COMPONENT ONE

Redistributive Effects
of Pension Reform
in China

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Redistributive effects of pension reform in China

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1. Introduction

Since the beginning of the new century, China has been in the era of rapid population aging. The trend of population aging is becoming a more serious problem now. The Sixth National Census data show that in 2010 China's population over the age of 60 accounted for 13.23% of the total population, while the aged 65 accounted for 8.92%. Over the past 20 years, China's aging process has exceeded. As shown in Figure 1, the proportion of the 65-year-old population in the country reached from 6.5% to 10.5% during the period 1996 to 2015, rising by 4 percentage points and the elderly dependency rose from 9.5% to 14.3%, rising nearly by 5 percentage points. The aging acceleration has brought great pressure to the economic and social development. With China entering an aging society, the total number of new laborers is declining, and the labor force advantage is weakened, and the population dividend is disappearing. On the other hand, the aging process means that the income of the residents is shifting more to the pension income from labor income, and at the same time it means that the pension system is facing unprecedented pressure and may cause intergenerational inequality in income distribution. The empirical results of micro data analysis have found that aging is an important factor leading to income inequality (Zhong, 2011; Qu Zhaopeng and Zhao Zhong, 2008; Liu Jindong et al., 2014). In this context, it is important to investigate the impacts of the pension system and its reform on the income distribution in China.

Figure1- Share and dependency of elderly population
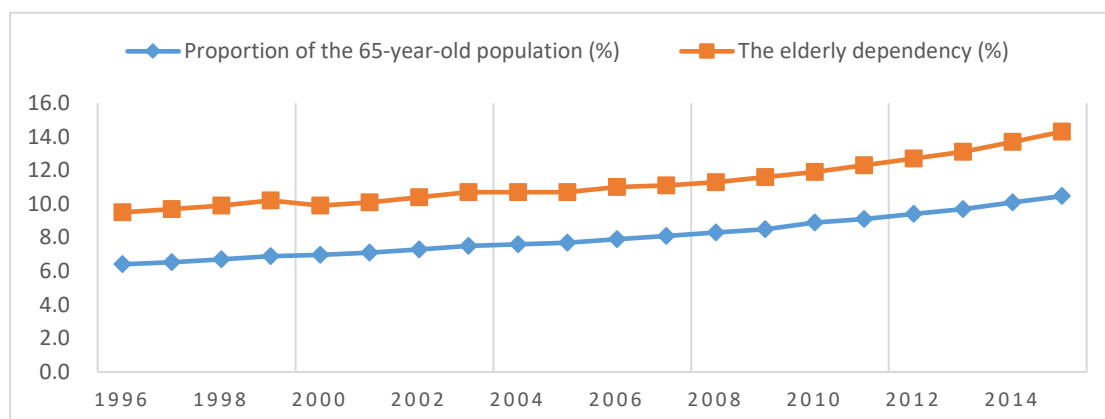
Sources: Authors computation based on the data from China Statistical Yearbook 2015

China's pension system has run for nearly two decades, and its coverage continues to expand. So far, the system has covered both the urban and rural population. The latest data show that in 2016, the national basic pension insurance received revenue of 379.99 billion yuan, increased by 18% over 2015, while the pension expenditure was 3,400.4 billion yuan, increased by 21.8%. At the end of 2016, the number of people participating in basic pension insurance was 887.77 million, an increase of 29.43 million over 2015 (see Figure 2). Among them, the number of urban workers is 379.3 million people, the number of migrant workers 59.4 million, and urban and rural residents 508.47 million.

However, the current pension system has differentiated institutional arrangements for formal urban workers, unemployed persons, and other urban workers, as well as rural laborers, which may result in redistribution of income among different types of insured people. In addition, even for the same group, such as urban employees, due to difference in insured income, insured time and survival life, there would be income redistribution effect. So, what is the effect on the income distribution of the current pension system in China? Whether does it really play a role in narrowing the income gap between the rich and the poor? These questions are worthy of further study.

Figure 2 Participants of pension insurance in China
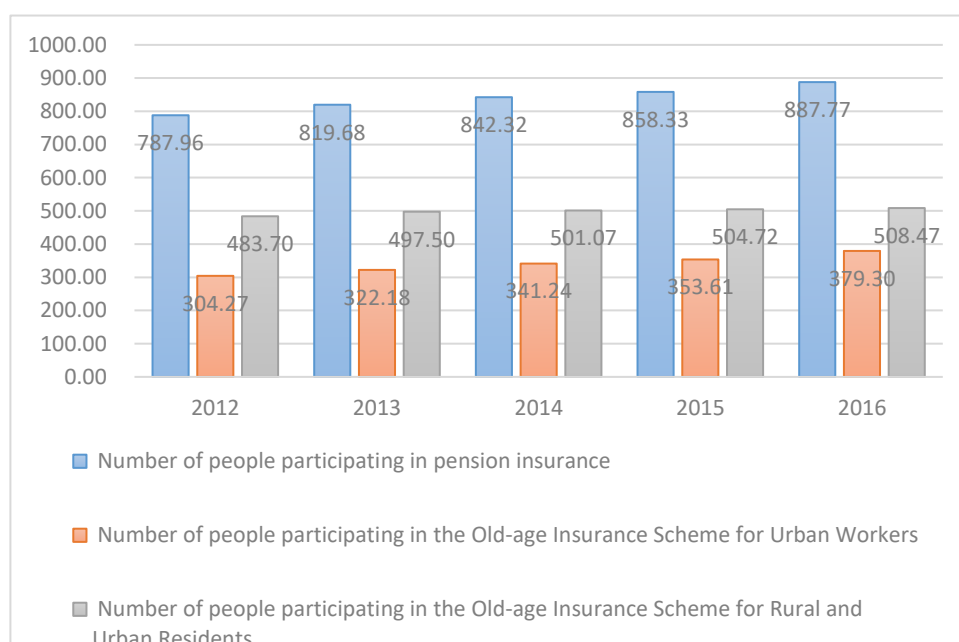
Sources: Statistic Bulletin of Human Resources and Social Security, various years.

The pension system is believed to have an important function of income redistribution in economic literature and its role has been studied intensively. The system, as the core of the social security system, provides the income guarantee for the retirees. To what extent the system can adjust income distribution depends mainly on the two linkages: First, the pension insurance contribution, as a "quasi-tax", whether it has a progressive nature. If the contribution of high-income population as a share of their income is higher than the low income group, then it is progressive, and thus has the role of narrowing the income gap. Second, whether pension income is equally distributed among pensioners, that is, equal distribution of pension income or not will have different effects on income distribution.

Considering China's economic characteristics, the so-called "income distribution effect of the pension system" can be viewed from three levels, the first is its effect on the distribution of income among retirees; the second is that it is between urban residents The third is its impact on the national income distribution. This report analyzes the income redistributive effects of the pension system and its reform from these three perspectives.

Using the data of China household income survey (CHIP), collected by China Income

Distribution Institute in Beijing Normal University in 2013, this paper estimates the redistributive effect of the pension system and discusses the changes of redistributive effect under different schemes. In the specific analysis, taking into account the implementation of our pension system is paid pay (pas-as-you-go) and fund accumulation (Funded) combination of financing, we also examined the old age insurance Crowd and the elderly population, and compare the different effects of the pension system on the different age groups, and provide the empirical basis for perfecting the social security system and formulating the redistribution policy.

This paper is structured as follows. The second section briefly introduces the pension system reform in China. The third section analyzes the income redistribution effect of the system, and estimates the redistribution effect of the system by age groups. The fourth section estimates the distributive effect for urban areas, and carries on the simulation analysis for the different reform plans. The fifth section examines the redistribution effect of the system in rural areas. The last section provides conclusions and policy recommendations.

2. The reform of pension system and its redistributive effects

2.1. The redistributive effects of the pension system

In China, the pension system combines social pooling and individual accounts, that is, combines the advantage of the pay-as-you-go and the funded system, however, the redistributive effects of these two systems are totally different.

The major function of the pay-as-you-go(PAYGO) system can be summarized as follows (Casamatta et al, 2000; Tabellini, 2000): First, the PAYGO arrangement can achieve the target of intergenerational transfer via social pooling, that is, the pension insurance paid by the young is shifting to the elderly in the form of pension benefits. In general, the pension contribution is based on their wage level, while the pension benefit is related to government subsidies going into individual accounts, as well as basic pension income based on the composition of the pension. As a result, the pension insurance fund in their individual accounts in present values may not equal to the old-age pension benefits they received. If the net pension benefit is positive, it indicates

that the PAYGO system has the function of redistribution of income. Secondly, the PAYGO system also has a significant effect on income redistribution within generations, which depends on the contribution rate and the computation of pension benefits. Considering that both the contribution rate and the computation of benefits were earnings-related, then the pension arrangement in China has no redistributive effect. However, in China the contribution rate is wage-related while the pension benefit is related to the average earning level of the society, then it plays a role in redistributing income; Thirdly, the PAYGO system has a function of gender redistribution. In urban China, both the pension benefit and contribution have a certain progressive role, namely, the higher wage is, the higher contribution, and higher pension benefits as well. Usually, the retirement age is 60 for men and 55 for women. For most women, they earn lower wage, have higher unemployment rate, and reach younger retirement age, then the retirement benefits they receive may be lower than men (Zhu, 2009). Last but not least, it has an indirect effect of redistribution among people with different life expectancy.

