


## Research Article

# Pension Security Level of Urban Employees in China Based on CHIPs

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In 2019, the Chinese government has put forward comprehensive plan for reducing social insurance premium rate, which will affect the measurement of the pension security level. In order to evaluate the pension level, this paper uses CHIPs data from 1988 to 2018 to calculate “empirical” pension replacement rate by “empirical” method based on different wage calibers. The result shows that the pension replacement rate and income replacement rate of urban employees have gradually declined in the past 30 years. The pension level of nonprivate employees is lower than that of insured employees, and that of insured employees is lower than that of full-scale employees. The pension level of male, high-income groups, the older generation, organs, and institutions is much higher than that of female, low-income groups, the younger generation, and enterprises relatively. Compared with other countries, the pension replacement rate of urban employees in China is not low, but the income replacement rate is relatively low. This paper makes an in-depth analysis of the actual pension level under the new policy. As a result, it is necessary to vigorously develop multilevel and multipillar pension system such as enterprise annuity, occupational annuity, and commercial pension insurance, so as to improve the pension level of urban employees.

## 1. Introduction

Since the 21st century, China’s per capita life expectancy has increased from 70.4 years in 2000 to 77.3 years in 2021, which promotes the increasingly serious problem of population aging. At the same time, according to the latest data of the seventh census released in 2021, the population aged 60 years and above of the Chinese mainland reached 264.02 million people, accounting for 18.7% of the national population, and the population aged 65 years and above reached 190.64 million, accounting for 13.5% at the end of 2020. Compared with the fifth national census in 2000, the proportion of people aged 60 years and above increased by 8.24%, and the proportion of people aged 65 years and above increased by 6.54%. Obviously, if we divide the degree of aging according to the international standard that “the population aged 65 years and above accounts for more than 7% or the population aged 60 years and above accounts for more than 10%,” China has entered a deeply aging society,

and the population structure will further age. This aging population phenomenon will also greatly increase the pension burden of families and society. In order to deal with this problem, the report of the 19th National Congress of the Communist Party of China clearly proposed comprehensively building a multilevel social security system with appropriate pension security level. Pension security system is an important part of social security. The Fourth Plenary Session of the 19th CPC Central Committee also stressed the importance of steadily improving the pension security level. In view of the demand for higher-level and higher-quality pension security, “the outline of the 14th five-year plan” proposes accelerating the development of multilevel and multipillar pension insurance system, improving the coverage of enterprise annuity, and standardizing the development of the third pillar pension insurance. In this context, it is of great theoretical and practical significance to choose which index to measure the actual level of pension security for urban employees in China, compare and evaluate it with

international empirical research, and then put forward policy suggestions to improve the pension security level in China, so as to provide an academic basis for accelerating the development of second and third pillar pension insurance. Relevant research has also become the focus of the government and academia.

Whether international or domestic research, there are relatively many studies on measuring the pension level by using the “institutional” pension replacement rate, but there are few studies on measuring the pension level by using the “empirical” pension replacement rate, especially domestic research. Under the policy background of the comprehensive scheme for reducing social insurance rates in 2019, this paper will measure the pension level under different wage calibers in China from 1988 to 2018 based on the “empirical” method, discuss with international research, and analyze the impact of the implementation of this scheme on the pension level. In addition, with the aggravation of China’s aging population and the policy background that the government attaches great importance to improving the pension security level, it is of great significance to measure and analyze the actual pension security level of urban employees in China.

In terms of system construction, China’s pension insurance system has developed for more than 20 years since the State Council officially promulgated the decision on establishing a unified basic pension insurance system for enterprise employees (GF [1997] No. 26) in 1997. The decision on improving the basic pension insurance system for enterprise employees (GF [2005] No. 38), published in 2005, improved the system and adjusted the proportion of individual accounts and the calculation and payment method of basic pensions, in which stipulated that the employer’s contribution is 20% and individual contribution is 8%. According to the system design calculation, for urban employees who have worked for 35 years, the target replacement rate of basic pension insurance is 59.2%, of which the replacement rate of basic account pension is 35% and that of personal account pension is 24.2%. The target replacement rate includes the target replacement rate of basic pension and the target replacement rate of individual account pension. For standard beneficiaries who have continuously contributed for 35 years and retired at the age of 60 and whose contribution wage is equal to the social average wage,  $W_{\text{average}}$  is used to represent the average social wage, and then the target replacement rate of basic pension =  $(W_{\text{average}} * 35 * 1\%) / W_{\text{average}} = 35\%$ , and the target replacement rate of individual account pension =  $(W_{\text{average}} * 8\% * 35 * 12) / (139 * W_{\text{average}}) = 24.17\%$ . At the same time, in order to develop a multipillar pension system and make up for the lack of relying only on the first pillar, the Ministry of Labor and Social Security promulgated the Trial Measures for Enterprise Annuity in 2004, but so far the coverage is still limited and the growth rate of coverage is slow. According to the 2020 national enterprise annuity fund business data released by the Ministry of Human Resources and Social Security, the enterprise annuity coverage rate is only 6.8%, with an average annual growth rate of less than 1%. Therefore, it is still difficult to promote the development of the second pillar and give full play to the role of the second pillar in pension security.

The State Council issued the decision on the reform of the pension insurance system for staff of organs and institutions, officially ending the “two-track system” in 2015, merging the pension insurance system of organs and institutions with that of enterprises, and adopting the same system model, payment proportion, and payment method. This system reform will have a crucial impact on the pension security level of staff in organs and institutions. Relevant research has also attracted extensive attention in domestic academic circles. Many scholars believe that the reform will reduce the pension treatment of staff, so it is necessary to build a supporting occupational pension. It can be seen that it is also of great significance to measure the pension security level of organs and institutions before and after the system reform.

## 2. Literature Review

Internationally, scholars often use the index of pension replacement rate to measure the security level of pension insurance system and conduct international and inter-institutional comparative research (Whiteford, 1995; OECD, 2005; Mitchell and Phillips, 2006; Borella and Forner, 2009) [1–4]. Specifically, the pension replacement rate includes “institutional” and “empirical” calculation methods. “Institutional” refers to the ratio of the expected future pension income of employees to their personal wage income for representative individual characteristics, that is, the target replacement rate. This method needs to estimate pension income and wage income by assuming working years, social average wage growth rate, and other parameters (Whitehouse, 2007; European Union, 2009; OECD, 2021; Congressional Budget Office, 2019; S. Ba, 2022) [5–9]. The “empirical” pension replacement rate directly compares the pension of current retirees with the wage income of on-the-job employees. Most relevant studies use statistical survey data to directly measure the actual replacement rate level of current retirees, which can more accurately reflect the security degree of the pension system [10, 11]. Among them, some studies calculate the pension replacement rate in different countries based on the average wage of on-the-job employees [12, 13]. In addition, the replacement rate level at all levels is calculated based on the total and net average wage income or median wage income [14, 15]. In addition, some scholars have analyzed the differences of pension replacement rate among different groups such as the nature of different units, age, gender, and marital status [16–21].

