

The Role of Public Pensions in Income Inequality among Elderly Households in China 1988–2013

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Abstract Using data from the Chinese Household Income Project surveys for 1988, 1995, 2002 and 2013, we investigate the role of public pensions in income inequality among households with elderly members across two decades of pension policy reforms. We examine the distribution and role of public pensions at a national level. We analyse the evolution of the contribution of public pensions to national income inequality across a much more extended time period than earlier studies, which have generally focused on regional changes over short periods. Our findings suggest that public pensions have become the most important source of income for households with elderly members on average in China, but the distribution of pension income is highly unequal, with a Gini coefficient of 0.74 in 2013. Public pension income has been the largest source of income inequality for elderly households since 2002 and contributed to more than half of total income inequality in the most recent year of the survey. This finding is robust against variations in the income inequality measures used. Additionally, our analysis suggests unequal distribution of pension benefits is the primary driver of pensioners' income inequality. Among several hypothetical policy changes, ensuring a minimum pension benefit for all existing pensioners seems to be the most fiscally effective option in reducing income inequality, with a 0.8% reduction in the Gini coefficient for a 1% increase in public pension expenditure.

Keywords income inequality, public pension, Gini decomposition

JEL Code H55, C53, C54

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I Introduction

China has seen a substantial increase in income levels in recent decades. About two-thirds of the population were living in poverty in 1990 according to the World Bank's international poverty line (\$1.90USD per day), but this ratio had dropped to 1.4% by 2014 (World Bank, 2018). At the same time, the country has been experiencing a rapid growth in income inequality, with the Gini coefficient increasing from 0.30 in the 1980s to around 0.50 in 2010 (Xie & Zhou, 2014; Molero-Simarro, 2017), making China one of the most unequal countries in the world in terms of income (Li & Luo, 2011).

Along with the dramatic changes in income distribution, China is also experiencing rapid demographic ageing. China's old-age dependency ratio – the population of those aged 65 years and above as a proportion of the population aged between 15 and 64 years – increased from 8.6% to 13.3% between 1990 and 2015, and is expected to reach 44% by the end of 2050 (United Nations, 2017). The growth of this demographic can be attributed to a variety of factors including the low fertility rate due to the government's population policy², and a general increase in longevity, which rising living standards have supported.

The elderly population is often perceived as one of the more vulnerable social groups in many countries, as older people tend to have lower capacity to generate private income than the younger population, because of both the physical effects of ageing and the greater likelihood of this cohort having mismatched skillsets in the labour market (Banister, Bloom & Rosenberg, 2012). Pension income is one of the most important sources of income for elderly people. In China, pension income is mainly dependent on public policy, which dictates who is eligible for a pension and the amount of any pension.

Frequent policy reforms in recent decades have led to substantial change in the income sources of elderly households and the role of public pensions has steadily increased. Public pensions have become one of the most important components of the social security system in China (Feldstein, 1999). However, policies often vary, and are rolled out at different paces, for different regions, industries and occupations. This results in numerous discrepancies in implementation. Several papers have been dedicated to studying the changes in income distribution due to pension reforms in China. He and Sato (2013) examined the redistributive effect of social security reform in urban private sectors using 1995 and 2002 data. Palmer and Deng (2008) examined elderly well-being using data from the Chinese Household Income Project surveys (CHIPs) between 1988 and 2002, using separate income classifications for urban and rural areas. Li, Zhao and Gao (2013) analysed the horizontal and vertical inequalities of public pension income in urban areas between 1988 and 2007 by comparing pension payout levels for different pensioners by occupation status. Zhu and Walker (2018) highlighted the impact of the stratification of the pension system in recent years. Cai, Giles et al. (2012) examined income support for rural elderly households in China and argued the need for public

² The fertility restriction has been changed in recent years. The one-child policy, however, was in place during the period of analysis (1988–2013).

intervention in the welfare of the elderly, especially for those who were not covered by the pension system.

Existing literature however, does not provide an estimate of the impact of public pension reform on the income distribution nationwide. Previous studies often focus solely on rural or urban areas, as pension reforms are often region-based in China. By focusing on rural or urban areas alone, the results ignore the dynamics of population mobility in China, where more than one-third of the entire working population are ‘rural migrant workers’, who move from rural areas to work in cities (National Bureau of Statistics of China, 2018). Additionally, no research has estimated the longitudinal change in the income distribution due to the changes in public pensions. Challenges in undertaking this type of research have included the lack of consistent income classification across time and difficulties in obtaining data over a sufficiently long period.

This paper addresses this gap in the literature by examining the role of public pensions in shaping income distribution in China, particularly among households with elderly members, between 1988 and 2013. As many pension reforms extend over this lengthy period, this study can better describe the full impact of these reforms. Additionally, this paper is one of the few that uses a longitudinally adjusted and consistent income classification across the entire country over an extended period. This involves a range of corrections and classification matching for both rural and urban areas. Substantial efforts have been made to separate incidental income from regular income, which in turn reduces the measurement error of pension income. Finally, we investigate the role of public pension income along with other social benefits, market incomes and private transfers in income distribution through the Gini decomposition method and examine the marginal inequality effect of the key elements in China’s public pension policy design. This derivation of the marginal impact of alternative policy designs enables a fair budget-neutral comparison of the income redistribution impact which previous literature has not explored. It offers a more realistic interpretation of the public pension impact compared with simply contrasting income inequality with and without public pensions.