Unlike the PAGO system, the funded system does not have a function of redistribution of income. The individual accounts are funded solely by employee contributions of his or her wages and payable at retirement as a lump sum, that is, it is kind of "mandatory pension savings", so it has no redistributive effect.

In China, the first old-age pension program was established in the early 1950, soon after the founding of the People's Republic of China. Like the different economic and social policies for urban and rural areas implemented by the government, there is also huge disparities between urban and rural households in terms of the pension system. Meanwhile, the fragmentation of the pension system still exists, namely, the pension system implements different systems for people with different employment status or Hukou status. Consequently, it leads to huge differences in pension benefits enjoyed by various social groups, for instance, rural residents, urban non-employed residents, and urban employees, which results in the stratification of social welfare.

Currently, the pension system consists of three main parts, which almost achieves full coverage: The pension system for Urban Workers, the Pension system for Rural and Urban Residents, and the new type of Pension system for rural residents. All the three schemes of pension system combine the PAYGO arrangement and the funded system, and they all have significant effect on income redistribution. However, since they are

different in terms of the coverage, contribution rate, as well as the pension benefits, their redistribution effect should also be different.

2.2. Relevant studies on the redistributive effect of the pension system in China

In general, the young labor force contributes to pension system while the elderly enjoys pension benefits. So the pension system has a function of redistribution of income in the entire life cycle of individuals. Meanwhile, the pension system also plays a vital role in the redistribution of income within families, especially in the unexpected accelerated aging process, and this role is becoming more and more important.

The original intention of the pension system is to help the elderly get out of poverty, however, resent studies regarding the redistributive effect of the pension system shows controversial results. Using micro data, lots of studies investigate the effect of the pension system and estimate its effect on income redistribution (Boskin，1987；Jeffrey，2011；Don 2005). As for China, on the one hand, some studies have noted that the pension can help to narrow the income gap(Wang and Kang， 2009；Yang and Wang，2007；Ren and Jin， 2007). On the other hand, other researches argued that the pension system lead to a reverse income redistribution, that is, it expands the income gap between low-income and high-income group (Wang and Fan，2005；He，2007；Li et al.，2013). Recently, Li et al. (2013) also find that there is an increasing difference in pension benefits among retirees, which leads to an increasing income inequality within cities.

Using the household survey data collected by the China Institute for Income Distribution, this paper mainly evaluates the redistributive effect of the pension system in China, and discusses the redistributive effects under different schemes as well.

3. Redistributive effects of the pension system in China

In this chapter, based on micro-individual data, first we discuss the redistributive effect of the pension system in china, and then analyze the effect of the pension system on income redistribution on different income and age groups, respectively.

3.1. Methodology

Generally, there are three main methods to investigate the redistributive effect of the pension system: First, using the Overlapping Generation Model to estimate the redistributive effect between generations. Previous research results point out that although facing lots of challenges, the PAYGO system is still the best option for a long period of time (Feng,2004); Second, recently some studies employ the Insurance Actuarial Model to evaluate the net pension benefit and the redistribution effect in the entire life. Although this model can directly estimate the direction and extent of the redistributive effect, it cannot predict the population structure, price, return on investment in the future precisely. Thus, there is no consistent conclusion (Peng and Shen, 2007); Third, when estimating the redistributive effect of an income redistribution policy, another method is to evaluate the difference between the Gini of market income and the Gini of disposable income after the system (Fritzell, 2000; Bradley et al . 2003; Ferrarini and Nelson, 2003). In this report, we also use this method to analyze the income redistribution of the pension system.

We mainly focus on the changes in the income distribution before and after the pension system implemented. Here, the market income, is individual or household income before the implementation of the pension system, which includes wages, business income, property income and other kind of income. The redistributed income here, refers to income excludes the redistribution income from the pension system. The specification is as follows:

Redistributed income ＝Market income-pension insurance contribution + pension income (1)

The main purpose of this report is to estimate the redistribution effect of the pension system. Thus we use the Gini coefficient to measure the income gap, and the difference between the Gini of market income and redistributed income can be seen as the redistributive effect of the pension system.

$$M = G - G' \quad (2)$$

Hence, if M is positive, it indicates that the pension system helps to reduce income

inequality, whereas if M is negative, it shows that the pension system expands income inequality.

3.2. Redistributive effects of the pension system in China

The data employed for this report comes from the China Household Income Project conducted by the China Institute of Income Distribution, with the reference year of 2013 (CHIP 2013). The households surveyed were drawn from the sampling framework of the regular household survey annually conducted by the National Bureau of Statistics of China (Luo and Li, 2016). The field survey includes detailed information about the demographic characteristics, the household structure and employment, while the information about items of income and expenditure is provided directly from the NBS's regular survey. The survey covers 12 provinces and 2 province-level municipalities in China, which contain around 10000 rural households, 8000 urban households and 760 migrant households.

The focus of this report is to estimate the redistributive effect of the pension system. Thus we restrict ourselves on individuals who are workers or retirees and over 15 years old, also we exclude students and house-workers who are out of the labor market. Meanwhile, we only keep individuals with positive market income, and disposable income as well. After cleaning outlier on the individual data, the final size of the sample is 14,968 urban individuals, 26,595 rural individuals and 1,278 migrants.

According to the formula (2), we estimate the market income inequality, and then the effect of the pension system, as shown in Table 1.

First, with the function of the pension system, the average income per capita in 2013 increased from 23428 yuan to 26,480 yuan. That is, the income level improved after the implement of pension insurance and pension benefit. The Gini coefficient of market income is about 0.556 in 2013, while the redistributed-income inequality measured by the Gini coefficient is 0.501. In other words, after the redistributive effect of the pension system, the Gini coefficient fell down by 10%.

Second, Table 2 also shows that the redistributive effect of the pension system is more obvious in urban areas. After the pension system implementation, the redistributed

income increases by 20 percentage points, and the Gini coefficient of income inequality fell 20%. By contrast, in rural areas, the effect of redistribution of the pension system is much smaller, which just makes the Gini coefficient of income gap of rural residents fell from 0.528 to 0.517. Although China has made significant progress in the development of the new pension system for rural residents, the pension system development in rural areas is still lagging behind. According to the statistical results, it is clear that pension income only accounts for 5% in redistributed income in rural areas, while the proportion reaches as high as 21% for urban residents. Especially for the elderly (who are over 60 years old), pension income accounts for 68% in redistributed income in urban areas, while only 18% for rural residents. Therefore, the role of income redistribution that the pension system play is very limited in rural areas.

In addition, the Gini coefficient of rural migrants gap in the market in 2013 is 0.4167, after the pension system, the Gini coefficient of redistributed income gap decreased to 0.4080. That is, the income redistribution effect of the pension system brings is very limited for migrant workers, only making the Gini coefficient of income gap fell 2%. Also, since pension benefits only accounts for a small proportion of disposable income, the pension project can help to narrow the income gap, but the effect is limited.

Table 1：Redistributive effects of the pension system in China

	Market income		Disposable income		
	Mean value(Yuan)	Gini	Mean value(Yuan)	Gini	Change in Gini（%）
All Samples	23428	0.5563	26480	0.5007	-9.99
Rural Residents	12743	0.5283	13048	0.5172	-2.10
Urban Residents	31266	0.5229	37539	0.4054	-22.47

Table 2 further presents the results of redistributive effects of pension insurance and benefits contributions. In general, it is quite clear that both pension insurance and pension income has a role in narrowing the income gap, but the size of the effects is different from one to another. The role of pension insurance is very limited, making the Gini coefficient of the market income decreased only 1.29%. By contrast, pension income has a more obvious redistributive effect, which makes the market income gap

narrowed by nearly 11%.

Among the pension benefits, pension of the urban retirees has a largest redistribution effect, making the Gini coefficient of market income gap decreased by nearly 10%. Urban elderly subsidy also helps to narrow the income gap, which makes the Gini coefficient of the market income gap to fall 2.2%. Both rural elderly subsidy and other subsidy have positive effect on income redistribution, resulting in decline the Gini coefficient of income inequality by 1.7% and 1.4%, respectively. In other words, the new Pension system for rural residents has a positive effect on reducing inequality, and alleviating poverty as well.

Table 2：Redistributive effects of the pension insurance and benefit

	Mean value(Yuan)	Gini	Change in Gini	Change in Gini （%）
Primary income	23428	0.5633		
- contribution payment	22805	0.5560	-0.0073	-1.29
+ Pension income	27103	0.5006	-0.0627	-11.12
+Pension of retirees	26776	0.5082	-0.0551	-9.78
+ pension of urban residents	23661	0.5509	-0.0124	-2.20
+ pension of rural residents	23497	0.5539	-0.0094	-1.67
+ other pension income	23452	0.5554	-0.0079	-1.40
Redistributed income	26480	0.5007	-0.0626	

3.3. Different redistributive effects of the pension system on working age population and the elderly

The results above present the positive income redistribution effect of the pension system in China. As is well known, the pension system is based on the pay-as-you-go (PAYGO) principle, and the objective of the government is to transfer pension insurance from the working age population to the elderly, in the form of pension benefits. In this section, we intend to compare different redistribution effects of the pension system on working age population and the elderly. Hence, on the basis of the normal definition, working age population is male adults aged 16~59 years and female adults aged between 16 to 54. While the elderly refers to male who are over 60 years old and female who are above the age of 55.