In domestic academic circles, there are many studies on using the “institutional” replacement rate index to measure the pension security level, including measuring the security level of different pension systems such as organs and institutions, enterprise employees, and enterprise annuity [22–24]. There are few studies based on the “empirical” pension replacement rate. Some studies mainly use the official statistical data to calculate the overall average wage of employees and take this as the caliber to calculate and analyze the difference of security level between enterprises and organs or different regions (Wang Xiaojun and Qiao Yang, 2007; Wang Xiaojun and Zhao Tong, 2006) [25, 26]. Li

Shi et al. (2013), based on the income data from CHIPs 1988 to 2007, measured the pension security level of urban retirees in China by using the “empirical” replacement rate index with two dimensions: the average wage of full-scale employees before retirement and the average wage of employees close to five years before retirement [27].

In conclusion, it can be seen that, due to the relative lack of micro statistical data in China, especially the long-term follow-up survey data, there are relatively few studies on using “empirical” indicators to measure the pension security level in China. This paper attempts to solve the following problems: in the process of the gradual reform of the pension insurance system for urban employees in China, what is the development trend of the actual security level of the pension system? What is the impact of different wage caliber on measuring the pension security level? What are the differences in the pension level of different income levels, the nature of the organization, the level of education, and different gender and age groups? How much has the pension level of organs and institutions decreased? Compared with other countries in the world, how much is the pension security level for urban employees in China?

Compared with the existing literature, the main contributions of this paper are as follows: first, based on the “empirical” replacement rate indicator, the six CHIPs data from 1988 to 2018 are used to calculate and analyze the actual level of pension security for urban employees in China and make some international discussions; second, relying on the comprehensive plan for reducing social insurance rates issued in 2019, the calculation standard of average wage is adjusted from the average wage of on-the-job employees of urban nonprivate units to the average wage of full-scale employees weighted by urban nonprivate units and private units, so as to reduce the burden of social security payment. According to the data of the National Bureau of Statistics, in 2019, the average wage of on-the-job employees in urban nonprivate units in China was 93383 yuan, while the average wages of employees in nonprivate and private units were 90501 yuan and 53604 yuan, respectively, so the weighted average wage of full-scale employees was 73561 yuan (average wage of full-caliber employees = (average wage of employees in urban non private units \* number of employees in urban nonprivate units + average wage of

employees in urban private units \* number of employees in urban private units)/(number of employees in urban nonprivate units + number of employees in urban private units)). Since the National Bureau of Statistics has not published the number of employees in private units in 2020, for this reason, only 2019 values have been calculated. It can be seen that the average wage of full-scale employees is significantly lower than that of on-the-job employees in nonprivate units and also lower than that of employees in nonprivate units. Obviously, this adjustment plan is bound to affect the measurement of the pension security level of urban employees in China, but how will it affect, increase, or decrease? From the perspective of insured employees, is their security level higher or lower than that of nonprivate units and higher or lower than that of full-scale employees? Therefore, this paper will measure the replacement rate level under different wage caliber and analyze the impact of the comprehensive fee reduction scheme on the measurement of pension security level. The third is to make an in-depth analysis of the differences in the pension level among different income levels, the nature of the unit, the level of education, and different gender and age groups, especially whether the reform of organs and institutions will reduce the security level of their staff and how to compare with enterprise employees in order to provide academic basis and development direction for future policy reform.

### 3. Research Method

*3.1. Research Method.* This paper adopts the “empirical” calculation method of the pension replacement rate, which can evaluate the actual security level more accurately. Firstly, according to whether the pension and wage income are gross or net, the pension replacement rate can be divided into total pension replacement rate and net pension replacement rate [28]. However, the estimation of total pension replacement rate ignores social security contributions and individual income tax, which will underestimate the relative benefits of pension [29, 30]. The wage income of on-the-job employees in China needs to pay social security contributions and individual income tax, while the pension income of retirees does not need to pay, so the net pension replacement rate can measure a more real security level.

$$\text{Total pension replacement rate} = \frac{\text{total pension}}{\text{total wage income}}$$

$$\text{Net wage income} = \text{total wage income} - \text{individual income tax} - \text{social security fee}, \quad (1)$$

$$\text{Net pension replacement rate} = \frac{\text{net pension}}{\text{net wage income}}$$

Secondly, the income replacement rate refers to the ratio of retirement income including pension and all other retirement incomes to the total income of active employees [20, 31, 32]. Income replacement rate integrates all sources of

income after retirement and measures the overall living security level of retirees. Generally speaking, the income replacement rate is higher than the pension replacement rate; especially in countries with developed multipillar

pension system, the income after retirement does not only come from the basic pension [12, 15]. (Retirement income should include cash income, employer pension, private pension, investment income, government noncash subsidies, and savings; the income of on-the-job employees should include wages and other labor incomes, investment income, and government noncash subsidies; the expenditure

before and after retirement includes direct tax and indirect tax (Whiteford, 1995).) The net income replacement rate is similar to the net pension replacement rate. The corresponding net value is obtained by subtracting social security contributions and individual income tax from the income before and after retirement, so as to measure the more real income security level.

$$\begin{aligned} \text{Total income replacement rate} &= \frac{\text{total retirement income}}{\text{total income of active employees}}, \\ \text{Net income replacement rate} &= \frac{\text{net retirement income}}{\text{net income of active employees}}. \end{aligned} \quad (2)$$

Finally, in the specific calculation of pension replacement rate, the choice of wage income caliber will also have a great impact on the results. Generally, it can be divided into the average wage of employees in nonprivate units and the average wage of employees in private units. Most previous studies have only calculated the pension replacement rate level under the average wage of employees in nonprivate units, and the result is low. If the average wage of full-caliber employees is measured, the actual replacement rate level may not be very low. Therefore, when calculating the total and net pension replacement rate and total and net income replacement rate, this paper will calculate them by different wage caliber and use multiple indicators to more comprehensively measure and effectively evaluate the security level of the pension insurance system.