The rest of the paper is structured as follows. Section 2 describes pension coverage and changes to public pension policy in China. Section 3 describes the data and the adjustments we have made to it. This is followed by the methodology section. Section 5 presents results from both the inequality decompositions and simulations. Section 6 concludes.

II Coverage and Benefit Policies for Public Pension Schemes in China

The public pension system was initially introduced in China in 1951. However, only a small proportion of the population was covered by the public pension. In 1988, less than 25% of those aged over 60 years were covered by the scheme, which was limited to urban workers only. The coverage was gradually extended and by 2013 most of the elderly was covered by at least one of public pension schemes, as shown in Table 1. The public pension system consists of the *private sector pension*, the *public sector pension*, the *urban-rural resident pension*, the *off-duties (li xiu) pension*, and the supplementary pension schemes, including *land-lost farmer*

pensions and *collective retiree pensions*. Each of these systems is largely independent and has its own eligibility and benefit policies.³

In 2013, nearly 76% of the elderly were covered by one of these five different public pension schemes depending on their place of residence, career trajectory and the sectors they had worked in. There has been a particularly rapid expansion of coverage in rural areas which can be largely attributed to the introduction of the new rural pension in 2009, which was integrated to the urban-rural resident pension in 2014. In 2013, about 70% of those above the retirement age were registered as being part of the rural population, who are only eligible for those pensions targeted at rural areas.

Table 1: Timeline of public pension coverage of the elderly, %

	1988	1995	2002	2013
All the elderly	24.8	37.6	34.9	75.8
Urban	58.2	74.3	76.2	87.0
Rural	1.9	2.0	2.7	69.3

Source: Authors' calculations based on weighted CHIPs data.

Note: The elderly means people aged 60+ years.

For most public sector workers and private sector workers in urban areas in 1988-2013, replacement rates tended to be around 60–90%, mainly depending on length of work experience, the job title and the wage prior to retirement (State Council: Document No.104, 1978). Among all public pension schemes, those referred to as the ‘off-duties’ pensioners are a special group as their pension replacement rate is 100% and the pension indexation is 100% linked to the wage growth of their last work (State Council: Document No.104, 1978).⁴ As a result, pension benefit levels for this group are the highest of all pensioners.

Since 1991, various reforms were implemented for public pensions for private sector workers, but pensioners who had worked in the public sector were largely unaffected by these changes. As a result, the average benefit levels of the two schemes diverged. In 2013, the average pension amount for public sector pensioners was more than 50% higher than for their private sector counterparts.

The urban-rural resident pension is a universal pension for rural residents and its payouts vary across regions, with benefit levels of 660 yuan (~US\$102) annually in 2009–2014, 840 yuan (US\$130) in 2015-2017, and 1056 yuan (US\$155) from 2018 for the majority of those eligible. This benefit level was about one-third of the national average of rural minimum living standards, and about 6.8% of rural per capita disposable income in 2015. These benefits are not

³ For details of each system, see Wang (2017).

⁴ “Off-duties” are those who participated in the works related to the Communist Party before the end of September, 1949, and their work status were above a certain rank when retire. The coverage of Off-duties pensioners was extended to general urban workers later (Ministry of Labor and Human Resources: Document No.21, 1983). The proportion of off-duties pensioners in the total group of urban pension beneficiaries was 8.5% and 4.6% in 1999 and 2002, respectively, based on CHIPs data.

automatically indexed. The benefit levels of supplementary pension systems covering the remaining population of urban elderly fall between the urban-rural resident pension and the private sector pension. These levels are sometimes benchmarked against the government’s minimum living standard policy.

The fragmentation of the pension system leads to substantial differences in the benefit level and is often considered as “unfair” (Wang, Béland & Zhang, 2014). Overall, the ‘off-duty’ pensioners enjoy the highest average benefit. This is followed by the pension scheme for public sector workers. The urban-rural resident pension is considered to have the lowest benefit level among all public pension schemes.

III Data

Chinese Household Income Project surveys (CHIPs)

This paper uses the data from the Chinese Household Income Project surveys (CHIPs) for the years 1988, 1995, 2002 and 2013. The CHIPs are designed for research on income distribution, with all the income and expenditure data coming from family diaries collected by the National Bureau of Statistics. The diary-based approach avoids the long recall periods that are inherent in the interview-only approach of other household surveys, thus improving the data quality. Besides the four waves of data used in this study, CHIPs also collected data in 2007. This particular wave, however, is excluded in this study as public pension income was not recorded as a separate item. Instead, the 2007 data reports the total social welfare payment received, which consists of public pensions and other payments.