The table below shows the comparison of the different redistributive effects of the pension system. In general, the pension system can reduce income inequality for both working age population, as well as the elderly, in both urban and rural areas. However, the size of the effect is different among different groups. It is not surprising that the redistribution effect of the pension system is higher for the elderly, who benefits more from the system currently. After the pension system, the Gini coefficient of the market income of the elderly experiences a decreases by 43% in urban areas, while just 4% for its counterpart, i.e., the elderly in rural China. By contrast, the redistributive effect is much smaller for the working age population, which only makes the market income gap narrowed by nearly 4% and 1%, for adults in urban and rural areas, respectively.

Table 3 Redistributive effects of the pension system on working age population and the elderly，2013

	Gini index of the primary income	Gini index of the redistributed income	Chang in Gini
Working age population in urban China	0.4369	0.4175	-0.0194
The elderly in urban China	0.6192	0.3556	-0.2636
Working age population in rural China	0.5087	0.5084	-0.0003
The elderly in rural China	0.5348	0.5160	-0.0188

3.4. The redistributive effects of the pension system on different income and age groups

Meanwhile, the government implemented different pension insurance system to different groups of people on the basis of their enterprises, namely, the fragmentation of the pension system still exists, and both the pension insurance and benefits of different groups of people have a huge difference. Thus, we further investigate the redistributive effects of the pension insurance system on different income groups and age groups.

First, Figure 3 presents the results of redistributive effects on different income groups. All the sample is divided into ten income deciles based on their market income, and the figure show the income redistribution before and after the pension insurance system. In the figure, the horizontal axis refers to the tenth income deciles, and the vertical axis is the ratio of the average market income and disposable income for each income decile with respect to the average income. As shown in Figure 3, the income level of high

income individuals, those who are in the eighth, ninth and tenth income decile, is much higher than the average. By contrast, for individuals from the lowest to seveth income decile, their income is below the average. Even after the redistributive effect of the pension system, the share of redistributed income only accounts for 28% in the average income. It is clear that the pension system has a larger redistributive effect on low-income groups, while lower effect on high-income groups. Specifically, the pension system benefits mainly low income individuals, showing that the redistributed income increased after the policy while the growth rate of redistributed income decreases along with the deciles. On the other hand, redistributed income of high income groups declines after the pension insurance system and the decline is very small. That is to say, the impact of the old-age pension system on income distribution is quite considerable, but the income redistribution is not achieved among different income groups.

Figure 3：The redistributive effects on different income groups
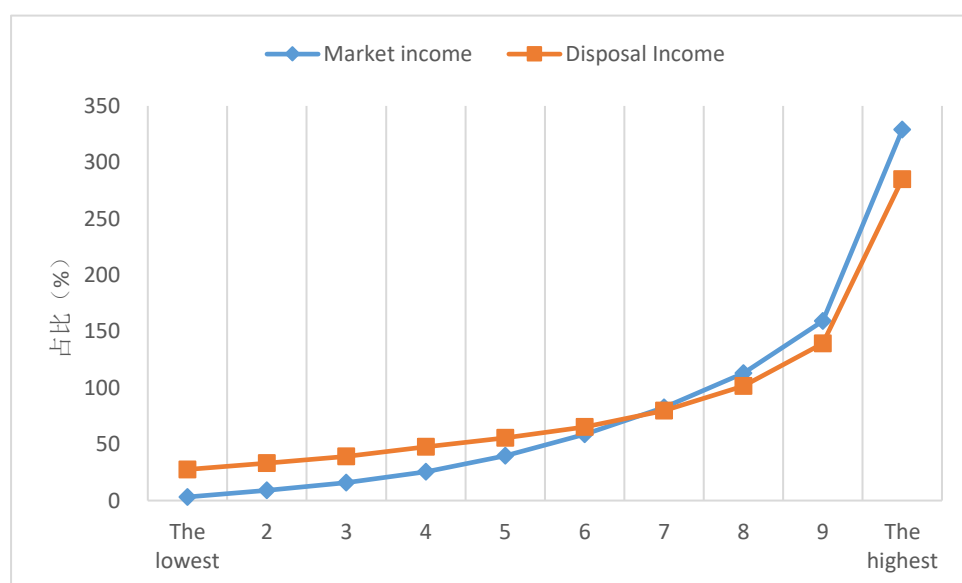
Second, China's aging process shows that China has undoubtedly become an aging society, then we further investigate whether the pension system has improved the income distribution between generations. Figure 4 shows the difference between market income and redistributed income of difference age groups. It can be seen that the pension system significantly improved the income of the elderly. That is, after the redistributive effect of pension income[1], the income level of those over the age of 50

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[1] In urban areas, the retirement age for women is 50 or 55, while for men 55 or 60.

significantly increases, whereas after the pension insurance payment, the income level of those under 50 years old decreases. For instance, through the redistribution effect of the pension system, the income level of those between 60~64 increased by nearly 105 percentage points, and the income level of those between the age of 65~69 increased by around 196 percentage points, and those over 70 increased by 277 percentage points. In other words, the pension system achieves the target of intergenerational transfer.

Figure 4： The redistributive effects on different age groups
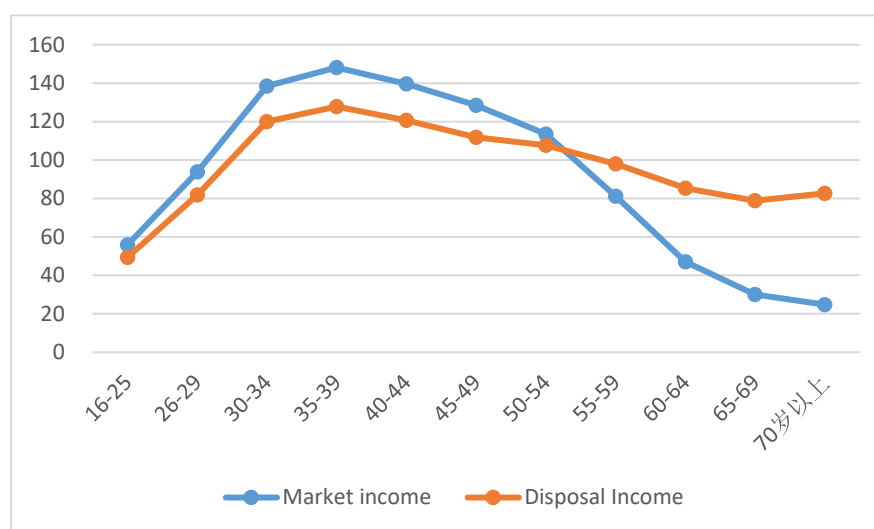
As the main component of the income of the elderly, the redistributed income level improved significantly. We then estimate the redistributive effect of the pension system and Figure 5 shows the differences in the Gini coefficient of market and redistributed income of different age groups. Generally, the pension system helps to narrow the income gap of each age group, but the size of the effects is different from one age group to another. The pension system has a more obvious redistribution effect on those over the age of 50, which makes the market income gap narrowed by nearly 14%. This result further shows that the pension insurance system has a positive impact on narrowing the income gap, through transfer the pension insurance paid by the young to the elderly in the form of pension benefits.

Figure 5： **The redistributive effects（Gini Index）**
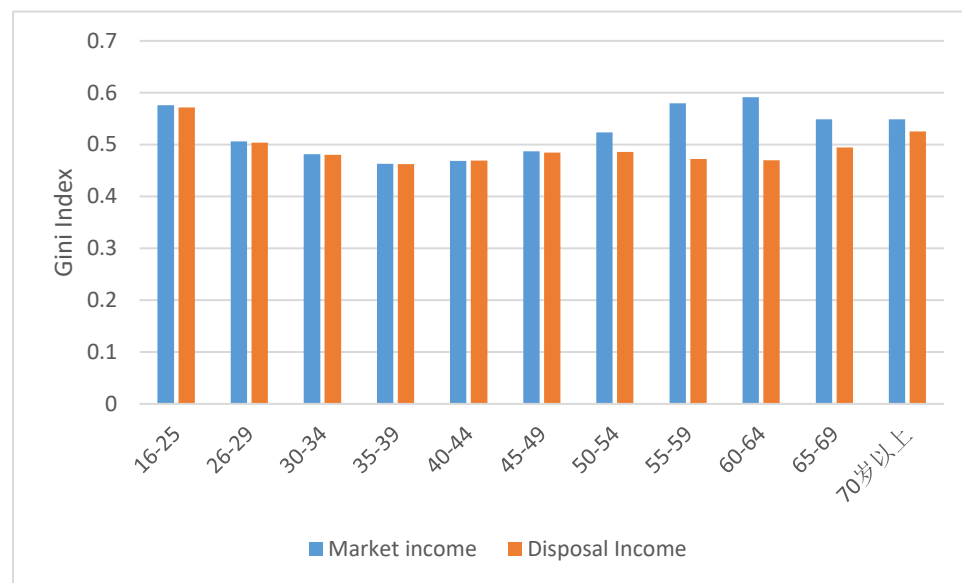
4. Income distribution effect of urban pension system in China

4.1. Impact of the pension system on urban income inequality

The results above show that, from the national point of view, after the impact of the pension system, the income gap decreased by 10%. The impact is greater in urban areas than that in rural areas. This is mainly due to the difference of current urban pension system from rural one. In this regard, we need to examine separately the impact of pension system on the redistribution of income within urban and rural areas.