**3.2. Data.** The data of this paper comes from the six urban household survey data CHIPs (Chinese household income project survey) of China Income Distribution Research Group from 1988 to 2018. This survey spans the 30-year process from the establishment of the pension insurance system to the establishment and perfection of the system, which can better reflect the historical changes of the pension insurance security level of urban employees. CHIP1988 covers 10 provinces, cities, and autonomous regions in Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Henan, Hubei, Guangdong, Yunnan, and Gansu. It is the first micro sampling survey conducted in China using international standards and statistical methods. CHIP2018 removed Fujian and Xinjiang and added Inner Mongolia and Shandong, a total of 12 provinces, municipalities, and autonomous regions (municipalities directly under the central government). CHIP2007 further added Shanghai, Zhejiang, Fujian, and Hunan, a total of 16 provinces and autonomous regions (municipalities directly under the central government) on the basis of 2002. CHIP2013 removed Shanghai and Zhejiang provinces (municipalities directly under the central government) from the provinces in 2007 and added Xinjiang, a total of 15 provinces, municipalities, and autonomous regions (municipalities directly under the central government). CHIP2018 is based on 2013. In addition to

Fujian and Xinjiang, Inner Mongolia and Shandong are added, with a total of 15 provinces, municipalities, and autonomous regions (municipalities directly under the central government). Among them, the data covers 15 provinces, cities, and autonomous regions (municipalities directly under the central government) in Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Henan, Hubei, Guangdong, Yunnan, Gansu, Sichuan, Chongqing, Fujian, Inner Mongolia, and Shandong. The survey covers different cities and regions in the east, central, and western regions, including pensions, wages, and other income conditions of different caliber and different groups, so that the actual level of pension security can be measured in an all-round way.

Since the legal retirement age in China is 60 years for male employees, 50 years for female employees, and 55 years for female cadres, the pensions in the CHIPs data analyzed in this paper are mainly concentrated in the people who have reached the age of 50 and enjoy pension benefits. At the same time, the sample of urban employees with wage income and relatively stable jobs is mainly concentrated in men aged 16–59 years and women aged 16–54 years. Total wage income mainly refers to the broad wage income including basic wage, post wage, performance wage, and various allowances and subsidies.

Table 1 makes descriptive statistics of the data by using Stata software. Among them, the employees of nonprivate units include the employees of party and government organs, institutions, state-owned and holding enterprises, collective enterprises, and foreign-invested or joint ventures; in addition, the full-caliber employees also include those of private and individual enterprises but do not include the employees of land contractors and other units. It can be seen from the table that the pension and wage income of urban employees in China have increased significantly in the 30 years from 1988 to 2018. The average wage has increased by about 53–55 times, while the pension has increased by more than 30 times.

## 4. Results and Analysis

**4.1. Pension Security Level under Different Wage Caliber.** According to the annual pension, wage income, retirement income, and on-the-job employee income of CHIPs from

TABLE 1: Descriptive statistics of data (unit: yuan, sample size: piece).

Year	Variable	Mean	Median	Minimum	Maximum	Sample size
1988	Pension	1188	1090	36	4566	2131
	Wages (nonprivate)	1404	1298	126	21002	9134
	Wages (nonprivate + private)	1332	1198	126	21002	15418
	Wages (insured employee)	1403	1298	126	21002	9541
1995	Pension	4575	4093	100	21980	2562
	Wages (nonprivate)	6019	5476	100	55407	9199
	Wages (nonprivate + private)	5807	5252	100	55407	10952
	Wages (insured employee)	5937	5300	100	55407	9581
2002	Pension	8104	7000	100	64355	3228
	Wages (nonprivate)	12735	11435	120	144530	6518
	Wages (nonprivate + private)	11894	10422	100	144530	8461
	Wages (insured employee)	12522	11059	100	144530	7205
2007	Pension	14901	12989	100	75320	5568
	Wages (nonprivate)	24997	20075	282	271623	11526
	Wages (nonprivate + private)	23683	18900	200	271623	13235
	Wages (insured employee)	24640	19742	282	271623	12185
2013	Pension	22847	18754	120	126680	4555
	Wages (nonprivate)	49600	41904	240	800000	4243
	Wages (nonprivate + private)	44673	36313	198	1170000	7296
	Wages (insured employee)	48578	40000	240	1170000	5293
2018	Pension	37156	34786	150	211882	3961
	Wages (nonprivate)	77758	67283	156	1117000	4878
	Wages (nonprivate + private)	71039	57831	156	1117000	9046
	Wages (insured employee)	75544	62645	156	1117000	6334

Source: authors' calculations by using CHIPs data.

1988 to 2018, the “empirical” pension replacement rate and income replacement rate under different caliber are calculated, respectively. The results are shown in Table 2. First of all, the level of pension replacement rate showed a downward trend in the 25 years from 1988 to 2013. It only increased slightly from 2013 to 2018 but decreased by about 38 percentage points as a whole. Taking the total pension replacement rate of full-scale employees, insured employees, and nonprivate employees as an example, the decline of the three is the same in each year. For example, it decreased by 8–10 percentage points from 1988 to 1995, by 10–13 percentage points in 2002, by about 4 percentage points in 2007, and by about 13 percentage points in 2013 but rose slightly by about 2 percentage points until 2018. However, the total pension replacement rate in 2018 was below 53%, still far below the target replacement rate of 59.2%. It can be seen that, in recent years, China’s pension insurance policy reform has played a role in improving pension treatment and improving the pension security level, but there is still a gap from the expected goal.