Table 2: Sample characteristics

	1988	1995	2002	2007	2013
Information on individuals					
Average age	28.9	31.7	34.9	37.0	38.8
% aged 60+	7.2	8.1	9.4	11.3	15.5
% male	50.4	50.8	51.1	50.7	49.2
% living in urban areas	18.5	22.7	34.2	46.3	54.2
Per capita disposable income	2671.4	4953.5	6744.4	11434.4	19413.1
Equivalentised disposable income	4682.6	8283.5	10817.7	17993.8	30745.8
Number of individuals	82951	56435	58625	62131	58898
Information on households					
Average household size	4.6	4.0	3.5	3.4	3.3
% of elderly households	26.0	23.9	24.5	26.4	33.5
% of elderly households with at least one other household member between age 15 and 59	97.4	94.4	90.9	86.4	77.5

Note: The reported statistics are weight adjusted. Equivalentised disposable income is calculated using the OECD-modified equivalence scale. Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors’ calculations based on CHIPs data.

CHIPs include between 56,000 and 83,000 observations in each wave and cover around 12,000 to 19,000 households, of which 18% to 54% (weight-adjusted) are from urban areas, depending on the year when the data was collected. The ageing of the population is evident from the dataset, where the proportion of the population aged 60+ years increased from 7% in 1988 to more than 15% in 2013. In this paper, we define elderly households as households with at least one member being 60 years of age or above, the *de facto* official retirement age in China. Rural areas seem to have a higher concentration of elderly households in comparison with urban areas.

The population ageing is also coupled with several shifts in key demographic characteristics, as seen in Table 2. A substantial increase in the average income level can also be observed during the same period. Disposable income per capita has increased by more than 600% over the 26 years, averaging an annual nominal growth rate of more than 14%. Together with the changes in average age, families in China have also been getting smaller. As shown in Table 2, the average number of persons living in a household declined from 4.6 in 1988 to 3.3 in 2013. Additionally, the proportion of elderly people living with their adult children has declined from 97.4% in 1988, to 77.5% in 2013. On average, the Chinese population is richer, older, more likely to live in an urban area, and in a smaller household in 2013 compared with 1988.

Income Definition

CHIPs report both aggregated household total disposable income and individual income items, including welfare and taxation. For the purpose of our analysis, we use the National Bureau of Statistics of China (NBS) 2013 income classifications and regroup all sources of income and taxation into six categories: wage income; income from business and assets; social benefits (excluding public pensions); public pension income; other income; and taxation for each year.

Table 3: Average annual per capita income at 2013 prices, yuan

Income source	All households				Elderly households			
	1988	1995	2002	2013	1988	1995	2002	2013
Wage	889.8	1870.3	3610.6	11464.7	549	1208.1	2000.1	5901.3
Business & asset	1565.2	2806.4	2071.9	4628.3	1558.5	2433.3	1893.2	3607.3
Tax	-18.6	-58.2	-165.4	-737.5	-19.5	-45.8	-87.4	-426.2
Public pension	78.1	224.2	648.7	2925.1	178.7	651.3	1785.8	6550.8
Social benefits	61.5	24.1	46.7	162.6	54.2	23.4	41.5	209.5
Other	95.4	86.5	532	969.9	109.5	102.9	532.6	1169.8
Total	2671.4	4953.5	6744.4	19413.1	2430.5	4373.2	6165.8	17012.6

Note: Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors' calculations based on weighted CHIPs data.

These six components add up to the total disposable income. The same classifications are consistently applied to both urban and rural areas. Note that the adjusted classifications differ from what was provided in CHIPs by default due to NBS's changes to income definitions over

time. Appendix A provides further details about the classifications. All income reported is adjusted by the consumer price index (CPI) to the 2013 level⁵ to make income comparable across time. Table 3 shows the mean value of each income category by household type. Negative values indicate a loss of income (taxation).

IV Methodology

This paper primarily focuses on the Gini coefficient given its wide use in the literature as a measure of inequality and the ease of comparison with government records. To identify the contribution of public pension policy to both the overall income inequality level and the income inequality level of the elderly population, we follow the method used by Lerman and Yitzhaki (1985) and Mussard, Seyte and Terraza (2003) of income source decomposition.

As shown in Equation 1, the Gini coefficient of the specified population, as denoted by G^E , can be written as a function of the covariance between income and its cumulative distribution.

$$G^E = \frac{2}{\bar{y}^E} \sum_{q \in Q} cov[y_q, F(y)] = \sum_{q \in Q} R_q G_q S_q \quad (1)$$

Where y_q is the income component q in the household, \bar{y}^E is the mean value of the total disposable income among elderly households, and y denotes the sum of all income components. As shown in Lerman and Yitzhaki (1985), the Gini coefficient can be further decomposed into three parts, where S_q is the share of component q of the income in total households. G_q is the Gini index corresponding to the income component q , and R_q is the Gini correlation of income components q and y . Decomposition by source can reveal the contribution of the current public pension schemes to the inequality level observed among elderly households. The inequality of public pension income itself also reflects the variation of the benefits introduced by public pension policy and the changes in coverage.