Table 4 shows the changes in the Gini coefficient of urban redistribution of income under the current pension system. It can be seen from the estimation results that with the pension system, the Gini coefficient of urban residents' income gap dropped from 0.5229 to 0.4054 in 2013, down by 22.47%. In other words, in general, urban pension system has a positive redistribution effect, that is, to narrow the income gap, and its redistributive role is quite obvious. Our further study shows that first of all, the distributive effect of pension insurance contributions alone is very small, and has disequalising role. That means the pension insurance in urban areas has a certain degree of regressiveness. Secondly, the pension system has played a significant role in narrowing the income gap, making the income gap narrowed significantly. Among

them, as a major economic source of urban retirees, pension income makes an adjustment in income distribution, reducing the Gini coefficient decreased by about 21%. In contrast, the income redistribution effect of urban residents' pension income is relatively limited, which makes the Gini coefficient of income gap decrease by less than 2%.

Table 4   Redistributive effect of urban pension system, 2013

	Mean	Gini	Change in Gini	Change in Gini (%)
Primary income	31266	0.5229		
- contribution payment	**30244**	**0.5245**	**0.0016**	**0.30**
+ Pension income	**38562**	**0.4038**	**-0.1191**	**-22.77**
+Pension of retirees	38052	0.4143	-0.1086	-20.76
+ pension of urban residents	31719	0.5129	-0.0100	-1.91
+ pension of rural residents	31295	0.5222	-0.0007	-0.13
+ other pension income	31294	0.5220	-0.0009	-0.16
Redistributed income	37539	0.4054		

Source: Authors' computation using CHIP2013 Data.

4.2. Effect on vertical inequality of the pension system

China is in the stage of fast population aging, the elderly population is growing rapidly, and the pension gap among elderly will become widening. In rural areas, farmers participate in the new pension scheme, after reaching a certain age can receive pension income. Pension income consists of government subsidies going into individual accounts and basic pension income based on the composition of the pension. Local governments can raise the basic pension standard according to the actual situation, but the pension income of the elderly in different provinces is not very different. As a result, the pension gap between the elderly in the rural areas is not large. However, in urban areas, under the current system, pension income is made up of retirement pension and post-retirement pension growth. Among them, the pension income at the time of retirement is based on the pre-retirement wages, length of service and other factors, coupled with the institutional arrangements. For the post-retirement pension growth, personal characteristics are no longer a decisive role. This raises the question of the inequality in the distribution of pension funds in urban areas. Is the pension income

equally distributed in urban China? What are the inequalities in the distribution of pension income among the elderly, especially retirees? We will present the analysis results in this section.

We first look at the inequality in the distribution of pension income in urban areas. Because the Chinese legal retirement age is 60 years old for male workers and over 50 years old for female workers. But taking into account the problem of early retirement, the focus of this analysis is mainly on individuals aged 50 and over in 2013. A total of 3369 samples were obtained with pension income.

In the setting of pensioners for urban workers, the retirement pension standard varies according to individual's job characteristics, but the growth of the pension is independent of the individual's characteristics. The data show the pension income for retirees in each age group Figure 6. As the age increases, the pension of retirees is on the rise. At the age of 90, the pension the highest level.

Figure 6 Pension income of age groups in urban China, 2013
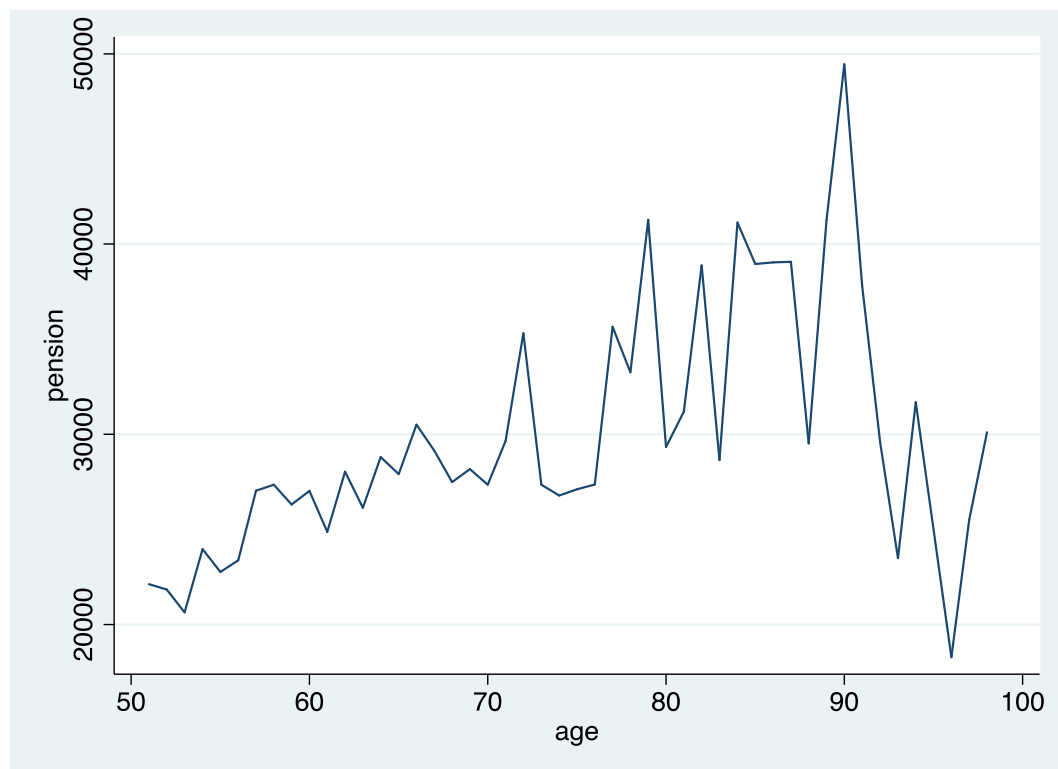
In addition, according to their initial income from low to high the retirees are divided

into deciles, Table 5 gives the average income of retirees in each decile and its relative share. It is not difficult to see that the distribution of pensions in urban areas is unequal, that is, pensions are tilted to a small number of rich groups, while relatively less affluent pensions are relatively lower. On the one hand, the low income group has a lower relative share of income. For example, the relative income share of the lowest income group is only 1.5%. On the contrary, the share of pensions received by the highest income group is as high as 23% of the total pension. The results show clearly that the distribution of pensions is not equal in urban China.

Table 5 Pension income in decile groups in urban China, 2013

	Average pension (yuan)	Share（%）
Decile		
1 (lowest)	3972	1.46
2	13157	4.82
3	17836	6.54
4	20545	7.58
5	23275	8.48
6	26455	9.70
7	29776	10.95
8	34192	12.61
9	40723	14.80
10(highest)	63109	23.07

Sources: CHIP 2013 data.

It should be pointed out that the pension standard for retirees is different with individual characteristics. We further compare the differences in the pension of retirees used to work different sectors. It can be seen from the results of the figure 7 that the pension of the retirees who have worked for the party and government organs is the highest, and much higher than the pension of retirees from other sectors (including those from Chinese and foreign joint ventures or wholly foreign-owned enterprises) . The pension of retirees from the government sector is 2.2 times higher than that of those from private sector (Figure 7).

Figure 7 Pension income of retirees from different ownership sectors, 2013
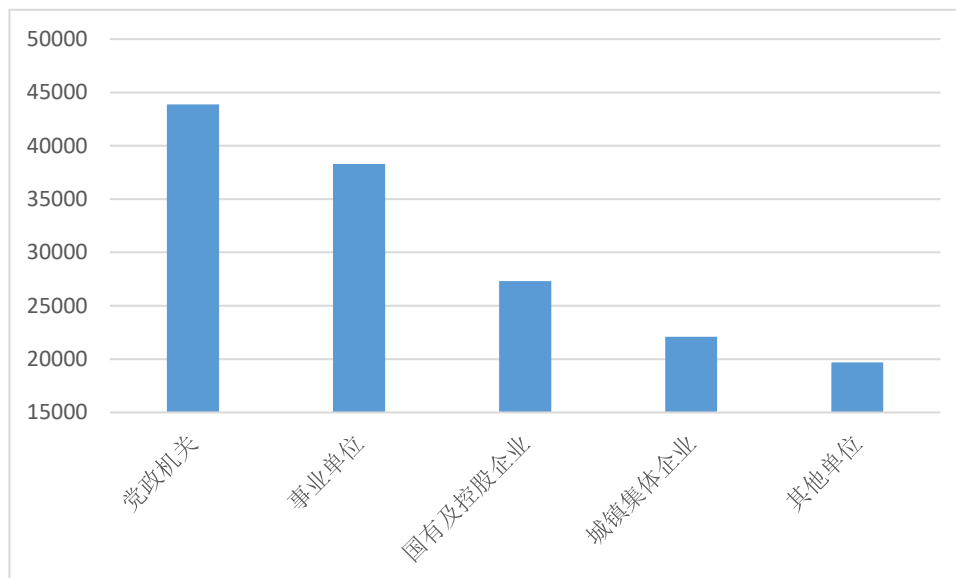
Sources: CHIP 2013 data.