The gradual decline of pension replacement rate is mainly because the average annual growth rate of wage is faster than that of pension, but the decline degree in different periods mainly depends on the gap between wage growth rate and pension growth rate in different periods. (The National Bureau of Statistics and the Ministry of Human Resources and Social Security focused on the wages of nonprivate units. Whether employed or on-the-job employees, the average annual growth rate of nominal nonprivate wages in China was about 18% from 1988 to 1995, 13% from 1995 to 2002, 15% from 2002 to 2007, 14% from

2007 to 2013, and 10% from 2013 to 2018. According to the adjustment mechanism on the basic pension of retirees issued by the Ministry of Human Resources and Social Security and the Ministry of Finance, the average annual growth rate of pension treatment was 10% from 2005 to 2015 and decreased to 6.5%–5% from 2016 to 2018. It can be seen that the more the wage growth rate was higher than the pension growth rate, the more the replacement rate decreased. In addition, inflation accelerates the growth rate of nominal wage, making the wage growth rate faster than the pension growth rate, which further leads to the decline of pension replacement rate.) According to CHIPs data, the specific growth rate of both can be seen in Figure 1. It can be seen that the average annual wage growth rate from 1988 to 2007 was about 2 percentage points higher than the average annual pension growth rate, while it was about 5 percentage points higher from 2007 to 2013, resulting in a gradual decline in the pension replacement rate from 1988 to 2007 and a bigger decline from 2007 to 2013. From 2013 to 2018, the average annual growth rate of wages was about 1 percentage point lower than that of pensions, which increased the pension replacement rate from 2013 to 2018. It can be seen that the more the wage growth is higher than the pension growth, the more the pension replacement rate decreases. When the wage growth is lower than the pension growth, the pension replacement rate will rise.

Secondly, from the perspective of income replacement rate, no matter what the caliber, it also showed a downward trend in the 25 years from 1988 to 2013, increased slightly in 2018, and still decreased by 30 percentage points as a whole. Taking the total income replacement rate of full-caliber

TABLE 2: Pension replacement rate and income replacement rate of urban employees in China.

	Caliber division	1988 (%)	1995 (%)	2002 (%)	2007 (%)	2013 (%)	2018 (%)
Total pension replacement rate	Nonprivate	84.62	76.01	63.64	59.61	46.06	47.77
	Nonprivate + private	89.19	78.78	68.14	62.92	51.14	52.29
	Insured employee	84.68	77.06	64.72	60.47	47.03	49.17
Net pension replacement rate	Nonprivate	84.62	76.72	69.33	68.04	48.56	52.39
	Nonprivate + private	89.19	79.54	74.08	71.45	53.76	56.20
	Insured employee	84.68	77.71	70.99	68.33	49.73	53.67
Total income replacement rate	Nonprivate	88.16	76.41	68.54	66.32	52.69	56.95
	Nonprivate + private	91.05	80.09	72.68	69.81	58.33	60.37
	Insured employee	88.72	77.26	69.38	67.17	53.16	58.09
Net income replacement rate	Nonprivate	88.16	77.00	78.98	74.80	55.35	61.55
	Nonprivate + private	91.05	80.67	83.93	78.35	61.01	64.42
	Insured employee	88.72	77.84	80.52	75.81	56.07	62.52

Source: authors' calculations by using CHIPS data.

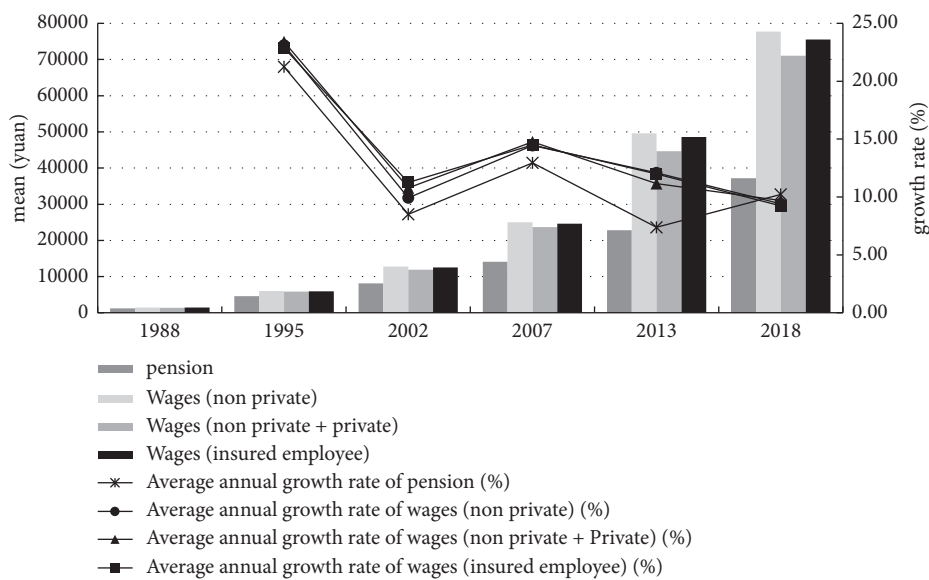


FIGURE 1: Average value and average annual growth rate of total pensions and total wages.

employees, insured employees, and employees in nonprivate units as an example, the replacement rate under the three calibers decreased by about 11 percentage points from 1988 to 1995, about 8 percentage points in 2002, about 3 percentage points in 2007, and nearly 13 percentage points in 2013 but rose slightly 2–4 percentage points in 2018.

At the same time, it is also found that the income replacement rate is always higher than the pension replacement rate, 1–9 percentage points higher, because retirement income also includes other incomes except pension income. In view of the situation that China's pension pillar is "dominated by one" and the development of the second and third pillar pension insurance is relatively lagging behind, in most years, the degree of income replacement rate higher than pension replacement rate is not high.

In addition, Table 2 also shows that the pension security level of nonprivate employees in each year is lower than that of insured employees, and that of insured employees is lower than that of full-caliber employees. This is because the average wage of employees in nonprivate units, including

organs and institutions, as well as state-owned and collective enterprises, is usually higher than that in private units, so that the average wage of full-caliber employees is lower than that in nonprivate units and higher than that in private units, so the replacement rate is naturally higher than that in nonprivate units. The average wage of insured employees is the product of the average wage of nonprivate employees and their own wage index. This index is the ratio of individual actual contribution wage to social average wage, which is generally greater than zero and less than one. Therefore, the average wage of insured employees is lower than that of nonprivate employees and higher than that of full-caliber employees, so the replacement rate is between the two.

Finally, it can be seen from Table 2 that the net replacement rate of pension also showed a downward trend from 1988 to 2013 and rebounded in 2018, but it still decreased by more than 30 percentage points as a whole. For example, the net replacement rate of full-caliber employees decreased from 89.19% in 1988 to 53.76% in 2013 and

increased to 56.20% in 2018. In addition, because the individual income tax and pension insurance system have not been implemented in 1988, the total and net replacement rates are the same. After that, the net replacement rate of pension is always higher than the total replacement rate, less than 1 percentage point higher in 1995 and 2–8 percentage points higher in 2002–2018. This is because employees need to pay social security contributions and personal income tax but do not need to pay after retirement, which makes the pension replacement rate higher when taking the net wage income as the measurement standard. It can be seen that taking into account the impact of social security contributions and individual income tax also plays an important role in measuring the pension level in China, which can more accurately measure the actual security level of employees.

