, the net benefit rate of the insured groups with different payment years will increase. However, under the three methods of the calculation and payment, the group with the highest average net benefit rate is the group with the payment duration of 15–20 years, and the group whose payment period is 31–35 years is the lowest. Therefore, in order to obtain the maximum lifetime net benefit, the payment period should be controlled between 15 and 20 years. At the same time, policy makers should pay more attention to the group whose payment period is about 30 years, increase welfare compensation and narrow the benefit gap with other groups.

Table 10. The lifetime net benefit rate of pensions at all overall planning levels under the difference of payment years.

Payment Years Groups	Provincial Overall Planning Level	Indirect National Overall Planning Level	Direct National Overall Planning Level
15–20 years	0.149	0.155	0.160
21–25 years	0.126	0.134	0.141
26–30 years	0.091	0.100	0.107
31–35 years	0.048	0.056	0.064
35–38 years	0.121	0.131	0.140

Note: the data in the table are calculated and sorted out by the author.

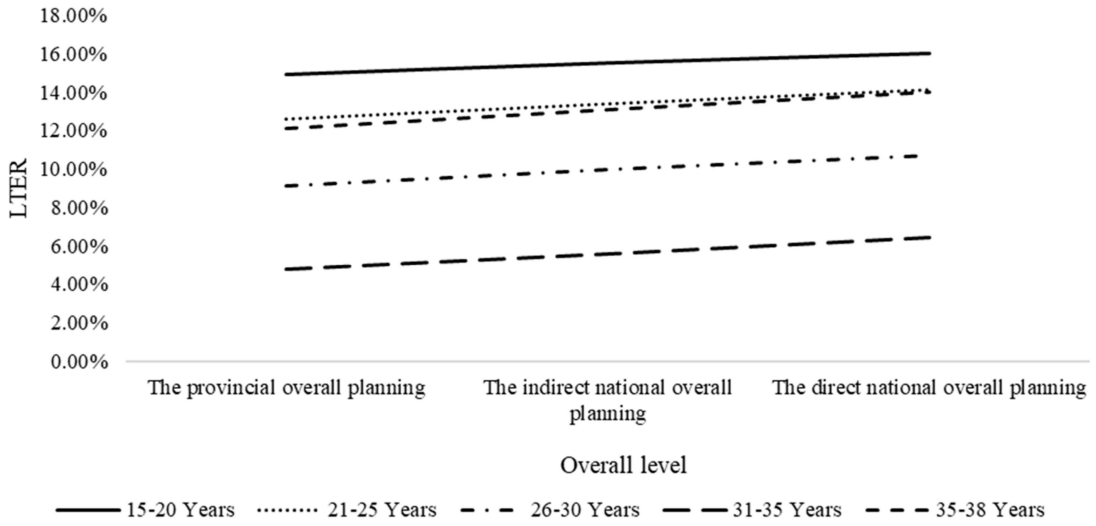


Figure 6. Distribution of lifetime net benefit rate of pension in different payment years.

4. Conclusions and Discussion

4.1. Conclusions

Based on the above analysis, the following conclusions may be reasonably drawn:

First, overall speaking, there is indeed prominent income redistribution effect of basic endowment insurance system for urban employees, and the regulation effect of income equalization is positively related to the overall planning level and strength of the system. According to the calculation results of income gap index, basic endowment insurance

system can effectively reduce the unfair degree of primary distribution, but the effect of current provincial overall planning is the weakest, and the effect of direct national overall planning is the most significant. Moreover, in the process of raising the overall planning level and strengthening of intensity, a negative correlation between the size of redistribution effect of basic endowment insurance system and scale of average wage income in specific regions is witnessed.

Second, under the provincial overall planning level, the income redistribution effect of the system is embodied in the following aspects concerning transferring: the transfer of the high-income group to the low-income group, the young generation to the older generation, the female insured to the male insured, and the non-state-owned economic unit to the state-owned economic unit. From the analysis of income groups, we can find that there is a reverse relationship between the individual wage income and the lifetime net benefit rate of pension, which makes the net benefit of pension flow from the high-income group to the low-income group, which is conducive to narrowing the overall gap of wealth between the rich and the poor and realizing the "regulator" role of social insurance. From the perspective of intergenerational analysis, the present value of lifetime contribution of the insured group is basically equal to the present value of receiving pension, while the young insured below the age point will transfer part of their wage income to the previous generation, which is the embodiment of social support responsibility.