4.3. Discussion on parameter reform

Since income inequality poses significant threats to growth and development of economy, the Chinese government puts a higher value on reducing inequality. As the core of social security system, the redistribution effect of pension system attracts lots of attention. In particular, with the increasing coverage of the pension system in recent years, the role it plays in narrowing income gap become more and more obvious. Since the reform of the pension system in 2005, the State Council has raised the basic pension income for urban retirees by 10% each year in 11 consecutive years, making the average pension benefit increases from 647 yuan in 2004 to over 2000 yuan in 2016. Consequently, the increasing pension income maintains the basic standard of living of the retirees. Also, it helps narrow the income gap between different generations.

It should be noted that many factors should be taken into consideration when analyzing the effect of the pension system. In particular, in the study of the reform parameters of pension system, to measure the redistributive effect, complete system design and scientific operation mechanism should be paid more attention. In fact, the redistributive effect of pension system depends not only on coverage, but also on the design and the transition of the system. In China, the pension account is composed of

general social planning and personal accounts. However, the adoption of personal account, and the following problems in the implement, to some extent, weaken the distributive effect of pension system. Although pension system almost achieves the goal of full coverage, poor people and the low-income population can not get access to equity of insurance as rich people, which in turn affect the redistributive effect of this system. Moreover, the fragmentation of the pension system leads to higher pension benefits for civil servants while less for the low-income population or workers in informal sectors, and it also decrease the effect of this system. In a word, the fragmentation of this system adversely affect its redistribution effect. Meanwhile, as pointed out, there is a strong linkage with the pension insurance and benefit, which is also difficult for the low-income group to improve their income.

Given all the above factors, when we employ simulation analysis of pension system in the next section, we focus on change in its redistribution effect simulating each scenario, respectively. And the main focus of the simulation is the benefit side. Also since this report use cross-sectional data to analyze, we do not predict further change.

4.4. Redistribution effect of pension parameter reform: simulation analysis

The reform of the pension system in China needs to pay attention to the following main parameters:

First, **the coverage of the insurance**, that is, the coverage rate. Coverage is the starting point of analyzing the redistribution effect of pension system, and determines the size of its redistribution effect. There is no doubt that the greater the coverage, the larger the size of the pension fund collected, the more conducive to narrowing the income gap. In addition, low coverage means that a group of the population is excluded from the system, resulting in an opportunity inequality. To ensure that the opportunity is fair, it is possible to achieve a fair distribution. At present, we can see from the data that about 28% of the samples of workers aged 20 to 59 with wage income in 2013 did not participate in any urban pension insurance. In addition, we also observed that about 42% of the individuals participated in the urban worker's pension insurance in 2013, but did not report their contribution, 30% of the individuals participated in other pension insurances, but did not explicitly report their insurance premiums. Below, based on the coverage of pension insurance, the first simulation of this paper is given as follows.

Simulation 1: Urban pension to achieve full coverage.

In other words, we assume that urban worker's pension scheme, urban resident pension scheme, commercial pension insurance covering all urban people. The simulation method is as follows: First, 28% of the population who did not participate in the system in 2013 are assumed to be covered. This group of the population mainly employed in private enterprises or self-employed, can participate in either urban worker's pension scheme or urban resident pension scheme. We assume that they pay 8% of their wage income to the scheme in 2013 or pay 128 yuan per person (according to the 2013 Human Resources Social Security Regulation, the average payment to pension insurance from urban and rural residents in 2013 is 128 yuan per person). Secondly, if the individuals reported their participation in the system in 2013 but did not report their contribution, 8% of their wage income would be deducted. Third, for those participated in other pension insurances but did not report their contribution, we assume their contribution is 128 yuan per person. Under these assumptions, we calculate the inequality of disposable income of the samples shown in Figure 8.

As can be seen from the figure 8, the overall view, if full coverage would be achieved, the inequality of disposable income would decline, but the decline is not so significant. The results show that the Gini coefficient of disposable income changes from 0.40540 to 0.40536 if those not participated in the system are assumed to make contribution to the urban worker's pension system. If those are assumed to make contribution to the urban resident's pension system, the Gini coefficient of disposable income would decline from 0.40536 to 0.40480. The decline is not significant (see Table 6).

In China, majority of urban workers are covered by the urban worker's pension insurance, and their income is relatively high. The low-income groups, such as temporary workers and self-employed, contribute to the pension in the form of taxation, but do not participate in the system because of "too high" contribution fees. According to China Statistical Yearbooks and Labor Statistical Yearbook, it can be calculated (Figure 9), with the improvement of the system for urban workers in China, the number of employees in urban enterprises increased year by year. In 2012, all most all the urban formal employees are covered by the system, but only 10% of the flexible job takers were covered. The low coverage rate of the flexible job takers leads to the difference of the coverage of the system for different types of employment, which affects the time of

entering the system and further affects the income gap among retirees. This will weaken the distributive effect of the system. In other words, the fragmentation of the urban pension system undoubtedly leads to low effect on income distribution.

Figure 8 Simulated Lorenz curves with full coverage of pension system, 2013
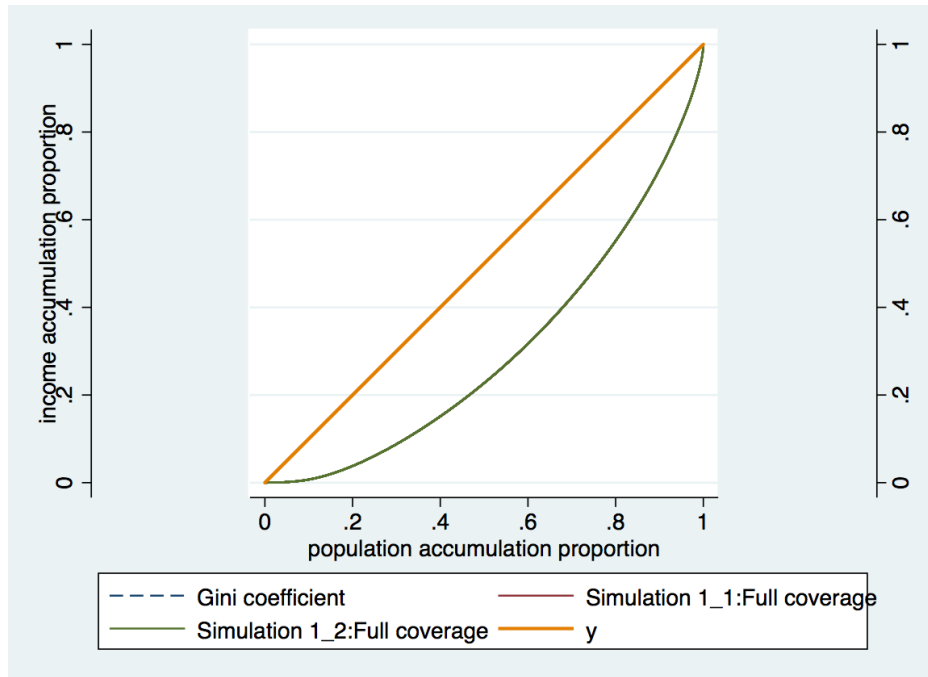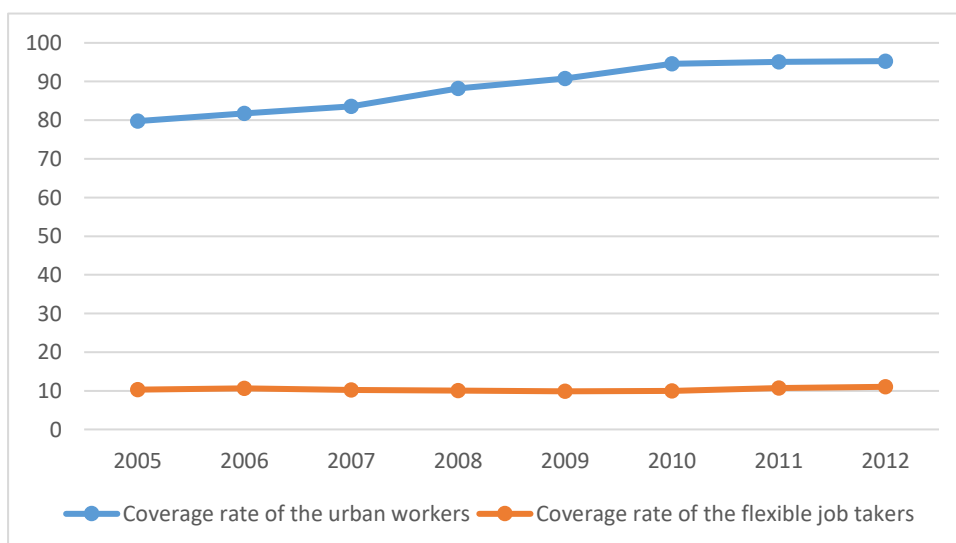

Figure 9 Differences in coverage rates of two types of employees, 2005-2012

Sources: Various China Statistical Yearbooks and Labor Statistical Yearbooks

Second, **the income base for contribution**. From the 2005 Pension Reform Agenda it is not difficult to see that the pension contribution is based on the wage level of workers, that is, the higher wage is, the higher contribution. It should be taken into account that high-income earners pay more to the system, but in general, the average life expectancy of high-income earners is higher than the low-income earners, which will weaken the progressive effect of pension contribution. In general, the income base for contribution has the upper limit and the lower limit. If the upper limit is higher, that is, the higher the income of workers, and the lower the lower limit is, the pension system can produce a strong progressive effect on the income gap. In accordance with the provisions of the 2005 Agenda, China's current system stipulates employers to pay for the urban worker's pension insurance 20% of the total wage, and individual workers to pay 8% of the total wage. This is the national contribution rate, but the provinces can make adjustments according to their own circumstances. It also provides that 3 times of the local average wage as the payment ceiling and 60% as the lower payment limit. This means that high-income groups with wage levels more than three times of the average wage are only required to pay on the three-fold wage base.