*4.2. Pension Level among Different Social Groups.* In this paper, for different groups, the difference of pension security level calculated based on nonprivate and full-caliber wages is similar. Therefore, this paper selects the total social average wage income of full-caliber employees as the denominator to calculate the pension replacement rate of different socioeconomic groups, so as to measure the difference of pension security level between different groups.

*4.2.1. Different Income Levels.* Based on different income, the pension level varies greatly. In this paper, the pension income of retirees is divided into five groups and compared with the total average wage of employees from the lowest to the highest income group, which is relative level of pension, so as to calculate the pension security level under each income group. The results are shown in Figure 2. Obviously, the pension security level of different income groups increases with the increase of income groups. For example, in 2018, the pension replacement rates of the lowest to highest income groups were 14.34%, 38.27%, 49.49%, 63.60%, and 99.38%, respectively. Only the highest and second highest (fourth) income groups reached the target replacement rate of 59.2%. Among them, it is worth noting that the security level of the highest and lowest income groups decreased significantly from 2013 to 2018, while the security level of the second, third, and fourth income groups increased. It can be seen that the redistribution effect between different income groups occurs more in the transfer of the highest and lowest to the middle-income group.

From the perspective of different income groups, the security level of the middle-income group from 1988 to 2018 was 82.36%, 77.82%, 59.07%, 54.66%, 43.62%, and 49.49%, respectively, while that of the lowest income group remained at 14%–45%, about half of that of the middle-income group. The security level of the highest income group decreased from 147.15% in 1988 to 99.38% in 2018. The pension security level of the high-income group was 3–5 times that of the low-income group and twice that of the middle-income group. It can be seen that the pension treatment of high-income group is higher relative to the social average wage, and the pension security level is higher, while the pension of

low-income group is relatively low, which is difficult to ensure the basic living standard after retirement.

*4.2.2. Different Age Groups.* As the pension security level among different age groups of retirees is also quite different, this paper divides the groups aged 50 years and above with pension into one group every five years, compares them with the average wage of employees, and analyzes the difference of pension security level among different age groups, so as to evaluate the redistribution effect between generations. Figure 3 shows the pension level of retirees in different age groups relative to social average wage. Obviously, the security level of different age groups is obviously different, and the characteristics of different periods are also different. From the change trend in various years, the pension security level of retirees aged 60–64 years was the highest in 1988, aged 65–69 years in 1995, 70–74 in 2002, 75–79 in 2007, and above 79 in 2013 and 2018. It is obvious that the older the age is, the higher the security level is in 2013 and 2018. From 1988 to 2013, a gradual change trend was shown. It can be seen that the pension security level of people born in the 1930s has been at the highest level compared with other age groups, while that of those born in other ages was lower, which reflects that the design of pension insurance system has a significant intergenerational transfer effect.

*4.2.3. Gender Grouping.* Due to the different working years, wage level, and retirement age of males and females, their pension security levels are naturally different. This paper analyzes the pension security levels of different genders, and the results are shown in Figure 4. It is obvious that the pension security level of males is higher than that of females in all years. From the long-term trend from 1988 to 2018, the pension security levels of males and females were 103.98% and 76.43%, respectively, in 1988, with a difference of about 28 percentage points, and 78.73% and 59.54%, respectively, in 2002, with a difference of about 19 percentage points, but then began to shrink gradually. They were 57.68% and 46.38%, respectively, in 2013. Males were only about 12 percentage points higher than females, but the difference widened slightly in 2018, 60.23% and 46.34%, respectively, about 14 percentage points higher. Obviously, the pension replacement rate of males has reached the level of the target replacement rate, while that of females needs to be improved. Because the legal retirement age of males in China is 60 and those of female cadres and workers are 55 and 50, the late retirement age and long contribution years of males also make their pension treatment relatively high, so their pension security level will be higher than that of females.

*4.2.4. Nature of Different Units.* In China, before the insurance system reform in 2015, the pension insurance system of government organs and institutions implemented a two-track pension system with enterprise; that is, the staff of government organs and institutions do not need to pay, and the pension is paid according to a certain proportion of the last year's wage after retirement, which only involves the

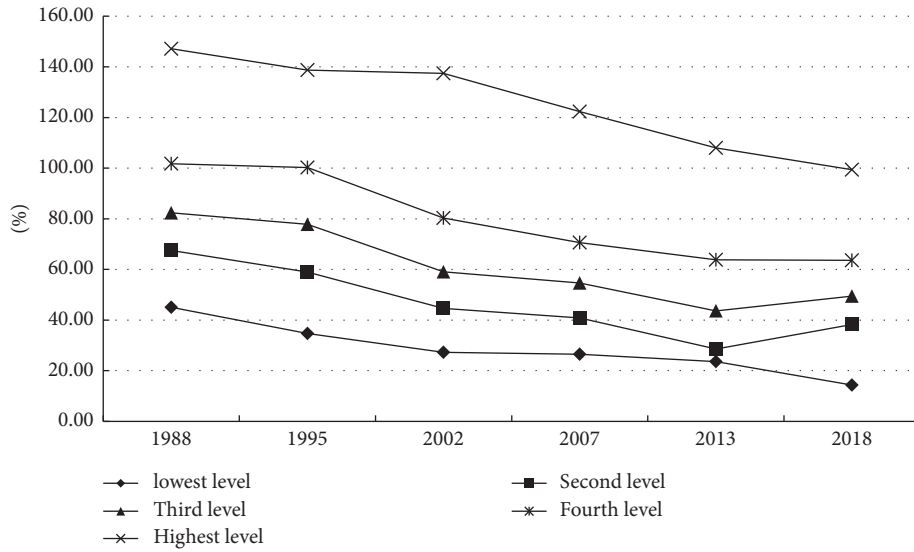


FIGURE 2: Pension security level of different income level.