As the Gini coefficient is sensitive to the middle section of the income distribution, we use extended Gini indexes with varying inequality aversion parameters for a robustness check, as discussed in Lerman and Yitzhaki (1989) and Chotikapanich and Griffiths (2010). The extended Gini introduces an inequality aversion parameter ν in its calculation, where

$$G^E(\nu) = \frac{\nu}{\bar{y}^E} cov\left[y, (1 - F(y))^{\nu-1}\right] \quad (2)$$

The extended Gini coefficient corresponds to the standard Gini coefficient when ν is set to 2. Compared with the standard Gini coefficient, the extended Gini assigns different weights

⁵ The spatial difference in living standards remains unadjusted, because consumption patterns greatly changed between 1988 and 2013 in China. Brandt and Holz (2006) developed a regional consumer price index for China but the consumption basket was largely based on the data from early 1990s.

to different proportions of the income distribution, serving as an additional robustness check for the analysis.

Additional to identifying the primary contributors to inequalities, we also estimate the Gini income elasticity, which measures the impact on income inequality of a marginal proportional change in an income source (e.g. Lerman & Yitzhaki, 1985; Stark et al., 1986; Makdissi & Wodon, 2012). Mathematically, the Gini income elasticity of income source q can be written as

$$E_q = \frac{\frac{\partial G}{\partial e_q}}{G} = \frac{R_q G_q S_q}{G^E} - S_q \quad (3)$$

The general Gini income elasticity measure shows the overall inequality sensitivity to the marginal increase of the income component. The measure, however, does not sufficiently identify the extent to which changes in inequality were due to policy design, and whether the current level of inequality contribution by pension incomes is due to inadequate policy rollout (low coverage), funding levels, or the progressivity of the policy design. Therefore, we use a simulation approach where we estimate the marginal effect on the Gini coefficient of a small change in one element, or a combination of the main policy elements, in pension designs, such as coverage and benefit level. The partial derivative of the Gini coefficient with respect to public pension income would indicate the influence of public pension policy on the inequality level. Numerically, the difference in Gini between the current policy p and an alternative policy p^* can be expressed as

$$\Delta G^E = G^E(p) - G^E(p^*) \quad (4)$$

To ensure direct comparability across policy changes, all policy changes correspond to the same amount of change in total public pension expenditure with each alternative policy only differing with the current policy marginally. Therefore, the ΔG^E can be used to estimate the Gini elasticity of a policy element with respect to public pension expenditure.

V Results

Income Composition of Elderly Households

Table 4 presents each income source as a proportion of total disposable income. The first four columns show the results for all households and the last four columns show results for elderly households. When comparing the two population groups, two of the income sources – wages and public pension income – stand out as the most apparent differences. Compared with all households, where nearly 60% of income is from wages in 2013, this income source only accounts for about one-third of income for households with elderly members. Public pension income, on the other hand, is the most important source of income for elderly households, contributing 37% of total disposable income in 2013. The contribution of other sources of income, including taxation, tend to be similar between all households and elderly households, with a difference of no more than a few percentage points. This is expected, as many elderly people cohabit with their children in China, as reported in Table 2.

Table 4 Income share for per capita household income

Income source	% of disposable income							
	All households				Elderly households			
	1988	1995	2002	2013	1988	1995	2002	2013
Wage	33.3	37.8	53.5	58.2	22.6	27.6	32.4	34.7
Business & asset	58.6	56.7	30.7	24.7	64.1	55.6	30.7	22.2
Tax	-0.7	-1.2	-2.5	-3.7	-0.8	-1.0	-1.4	-2.5
Public pension	2.9	4.5	9.6	14.4	7.4	14.9	29.0	36.9
Social benefits	2.3	0.5	0.7	0.9	2.2	0.5	0.7	1.3
Other	3.6	1.7	7.9	5.4	4.5	2.4	8.6	7.3

Note: Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors' calculations based on weighted CHIPs data.

The estimates of the contribution of public pensions to total disposable income over time suggest a heavy reliance on public pension income for the elderly in the last wave of the data. In contrast, the most important source of income in 1988 for both all households and elderly households was business and asset income. This relates to the relatively low wage levels and very high share (74%) of the population living in rural areas at that time.⁶

We further examine the distribution of public pension benefits among the elderly population. Figure 1 shows the relative contribution of public pensions to total disposable income among the elderly population in 2013. For 47% of elderly people, public pension income represented less than 10% of total disposable income, suggesting a likely unequal distribution of public pensions across the population despite this being the largest source of income for households with elderly members.

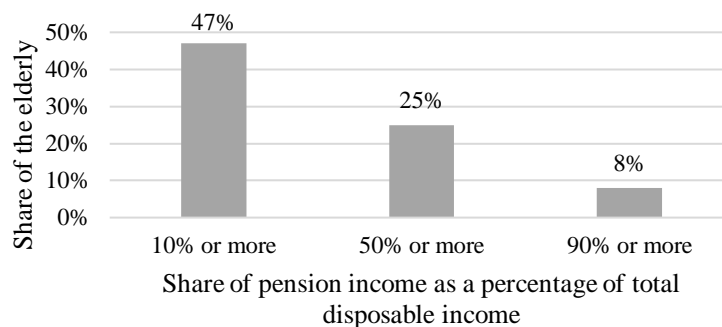


Figure 1 Contribution of public pension income as a percentage of total disposable income among people aged 60+ years in 2013

⁶ Population share data is based on the Population Census in 1990.