Simulation 2: Contribution fully in accordance with the income base

We assume such a scenario in which workers participate in urban worker's pension insurance make contribution to the system in accordance with the stipulation. The simulation method is as follows: First, the simulation is based on sampled individuals of 20 to 59 years old who have wage income and participate in the urban worker's pension insurance. If the wage of a worker in the province is less than 60% of the average wage, he/her contribution would be based on 60% of the average wage. Second, the wages of workers is higher than the local average wage of 60% but less than 3 times of the average wage, they would pay 8% of their personal wage income to insurance. Third, those with wages higher than three times of the average wage, their contribution is on the basis of three times of the average wage. Of course, we assume that this group of workers has 100% participation rate. It should be noted that the average wage here is the provincial average wage of the sampled workers aged 20 to 59 in the data. The figure 9 shows the inequality of disposable income before and after the contribution. It can be seen that the Gini coefficient of disposable income changes from 0.4054 to 0.3973, falling by less than 1 percentage point (see Table 6) when the urban workers make contribution following the stipulated income base.

It is important to note that about 33% of the workers aged 20-59 participating in the urban worker's pension insurance with wage income less than 60% of the provincial average wage, while only 4% of them with wage income higher than three times of the average income. In this case, the actual contribution rate for the low-income workers is higher than 8%. In the face of the high rate of contributions, many workers with economic difficult will give up their participation, causing them to be excluded from the pension insurance. In other words, the existing system is to impose a lower (actual) contribution rate on high-income earners and a higher (actual) rates for low-income earners, resulting in reverse redistribution of the system.

Figure 10 Simulated Lorenz curves assuming contribution is with income base stipulated, 2013
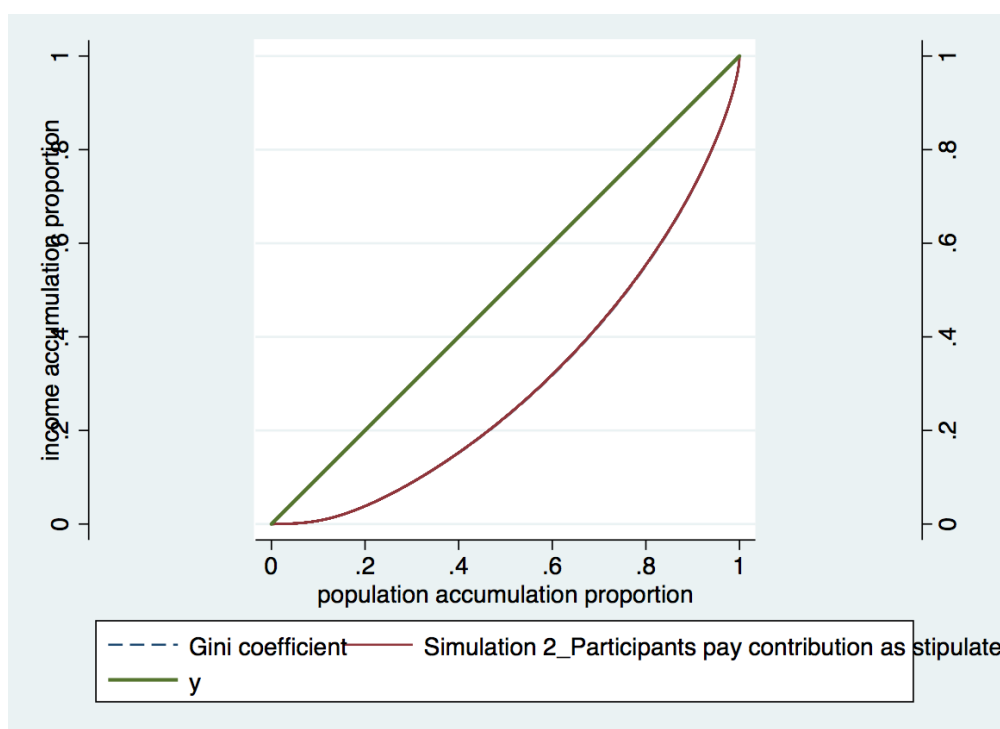
Third, **the pension contribution rate**. Contribution rate is the core of the pension system, having a direct impact on the pension level. According to the provisions of the 2005 Agenda, China's urban worker's pension insurance stipulates the personal contribution rate is 8% of participant wage. The statistics show that the main reason for workers not participating the system is that contribution is too high, so we try to adjust the contribution rate. Similarly, here we use the data to do two simulations. First, we simulate the first option which reduces the contribution rate from 8% to 6%. Second,

the results above show that due to the current income base there is regressive effect. Therefore, we simulate the second option in which different income groups take different contribution rates. Specifically, groups with income below 60% of the average income take the contribution rate of 6% of the average wage. And for those with income more than 3 times of the average wage, the contribution rate of 10% of the average income is applied. And for those with income between 60% and 300% of the average wage, the contribution rate of 8% is applied.

Simulation 3: the contribution rate reduced to 6%.

Simulation 4: different contribution rates for various income groups.

The figure 11 shows the inequality of the disposable income of all sampled workers before and after adjustments of contribution rate. It can be seen that the Gini coefficient of disposable income decreased from 0.4054 to 0.3993 after reducing the contribution rate, but the decrease was not significant. However, the Gini coefficient of disposable income decreased from 0.4054 to 0.3368, by about 7 percentage points (see Table 6), if a lower contribution rate is applied to the low-income group and a higher rate to the high income group. It is a significantly progressive effect on income distribution. It can be seen that the actual contribution rate of low-income workers is higher than that of high-income ones because of the setting of upper and lower limits and because of the average life expectancy of high-income workers is longer than that of low-income ones. Therefore, the adoption of progressive contribution rate or more contribution by high-income workers can effectively improve the redistributive effect of the system.

Figure 11 Simulated Lorenz curves with different contribution rates, 2013
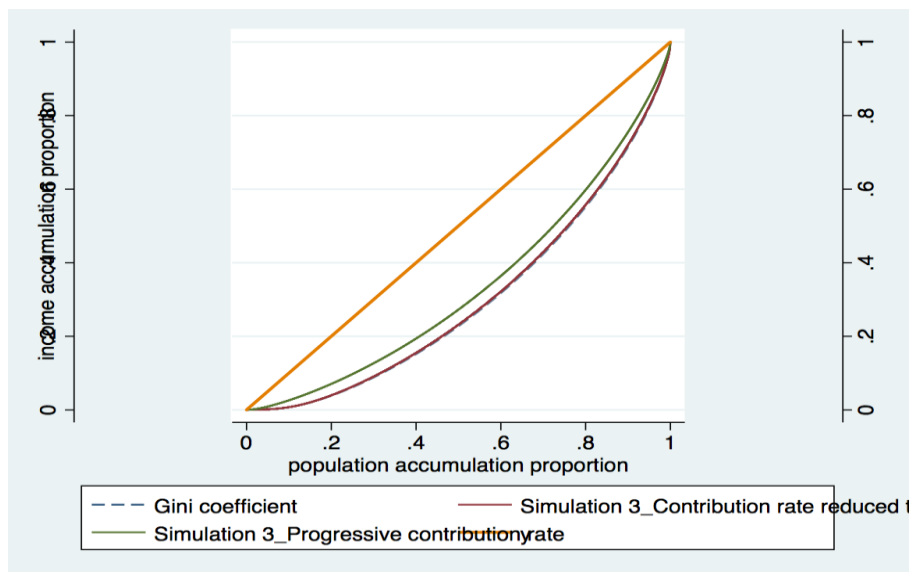
Fourth, **reduce differential of pension distribution**. The results above show that the distribution of pensions among urban retirees is less fair, and the pension levels of retirees in different sectors vary widely, and the pensions are tilted to a few rich retirees. Next, we simulate the impact of the pension adjustment on the redistribution of the pension system. Here, we only simulate changes in the pension income of individuals over 50 years old who have received pension income, and the income of other individuals remains the same. We simulate two scenarios: one is to maintain the pension income of low-income pensioners and reduce the pension income of high-income pensioners. In this case, we assume that the pension income has a minimum and maximum level, respectively, no less than 5% and no more than 95% of the average pension level. The second is the reunification of pension standards of retirees from different types of enterprises. So we conduct the following simulations.