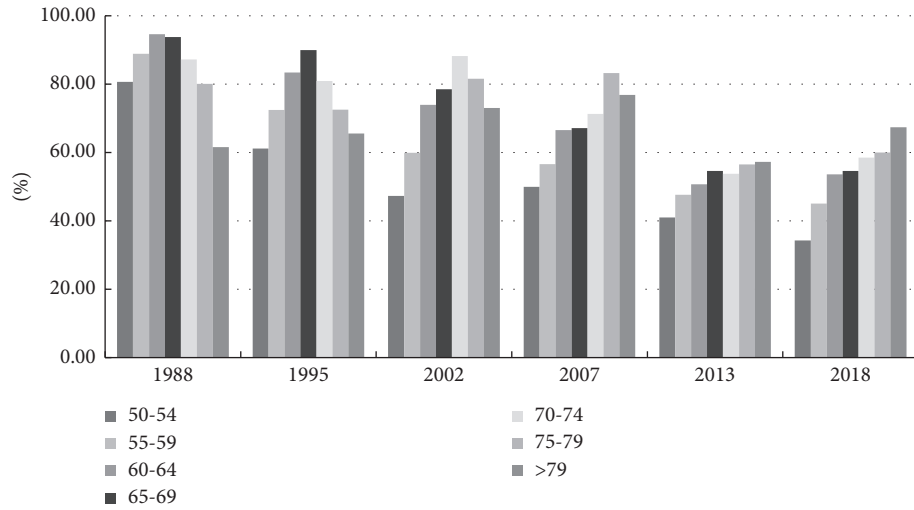


FIGURE 3: Pension security level of different age groups.

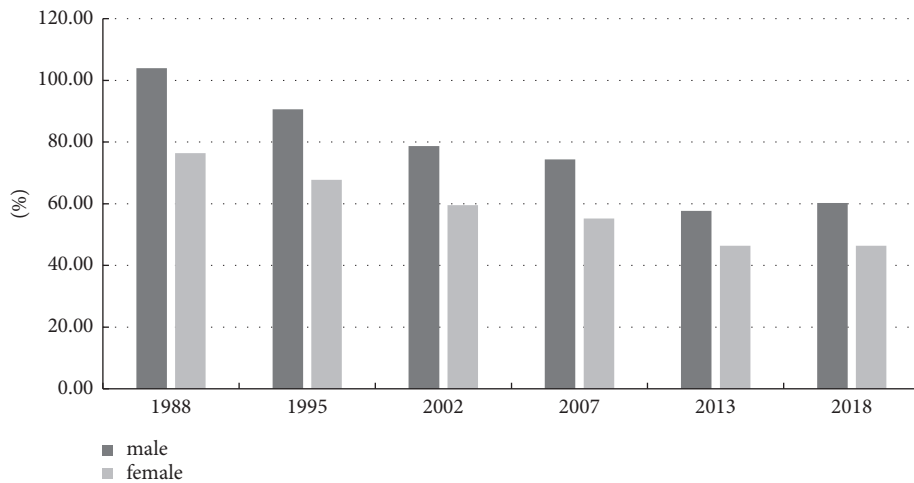


FIGURE 4: Pension security levels of males and females.



public account, while the enterprise employees need to pay jointly by enterprises and individuals. After retirement, they receive pensions according to a certain proportion of the contribution base, resulting in a great difference in pension treatment between the two groups. After the “system merger” in 2015, the two groups will implement the same contribution and payment methods. According to the six CHIPs data surveys from 1988 to 2018, a specific distinction survey was conducted in 1995, 2002, 2013, and 2018 on whether urban employees worked in enterprises or government institutions before retirement. Therefore, using this information, we can compare the differences of pension security levels between the two groups from 1995 to 2018.

For the retirees working in the enterprise before retirement, the pension replacement rate is the ratio of their pension income to the average wage income of the enterprise employees, and the pension relative level is the ratio of their pension income to the average wage of all employees, that is, the social average wage. Both of these can be used to measure the level of their pension security. Similarly, for those who work in organs and institutions before retirement, the ratio of their pension income to the average wage of employees working in organs and institutions is their pension replacement rate, while the ratio of their pension income to the average wage of all employees is their pension relative level. In this paper, the two indicators of enterprises and institutions are calculated, respectively, and the results are shown in Figure 5. For convenience, we use QPR and JPR to represent the pension replacement rate results of enterprises and institutions and QRR and JRR to represent the relative level results of enterprises and institutions.

As can be seen from Figure 5, the pension relative levels of government institutions and enterprises were 106.22% and 67.75%, respectively, in 1995 and 104.63% and 58.79%, respectively, in 2002. The pension relative levels of government institutions were about 38 and 47 percentage points higher than those of enterprises, respectively, in 1995 and 2002. The pension relative levels of government institutions and enterprises were 71.34% and 46.45%, respectively, in 2013. After the merger of pension system in 2015, they increased to 73.74% and 48.07%, respectively, in 2018. The pension relative level of government institutions was about 25 percentage points higher than that of enterprises in 2013 and 2018. Obviously, the gap between the two groups is gradually narrowing.

In terms of pension replacement rate, the results of government institutions and enterprises from 1995 to 2018 were 96.39% and 71.18%, 90.06% and 66.57%, 66.42% and 46.53%, and 64.22% and 50.87%, respectively. The pension replacement rate of government institutions was about 25 percentage points higher than that of enterprises in 1995 and 2002, while there were only about 20 and 13 percentage points in 2013 and 2018. It can be seen that the integration of pension system has indeed significantly reduced the gap in the pension level between organs, institutions, and enterprises.

In more than 20 years from 1995 to 2018, the relative level and replacement rate of pensions in government organs and institutions decreased by about 32 percentage points,

and those of employees in enterprises also decreased by about 20 percentage points. Among them, the pension relative level in government institutions is always higher than its own pension replacement rate, while the pension relative level in enterprises is always lower than its own pension replacement rate. In other words, the pension treatment of enterprise employees is lower relative to the social average wage and slightly higher relative to their own wage level, while the pension treatment of organs and institutions is just the opposite of that of enterprises. Obviously, whether measured by the replacement rate index or the relative level index, the pension security level of organs and institutions is always relatively high, which can ensure that their living standard will not decline after retirement, but that of enterprise employees is relatively low, far below the target replacement rate 59.2%, and cannot maintain half of own income before retirement.

*4.2.5. Different Education Level.* The education level of pensioners aged 50 years and above is divided into primary school and below, junior middle school, senior high school, technical secondary school, junior college, and university and above. Comparing the pension income of each group with the social average wage income, it is also found that the difference of pension security level is also reflected in different education levels.