Income Inequality among Elderly Households

Table 5 reports both the general trend in incomes and the inequality level of elderly households (defined as households with at least one member aged at least 60 years). The increase of inequality among elderly households can be observed through both the Gini coefficient and the widening income gap between the 10th and 90th percentiles over time. The 90/10 ratio for per capita incomes in elderly households increased from 5.6 to 9.6 respectively from 1988 to 2013, and the income Gini coefficient for all elderly households increased from 0.37 to 0.47 over the 26 years. Income inequality for the general population also increased over this period, although to a lesser extent. It should be noted that the inequality of elderly households reflects not only the current policies but also the accumulated advantages and disadvantages of particular population subgroups over their lifetime, especially given the frequent policy and economic changes over the past decades.

Compared with most developed countries, including the U.S., China seems to have a relatively high level of inequality among elderly households. Brown and Prus (2004) report Gini coefficients between 0.19 and 0.37 for households with a head aged 65-plus from a range of countries included in the Luxembourg Income Study.

To examine what contributes to growing income inequalities, we decompose the income measures and estimate the Gini coefficients of all income components for elderly households as reported in

Table 6. Throughout the analysis period, public pension income is the most unequally distributed component among the three primary income sources (wage, business and asset, and public pension), although its Gini coefficient had dropped from 0.937 in 1988 to 0.740 in 2013 as shown. The downward trend of inequalities in public pension income can be mostly attributed to the extension of coverage, notably the introduction of the flat-rate rural pension schemes from 2009.

Table 5 Disposable income distribution of elderly households, annual per capita

Measure	1988	1995	2002	2007	2013
Mean (yuan)	2671.4	4953.5	6744.3	10728.3	18342.9
Median (yuan)	2209.4	3535.6	4744.8	6919.1	13226.0
90-50 percentile ratio	2.2	2.4	2.9	3.3	2.8
90-10 percentile ratio	5.6	5.0	6.9	9.0	9.6
50-10 percentile ratio	2.5	2.1	2.4	2.7	3.4
Gini among elderly households	0.370	0.369	0.411	0.467	0.469
Population Gini	0.374	0.410	0.418	0.470	0.455

Note: Elderly households are defined as households with at least one member aged 60+ years. All income items are adjusted to 2013 price level.

Source: Authors' calculations based on weighted CHIPs data.

The finding of high inequalities in public pensions is consistent with previous research where inequalities were measured separately for rural and urban areas. Palmer and Deng (2008),

who examined elderly well-being using the CHIPs for 1988–2002, concluded that the Gini coefficient for public pension incomes increased from 0.221 to 0.329 in urban areas and from 0.421 to 0.791 in rural areas. They also found that the Gini coefficient for total disposable income for the elderly population increased from 0.248 to 0.302 in urban areas, and from 0.327 to 0.379 in rural areas.

Table 6 Gini coefficients of income components for elderly households

Income source	1988	1995	2002	2013
Wage	0.866	0.804	0.753	0.705
Business & asset	0.425	0.440	0.535	0.642
Tax	-0.891	-0.729	-0.841	-0.801
Public pension	0.937	0.893	0.834	0.740
Social benefits	0.867	0.978	0.976	0.817
Other income	0.983	0.900	0.807	0.778

Note: Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors' calculations based on weighted CHIPs data.

Contribution of Income Components to Income Inequality

Table 7 reports the Gini decomposition result based on the Lerman and Yitzhaki (1985) approach. Between 1988 and 2002, wage income made the largest contribution to inequality. Among the households with at least one person aged 60+ years, the public pension is the largest contributor to income inequality in China and has contributed to more than 50% of the total inequality level since 2002. This finding is robust with varying inequality aversion parameters as shown in Table 8.

Table 7 Income component contribution to the Gini coefficient

	All households				Elderly households			
	1988	1995	2002	2013	1988	1995	2002	2013
Wage	0.23	0.24	0.33	0.29	0.16	0.18	0.19	0.16
Business & asset	0.10	0.13	0.02	0.09	0.13	0.08	0.01	0.07
Tax	0.00	0.00	-0.01	-0.02	0.00	0.00	-0.01	-0.01
Public pension	0.02	0.03	0.07	0.08	0.05	0.10	0.21	0.24
Social benefits	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Other	0.01	0.01	0.02	0.00	0.02	0.01	0.02	0.01
Overall Gini (sum)	0.37	0.41	0.42	0.45	0.37	0.37	0.41	0.47

Note: Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors' calculations based on weighted CHIPs data.

It is important to note that the inequality share represented by public pensions is consistently higher than the income share of pensions in total disposable income over time and across household types and regions, as shown in Table 9. The estimates suggest pension income

has been the dominant factor in the inequality of the urban elderly, while the dominant factor for the rural elderly is wage income and business and asset income, as the income share of the pension is much lower in the rural regions. For all households, the contribution of pensions to inequality has been steadily growing over time, accounting for 8 percentage points in the coefficient, which is 18.7% of the total Gini coefficient. It is higher than its income share (14.4%) and the share of the elderly population (13.3%) in 2013. This finding suggests that the critical role of public pensions in shaping the income distribution among the elderly population.