Third, as overall planning level gets more advanced and strengthening of intensity, on the whole, the income redistribution effect of the basic endowment insurance system for urban employees in China will be more significant, but the benefit changes among different groups are different. From the perspective of the benefits of the system, with the improvement of the overall planning level of pension insurance, the number of beneficiaries of the system will continue to increase, and the net benefit rate of pension of all generations will be improved, which will help to expand the benefit range of the system and play a greater role in social welfare. However, this is based on the premise that the payment and calculation methods of the endowment insurance system remain unchanged, that the pension financial revenue and expenditure can be maintained in balance, and that the insured pay according to the regulations during the whole working period. From the perspective of Intergeneration, while all insured groups of all ages will benefit from it, the corresponding age at which the present value of individual lifetime contribution of pension and the present value of receiving pension are equal has moved forward, which means that the improvement of the overall planning level can also protect the interests of more young generation of insured people. From a gender perspective, although the net benefit rate of both men and women has increased, compared with the male insured group, the improvement of the overall planning level will cause more female insured persons to change their roles as welfare contributors to welfare beneficiaries, which is more conducive to protecting the interests of women insured groups. Among the different types of unit nature, the improvement of the pension overall planning level can simultaneously increase the benefit of state-owned economic units and non-state-owned economic units, but it cannot effectively narrow the benefit gap between the two.

4.2. Policy Suggestion

According to the above investigation, combined with the actual operation condition of China's existing urban employee's basic endowment insurance system, this article proposes the following suggestions:

First, an indirect way of calculation and payment can be adopted to promote the improvement of the overall planning level of the basic endowment insurance system. Through calculations, it can be clearly seen that the national overall planning of basic endowment insurance has a significant income redistribution effect and can improve the level of welfare benefits of the whole insured persons. Therefore, the overall planning level should be improved as soon as possible to promote fair and efficient economic development. Taking into account the fact that the direct implementation of the basic

endowment insurance system is too difficult for the national overall planning reform, the indirect transition path designed in this article can be adopted, of which the gradual reform can be taken on the basis of full attention to the interests of different regions and groups. When the difference level of regional development has been reduced to a certain extent and the path has been sufficiently recognized by the public, the direct transition plan can be implemented.

Second, implementing flexible compensation methods for areas with severely damaged welfare. The biggest obstacle to the implementation of the national overall planning reform of the basic endowment insurance system comes from the difference in interests in different regions. As mentioned above, the national overall planning means that part of the pension benefits of the insured groups in high-income areas will flow to low-income areas, accelerating the consumption of the pension fund balances and sacrificing the interests in the region and raising dissatisfaction and resistance from the local government. Therefore, it is recommended that the central government first affirms the historical achievements of local economic development, allows local governments to retain fund balances before a certain point in time. After this point in time, the fund balances shall be turned in in accordance with the requirements of the national overall planning reform. Secondly, at the initiation stage of the reform of the pension insurance system, the local government and the state finance should share proportionately to make up for the fund gaps and transition cost gaps in economically underdeveloped areas. This can not only effectively reduce the difficulty of starting the reform, but also be conducive to enhancing the local government's awareness of pension responsibility and promoting the healthy development of the basic endowment insurance system.

Third, targeted subsidies should be implemented to the welfare damaged objects whose regulation of the basic endowment insurance system fails. Overall speaking, the improvement of the overall planning level can further strengthen the income redistribution effect, but the effect is weak for the insured groups of non-state-owned economic units. Although the average wage income of state-owned economic units is higher than that of non-state-owned economic units, the former still benefits more from the basic endowment insurance system than the latter, which may reduce the willingness of non-state-owned economic units to participate in insurance, thus affecting the sustainability of the system. Similarly, the individuals whose payment period is 31–35 years are also the welfare damaged objects of system regulation failure. We should consider increasing the financial subsidies to the non-state-owned economic units and the insured with the payment period of 31–35 years, and issue special pension allowance, so as to narrow the benefit gap of pension, strengthen the willingness of such groups to participate in insurance, so as to enhance the sustainability of the system.

4.3. Shortcomings and Prospects

(1) The accuracy of measurement needs to be improved

First of all, limited by the availability of data, in the process of estimating personal lifetime wage income, this paper assumes that many characteristics of the interviewees, such as education level, location, marital status, and industry, remain unchanged throughout their lives, which inevitably leads to certain measurement errors. However, based on the final measurement results, the estimated data is more in line with the actual situation. Secondly, the difference of individual retirement age is not considered. In order to simplify the calculation, the retirement age is set to 60 in this paper, ignoring the difference of retirement age between different genders and different types of work.

(2) The influencing factors need to be supplemented

First of all, although the basic pension insurance for urban workers is the main content of the basic pension insurance system in China, the pension insurance for urban and rural residents cannot be ignored. In the next step, we can increase the calculation and analysis of the income redistribution effect of the pension insurance for urban and rural residents, so as to more comprehensively reflect the income redistribution effect of the basic pension

insurance. Secondly, we should give full consideration to the delayed retirement policy, and further explore the effect of system redistribution under different retirement ages in the future research. Finally, according to the actual situation, the research on the income gap in China should not only stay in the perspective of individuals, but also extend to family units to explore the changes of income redistribution effect of pension insurance among different families after the improvement of overall planning level.

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