Simulation 5: **Reduce pension income inequality - setting upper and lower limits.**

Simulation 6: **Adjustment of pension income: uniform standards.**

The following figure shows the inequality of all disposable income before and after the adjustments. It can be seen that the Gini coefficient of disposable income decreases from 0.4054 to 0.4012 when the upper and lower limits are set, the decrease is not significant. But if we further reduce the upper limit by 10%, the Gini coefficient drops to 0.3978. Further, if we only increase the lower limit by percentage (such as 5% or 10% or 15%), there is little impact on the overall income gap. This result shows that the

vertical imbalance in the distribution of pensions, especially the pension more distributed to a small number of rich people, increases pension inequality among pensioners and income inequality among all people as well.

Suppose the pension income is adjusted uniformly. The Gini coefficient of the income distribution decreases from 0.4054 to 0.3822, 6% lower (see Table 6), when the pension income of all types of retirees is uniformly paid. This further shows that the vertical imbalance of the pension, affecting its income redistribution effect. Of course, it should be noted that in this case, is not conducive to mobilize the enthusiasm of the incumbent payment, may induce more people to choose early retirement, resulting in fiscal unbalanced of pension insurance and new social problems.

Figure 12 Simulated Lorenz curves assuming same pension for all pensioners, 2013

Fifth, **the pension adjustment mechanism**. It should be noted that both inflation and real wage growth will affect pension income. First, if the pension income is fixed, the slight inflation will make it decreased in real value. In order to avoid the redistribution effect of inflation, the pension income will be considered to be attached with inflation in all countries. However, this adjustment mechanism relies on accurate inflation data. Another consideration for adjustment is the growth rate of real wage. Adjusting pension

based on post-tax real wage growth can ensure that retirees share the fruits of economic development with their incumbents, while adjusting pension with inflation ensures that retirees maintain their basic standard of living. But this adjustment mechanism will bring huge financial pressure, may also deepen the intergenerational imbalance, and deteriorate fiscal balance of the pension system.

At present, China's pension adjustment mechanism is to make the fixed amount of adjustment. Since the reform of the pension system in 2005, the State Council has raised the basic pension income for urban retirees by 10% each year in 11 consecutive years, but it is not fully studied about the fairness and sustainability of this adjustment mechanism. The results above show that the distribution of pension income is not equity, which in turn lead to an increase in pension inequality, and income gap as well. Hence, in this case, we simulate differential pension adjustment mechanism for different groups. Specifically, assume that the growth rate for pension income of elderly groups with pension income more than 95%(or 90%) of the average pension level is only 5%(in stead of 10%) in 2013, that is, adjust their pension income to around 95% of their current income in the year of 2013; Secondly, besides assuming that the growth rate for pension income of elderly groups with pension income more than 95% of the average pension level is only 5% in 2013, we also simulate that the growth rate for the poor group (with pension income less than 5% of the average pension level) is 15% in 2013. So we conduct the following simulations.

Simulation 7: Adjustment of the annual growth rate of pension income: controlling upper growth.

Simulation 8: Adjustment of the annual growth rate of pension income: different pension adjustment mechanism for differential groups.

The following figure shows the inequality of all disposable income before and after the adjustments. It can be seen that the Gini coefficient of disposable income decreases from 0.4054 to 0.4048 (0.4046) when controlling the upper growth, while the decrease is not significant. Then if we further apply different pension adjustment mechanism for the rich and poor, the Gini coefficient drops to 0.4047, implying that there is little impact on the overall income gap. This result further indicates that the vertical imbalance in the distribution of pensions increases pension inequality at first. Then

even though we adjust the pension growth mechanism, there is little impact on its redistribution effect.

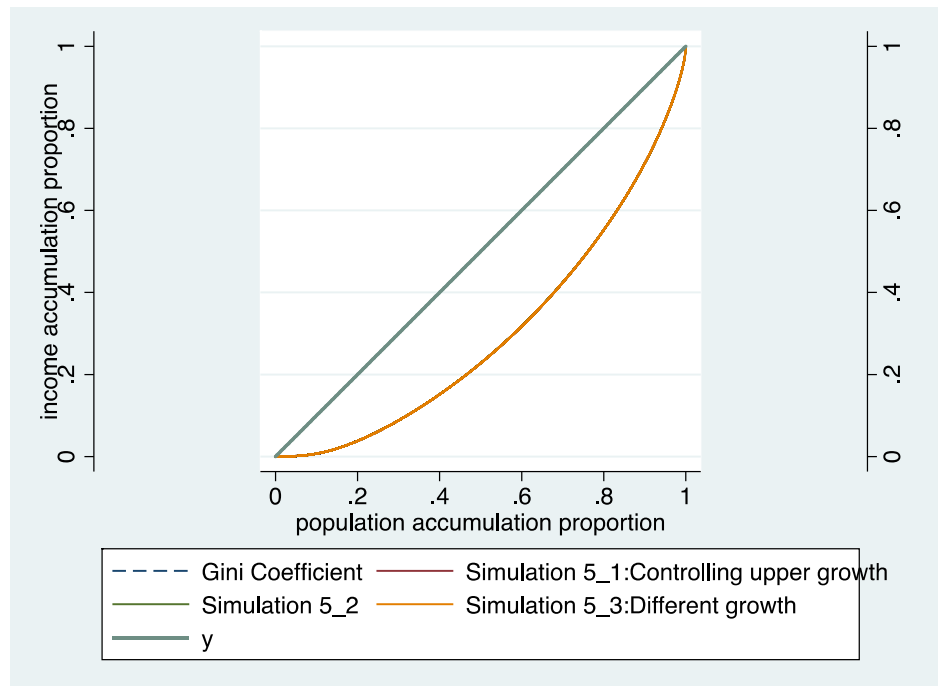**Figure 13   Simulated Lorenz curves assuming the pension growth, 2013**

Table 6 Summary of simulation results of redistributive effects of pension parameter reform

		Simulated Gini	Change in Gini	Change in Gini（%）
Simulation 1：Full coverage	Non-participants pay 8% of their wage	0.4054	0.0000	0.01
	Non-participants pay 128 yuan	0.4048	-0.0006	-0.14
Simulation 2：income base	Participants pay contribution as stipulated	0.3973	-0.0081	-1.99
Simulation 3：contribution rate	Contribution rate reduced to 6%	0.3993	-0.0061	-1.49
	Progressive contribution rate	0.3368	-0.0686	-16.91
Simulation 4：reduce pension gap	Setting upper and lower pension	0.4012	-0.0042	-1.03
	Same pension income	0.3822	-0.0232	-5.71
Simulation 5：Adjustment pension mechanism	Controlling upper growth	0. 40476	-0.0006	-0.16

Different growth	0.40474	-0.0007	-0.16

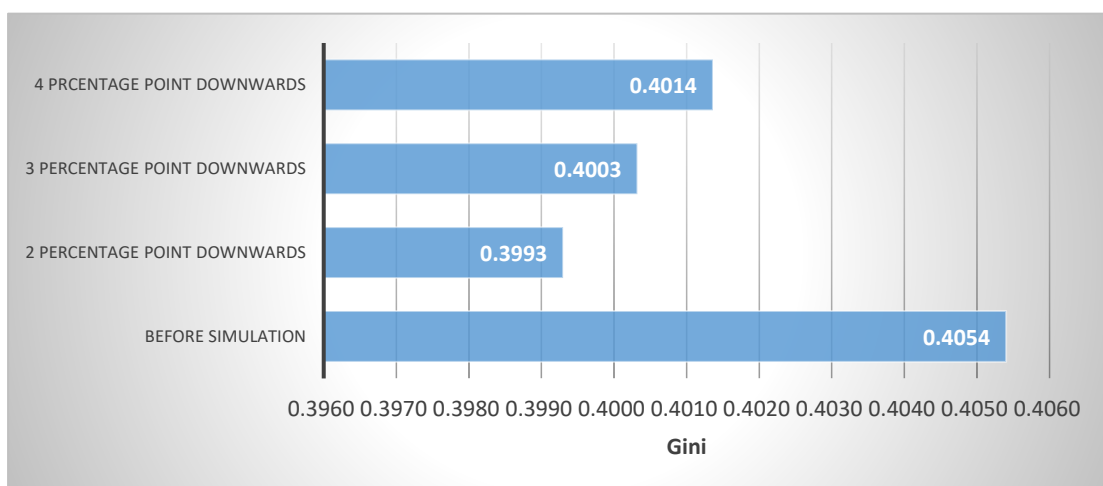4.4. Simulation analysis of urban pension system parameters reform in China

Parameter reform 1: **Change in the contribution rate**

As mentioned above, the contribution rate is the core of the pension system. The results above also show that the existing pension system caused low-income workers to pay actually the higher rate than the high-income ones, generating a regressive redistribution. Homeopathy, we propose the first parameter reform, that is, the contribution rate reduced by 2 or 3 or 4 percentage points. According to Table 1, when the contribution rate decreased, the disposable income of workers increased. On the other hand, the pension income of retirees will decline. Because pension of retirees are made up of basic pension and personal account pension, the lower contribution rate would reduce the pensions from personal account. Therefore, we assume that for the urban workers the contribution rate is reduced by 2 or 3 or 4 percentage points, while pension income of retirees is decreased by 1 or 1.5 or 2 percentage points. In order to observe the redistribution effect of the parameter reform, we make simulation below.

Simulation of Urban Pension System Reform 1: Downgrade Contribution Rate.