Table 8 Relative contribution of the income component to the extended Gini indices

($v=2,4,6$), elderly households (%)

	1988			1995			2002			2013		
	$v=2$	$v=4$	$v=6$	$v=2$	$v=4$	$v=6$	$v=2$	$v=4$	$v=6$	$v=2$	$v=4$	$v=6$
Wage	43.2	34.3	29.9	47.6	43.4	41.0	44.9	43.2	41.6	33.9	35.9	36.7
Business & asset	34.3	46.9	53.0	22.0	28.4	32.5	1.1	6.7	10.2	16.4	17.3	18.4
Tax	0.4	0.6	0.8	0.1	-0.0	-0.1	-1.7	-1.6	-1.5	-2.3	-2.2	-2.1
Public pension	14.5	11.4	10.0	27.7	25.2	23.4	50.4	44.9	42.1	50.3	47.0	44.7
Social benefits	2.6	2.5	2.3	0.6	0.6	0.6	0.6	0.6	0.7	-0.1	-0.1	-0.0
Other	5.0	4.3	4.0	2.1	2.4	2.5	4.7	6.2	6.8	1.9	2.0	2.4
Total Contribution	100	100	100	100	100	100	100	100	100	100	100	100

Note: The notation “ v ” corresponds to the aversion parameter in equation (2). The columns with different aversion parameters represent alternative ways to weight various parts of the income distribution. When $v=2$, the result is the same as the standard Gini decomposition. Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors’ calculations based on weighted CHIPs data.

Table 9 Comparison of public pension share to income and inequality ($v=2$), %

	Pension income share				Pension inequality share			
	1988	1995	2002	2013	1988	1995	2002	2013
All households	2.9	4.5	9.6	14.4	5.2	7.1	15.6	18.7
Elderly households	7.4	14.9	29.0	36.9	14.5	27.7	50.4	50.3
Urban	26.0	44.3	51.3	47.8	27.5	48.0	57.4	52.2
Rural	0.8	0.4	1.5	10.3	0.9	0.6	3.9	14.0

Note: Elderly households are defined as households with at least one member above aged 60+ years.

Source: Authors’ calculations based on weighted CHIPs data.

Gini Income Elasticity (GIE) of Public Pensions

Table 10 and Table 11 further report the GIE of public pensions. This measures the impact on income inequality of a marginal proportional change in an income source. A negative value indicates that the marginal increase in this income will narrow inequality and vice versa. All GIE estimates are positive, indicating a marginal proportional change in public pension income

tends to increase inequality in all years, suggesting its regressive marginal impact on the income distribution. In 2013, income from the labour market, social benefits and other (incidental) income tends to reduce inequality. This is interesting as market income, including business income, is often considered as the primary source of gross income inequality in most countries, while public pensions, as part of the social welfare system, generally tend to reduce income inequality.

Table 10 Gini income elasticity of public pensions, %

	1988	1995	2002	2013
All households	0.023	0.026	0.059	0.036
Elderly households	0.071	0.128	0.214	0.127
Urban	0.000	0.002	0.022	0.036
Rural	0.014	0.035	0.061	0.041

Note: Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors' calculations based on weighted CHIPs data.

The results of the analysis echo the timeline of the pension reform history as discussed in earlier sections. Before 2009, less than one-third of the elderly population was covered by any public pension and even in 2013, nearly a quarter of elderly people remained uncovered. For most of those covered for rural areas, the benefits were set at about one-third of national minimum living standards, while the number of the rural elderly make up of about two-third of the whole countries' elderly. However, the benefits for urban public sector pensioners have been increasing at a higher rate over the period due to urban-biased policies. The annual growth of the pension benefits for vast majority of urban pensioners has been around 10% in 2005-2015 and 6.5-5% in 2016-2018. The growth rate is much higher for urban pensioners than rural pensioners. As a result, in 2013, for 53% of the elderly, the public pension benefits share of their total disposable income was less than 10%. This is the result of the urban-biased and status-biased public pension benefit policy, similar to many other urban-biased policies in China, as discussed in Yang (1999).

Table 11 Gini income elasticity of income components of elderly households, %

	1988	1995	2002	2013
Wage	0.207	0.199	0.125	-0.008
Business & asset	-0.298	-0.336	-0.296	-0.058
Tax	0.012	0.011	-0.003	0.001
Public pension	0.071	0.128	0.214	0.134
Social benefits	0.004	0.001	-0.001	-0.015
Other	0.005	-0.003	-0.039	-0.055

Note: Elderly households are defined as households with at least one member aged 60+ years.

Source: Authors' calculations based on weighted CHIPs data.

The Contribution of Public Pension Policy Design to Income Inequality

The empirical finding that public pensions contribute to greater income inequality in China leads to the question of whether it is the inherent design of the policy that contributes to worsening income inequality among the elderly population.