As can be seen from Figure 6, from 1988 to 2018, the pension security level increased with the education level, and the pension level of technical secondary school and above education group was significantly higher than those of the other education groups. Specifically, in 1988, it increased from 76.80% in the primary school and below education group to 129.88% in the university and above education group, from 63.13% in the minimum education group to 114.45% in the maximum education group in 1995, from 53.80% to 111.39% in 2002, from 47.41% to 108.66% in 2007, and from 41.21% to 81.02% in 2013. In 2018, the pension level results under various education levels were 42.96%, 47.27%, 50.43%, 65.99%, 64.29%, and 84.06%, respectively.

It can be seen that the pension treatment of retirees with technical secondary school and above education level is more than 60%, which fully meets the level of the target replacement rate, and can ensure that the living standard after retirement is maintained at a high level, while the pension treatment of senior high school and below education level is low, at 50% and below, which is inadequate security level and pension treatment. This is because those with higher education level naturally have higher wage income and large contribution base. According to the contribution principle of “contribute more, get more,” after retirement, they also get relatively high pension treatment and higher security level.

## 5. Discussion

By means of comparison with the level of pension replacement rate in the world, which is used to evaluate the pension security level in China and make some discussions,

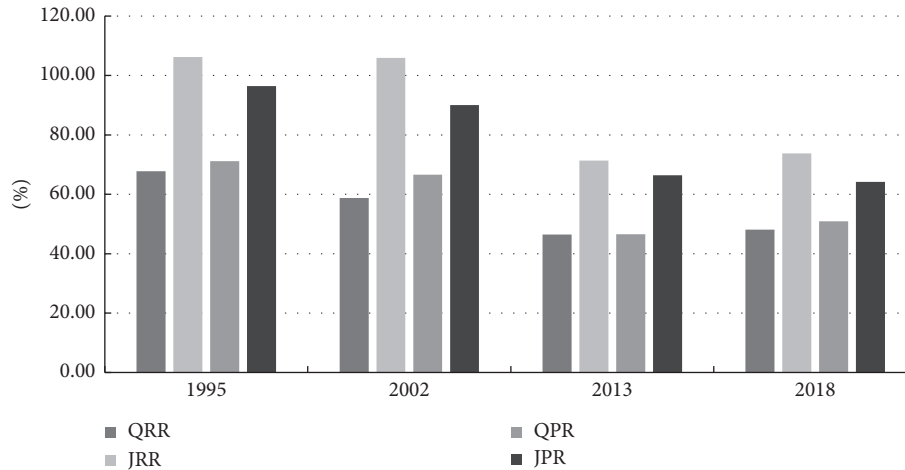


FIGURE 5: Pension security level of employees in enterprises, organs, and institutions.

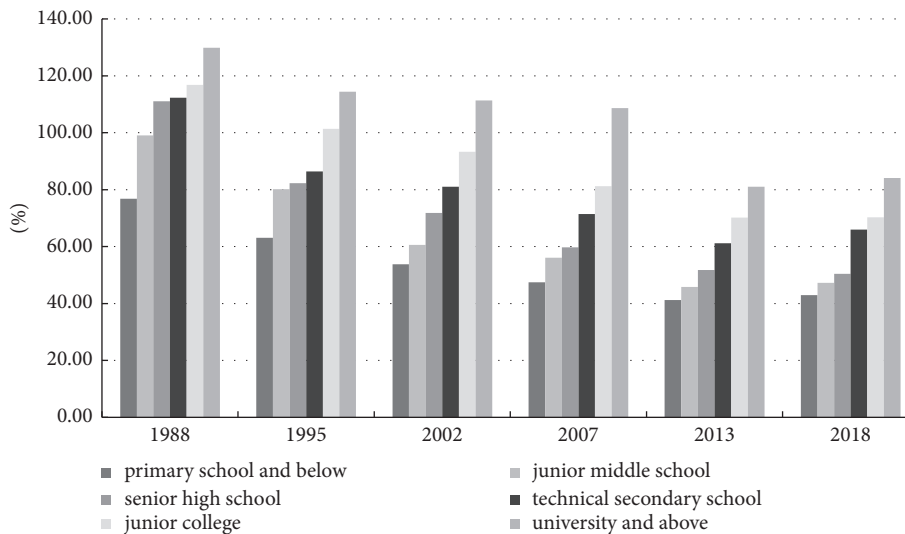


FIGURE 6: Pension security level under different education levels.

this paper collects the “empirical” replacement rate research consistent with the index caliber of this paper, that is, the results based on the full-caliber wage caliber. Because of the need for more detailed micro income data, there are not many new “empirical” results calculated with a full caliber in the world. For the pension replacement rate, the official website of the European Union will regularly update the relevant data every year. This paper collects the calculation results in 2018. Its caliber is the ratio of the median pension of retirees aged 65–74 years to the median wage of employees aged 50–59 years (Eurostat, 2019) [33]. For the income replacement rate, the paper collected the OECD calculation results in 2001. Its caliber is the ratio of the net average income of retirees aged 65–74 years to the net average income of employees aged 51–64 years (OECD, 2001) [34].

Similarly, for comparison and discussions, this paper uses the median pension of retirees aged 65–74 years and the median wage of employees aged 50–59 years in CHIPs data in 2018 to calculate the corresponding pension replacement rate and uses the net retirement income of retirees aged

65–74 years and the net average income of employees aged 51–64 years to calculate the corresponding income replacement rate, compared with international indicators, so as to better evaluate the pension security level in China.

Table 3 reports the international comparison of pension security levels under the two indicators of pension replacement rate and income replacement rate. From the perspective of pension replacement rate, China’s pension replacement rate is not low compared with most EU countries, reaching 69%, higher than the average level of the EU and higher than that of almost all developed countries. It can be seen that China’s basic pension insurance for urban employees has a relatively high security level and can meet the basic life level of retired elderly people.

However, from the perspective of income replacement rate, it is found that the retirement income replacement rate of nine OECD developed countries is at the level of 70%–90%, while that of China is relatively low, only 66%. It can be seen that although China has established a relatively mature pension insurance system, so the pension security

TABLE 3: Pension security levels in some countries (China and EU in 2018 and OECD in 2001).