As shown in the figure 13, when the contribution rate is reduced by 2 percentage points to 6%, the Gini coefficient decreases from 0.4054 to 0.3993; when the contribution rate is reduced to 5%, the Gini coefficient decreases to 0.4003; when the contribution rate drops 4 points to 4%, the Gini coefficient decreases to 0.4014. In other words, in the short term, the decline in contribution rate can make a positive redistribution effect. However, it should also be noted that as the contribution rate continues to decline, the Gini coefficient of income distribution does not decrease. It is not difficult to understand that with the decline in personal pension contributions, although the current disposable income has increased, but then the individual accounts of the pension will be reduced accordingly, and then pension income of retirees also declined. Therefore, the decline in the contribution rate in short-term can play a positive redistribution effect, but in the long run it may widen the income gap between generations.

Figure 13 Redistributive effect of downgrading contribution rate, 2013

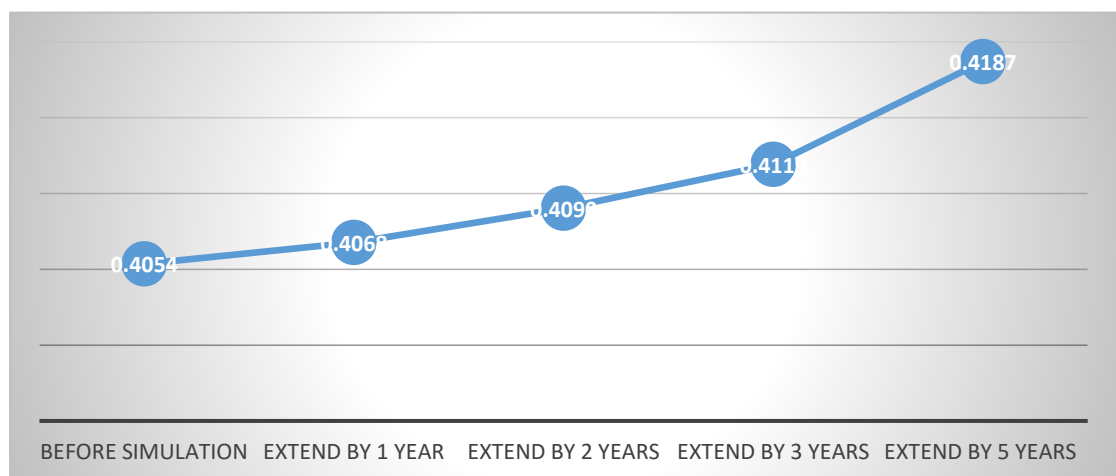|	Gini
4 PRCENTAGE POINT DOWNWARDS	0.4014
3 PERCENTAGE POINT DOWNWARDS	0.4003
2 PERCENTAGE POINT DOWNWARDS	0.3993
BEFORE SIMULATION	0.4054

Parameter reform 2: **Postponing retirement age**

As we all know, in recent years, China's aging trend is grim. According to the forecast, by 2025 the number of elderly people over 60 years old in China will be 291 million, and the elderly population aged 65 and over was 195 million. By 2040, elderly people over age 60 were 398 million (Du Peng et al., 2015). In other words, in the next 10-20 years, China's aging problem will be more challenge. With the process of aging society, the pressure on the pension system is increasing. In order to minimize the gap in pension accounts, domestic and international scholars and government officials have proposed solutions to postpone the retirement age. We further predict the impact of extended retirement age on the income redistribution effect in urban areas. Since it is not possible to accurately predict changes in the demographic structure and employment structure in 2020, we use the simplest method, that is, to assume that the elderly in the 2013 data will receive a pension after reaching a certain age and pay contribution to the pension system before then. In accordance with the current retirement policy, the legal retirement age for both men and women is 60 and 55 years respectively. We then assume that the retirement age is extended by one year, two years, three years and five years respectively to predict the income redistribution effect of the system. The forecasting method is as follows: First, the individual income equation is estimated from the data and then the predicted value of the individual's annual income is obtained. Secondly, according to the individual's income function, it is predicted that the individual who has retired after retirement age (but does not reach the extended retirement age) (60 to 61, 60 to 62, 60 to 63, 60 to 64 for males) and 55 years old (55 to 56,55 to 57,58 for females); again, to keep other people's income unchanged. The effect of extending the retirement

age on income redistribution is estimated.

Simulation of Parameter Reform 2: Extension of retirement age.

The simulation results are shown in Figure 14. It can be seen that with the extension of retirement age, the redistribution effect of pension is declining. If retirement age is extended by one year, the Gini coefficient of income inequality rises to 0.4068. And when the retirement age is extended by five years, the Gini of income distribution rises to 0.4187, by about 3 percentage points. In other words, with the extension of the retirement age, the system becomes more disequalising. Of course, it is undeniable that extending the retirement age can narrow the intergenerational pension gap. It is out of the scope of this paper, so it is not discussed here.

Figure 14 Redistributive effect of postponing retirement age, 2013

5. Redistributive effects of the pension system in Rural China

Table 7 shows the income redistribution effect of the pension system in rural China. Generally, the effect of redistribution of the pension system just makes the Gini coefficient of income gap of rural residents narrowed by 2.1%, which is much smaller than that in urban areas. Similar to the situation of urban residents, the burden of rural residents not only did not reduce the income gap, but to expand the income gap. The redistribution of pension insurance makes the Gini coefficient of rural residents' income gap increased by 0.13%. Due to the development of the rural pension system is

seriously lagging behind, the share of pension benefits in income is still very low, thus the income redistribution effect of farmers received pension income brings is very limited, but the peasant household market income gap narrowed by 2.21%, and the rural elderly subsidy has a more obvious effect on narrowing the income gap, which made the market income gap between the rural residents of the Gini coefficient decreased by 1.12%.

Table 7 Redistributive effects of the pension system in Rural China

	Mean value(Yuan)	Gini	Change in Gini	Change in Gini （%）
Primary income	12743	0.5283		
- contribution payment	12543	0.5290	0.0007	0.13
+ Pension income	13248	0.5166	-0.0117	-2.21
+ Pension of retirees	13049	0.5239	-0.0044	-0.83
+ pension of urban residents	12789	0.5278	-0.0005	-0.09
+ pension of rural residents	12868	0.5224	-0.0059	-1.12
+ other pension income	12769	0.5272	-0.0011	-0.21
Redistributed income	13048	0.5172	-0.0111	-2.10

Table 8 reports the redistribution function of the pension system of migrant workers. In general, it is quite clear that the pension system has a role in narrowing the income gap for migrant workers, but its role is very limited. However, the pension insurance helps to narrow the income gap, making it fell by 0.09%. Pension income has a positive role in income redistribution and makes the Gini coefficient of the income gap narrowed by about 1.98%. Also, similar to the situation of urban residents, retired pension has the most important redistributive effect.

Table 8 Redistributive effects of the pension system, for the migrants

	Mean value(Yuan)	Gini	Change in Gini	Change in Gini（%）
Primary income	33811	0.4167		
- contribution payment	33215	0.4163	-0.0004	**-0.09**
+ Pension income	34201	0.4085	-0.0083	-1.98
+ Pension of retirees	34182	0.4091	-0.0076	-1.83
+ pension of urban residents	33821	0.4165	-0.0002	-0.06
+ pension of rural residents	33821	0.4164	-0.0003	-0.07
+ other pension income	33811	0.4167	0.0000	0.01
Redistributed income	33605	0.4080	-0.0087	-2.09

6. Conclusion

The role of the pension system in the redistribution of income is worthy of attention and needs to be studied in depth. Since the reform and opening up, under the influence of multiple factors such as family planning policy and economic development, the trend of population aging in China is becoming more and more serious. The acceleration of aging process has brought great pressure on economic and social development, and it also means that the pension system is facing unprecedented pressure, which may cause inequality in within generations and intergenerational income distribution.

The Chinese pension system after nearly two decades of reform and development, its coverage continues to expand. So far, the system has basically covered the urban and rural population. However, the current system has different institutional arrangements for urban formal employees, urban residents and rural laborers, and lack of cohesion and coordination between different systems and lack of significant redistributive effect.

Using the nationally representative data of household income, we found that the current pension system has played a certain role of income redistribution. However, due to the difference in urban and rural system, the system has effects on income redistribution mainly in urban areas, and almost no impact in rural areas. In addition, we also found that in urban areas, pension distribution is not equal, retirees from different work units receive significantly different pension, and the pension is more distributed to a small number of high-income retirees.

It is also found that the actual contribution rate of low-income workers is higher than that of high-income ones because of the upper and lower limits of the income base and the same contribution rate for all workers in different income deciles. The high income group benefits more from the pension system than the low-income group. The system has negative impact on income distribution. In addition, the difference in pension income provided by variant pension systems leads to the vertical imbalance in its distribution, which will also increase the income gap and is not conducive to the development of social fairness and the establishment of a harmonious society.

To future reform the pension system, it should pay attention to the following solutions: First, it needs to further improve the coverage to achieve the goal of protecting all the old people. Second, it is necessary to use progressive contribution rates, i.e., higher rates for high-income participants it effectively improve the redistribution effect of the system. Thirdly, it is to unify the urban and rural system to change the fragmented pension system. The formation of a unified national institutional arrangements in the system helps to reduce pension inequality among the different groups of pensioners. Third, the reform of pension system for civil servants should be accelerated. It should be merged with the urban worker's pension system.

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