To assess the individual policy elements of public pension design, we numerically derive the marginal effects on the Gini coefficient with respect to one or several pension policy changes with the same fiscal burden. Each of the four scenarios has three variants, which correspond to an increase of 0.5%, 1% and 1.5% of total expenditures. The four policy scenarios are:

- (1) Increase existing pensioners' benefits proportionally.
- (2) Increase the minimum level of public pension benefits for existing pensioners.
- (3) Expand coverage of public pensions to more elderly people based on the current pension benefit distribution.
- (4) Full coverage of public pensions with minimum benefit guarantee.

Different policy scenarios with the same variant will have the same amount of increase in total public pension expenditures, enabling us to compare the marginal Gini change at the same fiscal level. Appendix B lists further technical assumptions related to the simulation. The results are reported in Table 12.

The result from the first scenario suggests that proportionally increasing existing benefits for all pensioners will exacerbate income inequality for elderly households. In contrast, scenarios two, three and four will reduce income inequality by increasing pension coverage and the minimum pension payout. This finding has important policy implications given the considerable income inequality among elderly households. The first scenario in some way resembles the current policies of China's public pension indexation in terms of the increasing gaps between urban and rural pension payouts. The pension indexation policies in China have only been applied to urban pensioners, but not rural pensioners.

Table 12 Changes in Gini of per capita total disposable income compared with 2013

Public pension expenditure increase (%)	Public pension policy scenarios			
	(1)	(2)	(3)	(4)
Changes of Gini coefficients for elderly households, %				
0.5 %	0.06	-0.45	-0.29	-0.37
1.0 %	0.13	-0.87	-0.59	-0.75
1.5 %	0.19	-1.28	-0.87	-1.15
Changes of Gini coefficients for all households, %				
0.5 %	0.02	-0.15	-0.11	-0.13
1.0 %	0.04	-0.30	-0.21	-0.26
1.5 %	0.06	-0.45	-0.32	-0.40

Note: Elderly households are defined as households with at least one member aged 60+ years. In the third scenario, the pension level is drawn randomly from the current distribution. Results reported are the average of 100 runs.

Source: Authors' calculations based on the CHIPs data. See Appendix B for detailed simulation parameters.

Among the three policy change scenarios that reduce income inequality, we note that the two scenarios providing a minimum public pension guarantee related policies seem to be the most fiscally effective ways of reducing income inequality among the elderly population in China. This is in line with expectations, given the poor pension coverage among the low-income population. Earlier studies, such as research by Gao, Garfinkel and Zhai (2009), suggested subsidies assisting residents to maintain minimum living standards in China can lower the poverty rate and substantially reduce the poverty gap. Considering that poverty is more likely to concentrate in rural areas, raising the minimum public pension would be likely to also have a positive effect on poverty reduction.

VI Conclusion

Using CHIPs data from 1988, 1995, 2002 and 2013, we decomposed the inequality of per capita income of elderly households over the past three decades. The data has been adjusted to a consistent income classification with price inflation correction and calibrated regional weights. This adjustment allowed us to overcome the traditional hurdle of regional comparability, and to derive national estimates. The analysis is the first to our knowledge that examines the national income distribution of the elderly population and the contributions of public pensions to income inequality in China across this extended period of time.

In 2013, public pension income constituted 37% of total disposable income in households with elderly members, dominating all other income sources. Public pensions have become an increasingly important policy instrument for influencing income distribution in China for both the elderly population and the general population. During the period we examined, the share of elderly people in the population doubled, covering about one-third of all households in China by the end of the period. The pension benefit, however, is highly unevenly distributed, with a Gini coefficient of 0.74, contributing more than 50% to the income inequality of elderly households in 2013 based on our decomposition estimates. Throughout the 26 years, public pensions increased rather than decreased income inequality.

By examining the marginal change in inequality with respect to policy element changes such as increased benefit level or minimum pension amount, we found that the pension income inequality seems to be driven by the policy coverage and design. Merely increasing the existing pensioners' benefits at the same rate would worsen income inequality among elderly households in China. This means that if current urban biased pension benefit indexation policies continue, income inequality among the elderly population will be likely to rise further. It seems that ensuring the minimum pension amount, rather than only expanding coverage, is the most fiscally effective way of reducing income inequality.

Lastly, it should be noted that our analysis is limited to income inequality and thus does not capture the savings and wealth that retirees may also rely on. This may be of particular interest for pensioners, as they would typically consume their savings to maintain their living standards. While the exclusion of wealth does not alter our conclusion on the income distribution *per se*, it would certainly be useful to complement the income-based analysis with an examination of wealth distribution in future research, to provide a complete picture of the interactions between pension policies and the living standards of elderly households.