European Union	Pension replacement rate (%)	European Union	Pension replacement rate (%)	OECD	Income replacement rate (%)
Italy	73	Netherlands	53	Canada	87
Spain	70	Romania	51	Germany	84
France	67	Belgium	50	Netherlands	81
Portugal	67	Czech republic	50	United States	80
Austria	62	Switzerland	50	Japan	80
Poland	60	Denmark	49	Italy	79
Hungary	59	Germany	46	Sweden	76
Norway	58	Lithuania	40	Finland	76
Sweden	56	Ireland	35	United Kingdom	74
United Kingdom	55	European Union (mean)	55	OECD (mean)	80
Finland	54	China	69	China	66

Source: the data of China (2018) are calculated by the author, using Stata measurement software according to CHIP 2018, and the data of EU are from Eurostat (2019); OECD (2001) data come from aging and income: financial resources and retirement in nine OECD countries.

level is not low, the pension pillar is relatively single, mainly relying on the basic pension insurance system of the first pillar, while the second and third pillars such as enterprise annuity and commercial pension insurance are not fully developed; that is, the development of different pillars is seriously unbalanced. As a result, the replacement rate of retirement income is relatively low. Therefore, we should speed up the construction of multipillar and multilevel pension system. On the premise of maintaining the continuous growth of the absolute pension value, we should appropriately reduce the replacement rate of basic pension and increase the replacement rate of other pillar pensions, so as to ensure that the basic living standard of retired elderly people will not continue to decline.

## 6. Conclusions and Policy Recommendations

**6.1. Conclusions.** Based on the data of six CHIPs household income surveys of urban households from 1988 to 2018, this paper calculates and analyzes the actual level of pension security for urban employees in China based on multiple indicators such as pension replacement rate and income replacement rate and measures them, respectively, according to different wage caliber, so as to more accurately measure and evaluate the actual level of pension security. The results show that the pension replacement rate under any caliber decreased from about 90% in 1988 to about 50% in 2018. The income replacement rate is higher than the pension replacement rate, but it also shows a downward trend, from about 90% in 1988 to about 60% in 2018. Moreover, based on the background of the comprehensive plan for reducing social insurance premium rate in 2019, in view of the wage income under different caliber, the replacement rate level under nonprivate caliber is always lower than that of insured employees, and that of insured employees is lower than that under full caliber. It can be seen that different measurement indicators and measurement caliber will have a crucial impact on the evaluation of the pension level. As a result, comprehensive plan for

reducing social insurance premium rate in 2019 will improve the replacement rate level of urban employees by adjusting wage caliber.

In addition, the pension security level under different income levels increases with the increase of income group. The pension security level in low-income group is low, while that in high-income group is high. The pension security level of different age groups showed a positive correlation with age in 2013 and 2018, indicating that pension insurance system played a redistribution effect of transferring from the younger generation to the older generation. The pension security level of males is 12–28 percentage points higher than that of females. The pension replacement rate of government organs and institutions is 13–25 percentage points higher than that of enterprises, and the pension relative level is 25–47 percentage points higher than that of enterprises. Both of them decreased by 18–30 percentage points in more than 20 years from 1995 to 2018. Compared with international empirical research, it is found that the pension replacement rate of urban employees in China is not low, but the income replacement rate is low.

**6.2. Policy Recommendations.** In view of the gradual decline of the replacement rate in the 30 years from 1988 to 2018, in order to ensure the pension security level of urban employees after retirement, the following suggestions are put forward: First of all, taking into account the factors such as the extension of China's per capita life expectancy, the deepening of population aging, the increase of education level, and the change of labor structure, we can gradually delay the legal retirement age based on the principles of small-step adjustment, flexible implementation, classified promotion, and overall consideration and improve the pension security level. Secondly, there are great differences in the security levels among different income groups; in particular, those in the high-income group are much higher than those in the low-income group. It can be seen that, in order to improve the pension security level in China, it is bound to improve and perfect the pension treatment

adjustment mechanism, improve the treatment level of low-income groups, and promote the social public basic pension to play a greater redistribution effect. The difference in the security level of different age groups is due to the discontinuity and ups and downs in the process of policy reform. Therefore, we should ensure the stability of future policies and carry out gradual reform, because a certain system guarantee is also an important measure and content to steadily improve the pension security level in China. Finally, in order to improve the income replacement rate, some measures should be taken to encourage the development of enterprise annuity and commercial pension insurance, such as preferential tax policies. At the same time, expand the coverage of the second and third pillars, improve the pension replacement rate of corresponding pillars, and make up for the insufficient level of retirement income security caused by relying only on the basic pension of the first pillar, actively improving the pension security level of urban workers in China.

## 7. Limitations and Further Research

**7.1. Limitations.** On the one hand, the calculation of pension replacement rate is not comprehensive enough. Based on the six CHIPs micro data from 1988 to 2018, this paper calculates and analyzes the “empirical” pension replacement rate and better reflects the historical changes of the actual pension security level of China’s urban employees in recent three decades. However, because there are no long-term micro tracking survey data, we can only use the wages of on-the-job employees and the pensions of retirees in the same year to calculate the overall average pension replacement rate in the current period, that is, the horizontal pension replacement rate, but cannot calculate the vertical pension replacement rate for the individual life cycle based on the income difference before and after retirement. On the other hand, it is difficult to accurately unify the income caliber. Due to historical changes, the income caliber of CHIPs data is slightly different in the annual survey. For example, the severance pay was a transfer income in 2002 and 2007, but it was a part of wage income in 2013 and 2018. In addition, due to the different classification of income such as housing provident fund, reimbursement of medical expenses, and estimated rent of self-owned housing, or the lack of data, it is difficult to analyze specifically, which makes the calculation accuracy of replacement rate biased.

**7.2. Further Research.** The further research of this paper can start from the following aspects: First, in the future, we can calculate the vertical pension replacement rate based on individual own wage income and pension income before and after retirement by creating long-term micro tracking survey data, so as to evaluate the security level difference across the whole life cycle of individuals from work to retirement. There is also further research under the new policy background. Since China has established different basic pension insurance systems for different groups and the periods for the establishment and reform of different systems are

different, the existing literature has conducted relatively rich research on the security level of basic pension insurance for urban enterprise employees in China. However, due to the short implementation time of urban and rural residents’ pension insurance and the newly reformed pension insurance system for organs and institutions, there is relatively little further research on these systems. More in-depth research is needed to deal with the increasing population aging and downward economic pressure under the new policy background and international situation, so as to provide theoretical basis and policy suggestions for the government’s institutional reform.

## Data Availability

CHIPs data come from China Income Distribution Research Institute. The official website of China Income Distribution Research Institute has a large number of relevant research literature on these data.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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