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Appendix A: Definition of household income in CHIPS

Variable	Description
Disposable income	wage + business & asset - tax + public pension + social benefits + other income.
Wage income	Gross wage income (before paying income taxes, social insurance and housing provident funds contributions). Includes wages, salaries, fringe benefits, cash and in-kind benefits, inflation and housing subsidies; matched housing provident funds contributions from employers.
Business & asset income	Net values (gross income minus costs, and business or value-added taxes, fees and (contract) payments paid to state government or collective, etc.). Includes incomes from business activities in primary, secondary and tertiary industries; self-consumption of the products; income from renting out (intellectual) property; insurance income; other incomes directly from collective-units; boarding fees from relatives and friends; dividends; interest income.
Tax (negative values)	Personal income taxes; social insurance contributions; payments to collective welfare and social pooling funds (Cun Tiliu, Xiangzhen Tongchou), rural education funds, miscellaneous fees; value of unpaid work and payments to uncompleted work for a collective; penalties on planned parenthood; other taxes.
Public pension	Public pensions paid for both standard and early retirees, excluding internal retirees (employer-specific arrangements for workers close to retirement) .
Social benefits	Social assistance and social insurance benefits, excluding public pension benefits and medical care paid by governments. Includes social assistances in cash; in-kind or free services offered by governments; old age allowance; one-child allowance; pensions for internal retirees; unemployment insurance; cash subsidies for agriculture support; implicit incomes from all kinds of coupon benefits from the price differences between markets and governments.
Other income	Incidental, unclear incomes, etc. Includes incidental bonuses, allowances and payments for an incidental article or book written; severance payments (or compensation received for being laid off between 2002 and 2013); income from inheritance; reparations; remittances and alimony income; medical care paid by governments.

Notes: The creation of household income variables:

- Disposable income. Disposable household incomes are calculated by summarising income across all six categories.
- All kinds of incidental income were separated from main income sources and included in the ‘other income’ category. For example, severance payments or compensation received for being laid off between 2002 and 2013, which were classified as part of wage income in NBS and/or CHIPS data, are moved into the ‘other income’ category in our data. This differs from some other CHIPS-based publications such as Griffen and Zhao (1993), Gustafsson, Li and Sicular (2008) and Li, Sato and Sicular (2013). Such adjustment however, does not affect our main conclusions.

- Medical care paid by governments has been moved from ‘social benefits’ into ‘other income’ due to its extremely large variance, which results from the very different benefit policies across work status.
- Housing income. Housing subsidies and provident funds matched by employers have been included in the ‘wage income’ category as a type of fringe benefit. The contribution rates of housing provident funds from employers vary from 1% to 9% according to the government records. Employers would match the same amount of contributions to employees’ individual accounts. This data is not directly available in CHIPs for 2013. It however, can be imputed based on the difference between the total social security contribution and the sum of all other social security contribution components.
- Imputed rental value of self-owned occupied housing. We have excluded this type of income for the following reasons. Firstly, the role of public pensions for elderly households is mainly to finance their daily non-durable consumption. Therefore, the differences in the value of their self-owned occupied housing should be excluded. Secondly, compared to young people, far fewer elderly people have to pay rent for their own housing. Finally, consistent time series data are not available due to the long period covered by this study and the high volatility of housing markets between 1988 and 2013.
- Internal migrants. The extra internal migrant samples from CHIPs are excluded from our analysis. Few migrants live in elderly households, and the migrant elderly only could be covered by the new rural public pension systems even though they live in urban areas. The survey for migrants began in 2002, and the income data has been collected through inquiries by inspectors in 2002–2007, which differs from the data collection approach used in the general urban and rural survey, which is through families keeping records.
- Sample weights across regions were adjusted by four groups – western, eastern, middle, and large cities (Beijing, Tianjin, and Shanghai) – using the weights in CHIPs. Population data for each region are from the nearest wave of the Population Census. For the weights in 2002–2013, migrants are deleted from the total urban population.

Appendix B Parameters used in the policy simulation

No.	Policy scenario	Scenario description
1	Increase each of the existing pensioners' benefits proportionally	Increase each of the existing pensioners' benefits: (a) 0.5% (b) 1% (c) 1.5%.
2	Increase the minimum level of public pension benefits for existing pensioners	Increase the minimum level of the existing pensioners' benefit levels to: (a) 940 yuan/year (b) 1320 yuan/year (c) 1665 yuan/year.
3	Expand coverage of public pensions to more elderly people	Expand coverage of public pensions according to the existing public pension benefit distribution. Pension benefits are assigned randomly to those who are above the pension age but not receiving any benefit: (a) 7.5 % of the elderly population (b) 15 % of the elderly population (c) 22.5% of the elderly population.
4	Full coverage of public pensions with minimum benefit guarantee	If anyone above age 60 has a pension benefit level lower than the specified level, increase it to: (a) 400 yuan/year (b) 700 yuan/year (c) 925 yuan/year. This is a combination of full coverage and increases in the public pension benefit level.

Note: (1) In the 2013 CHIPs data, the annual public pension benefits for 31.87% of the rural elderly are less than 660 yuan, which is the public pension benefit. One reason for this could be that the public pension benefit was paid monthly, and many of the pensioners only received partial-year payment given the different local pension rollout schedules. (2) In the third scenario, public pension benefits are extended to the elderly population without public pensions. The amount is randomly drawn from the current distribution of the public pension (excluding zero). Given the stochastic nature of the simulation, the result reported from the third scenario are the average of 100 runs.