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**Income Redistribution in Urban China by
Social Security System:
An Empirical Analysis Based on
Annual and Lifetime Income**

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Abstract

This study investigates the redistributive effect of the social security reform in urban China using the nationally representative urban household surveys in 1995 and 2002. The main findings are as follows. First, public pension is the main income for the elderly in urban China. Majority of people aged 60 and over (72% in 1995, 82% in 2002) have pension. Second, the social security system in urban China improved the income of low-income and older age groups and reduced the relative poverty rate. However, the redistributive effect did not offset the expanding income inequality, which resulted in the Gini coefficient of redistributed income in 2002 being higher than that in 1995. Third, during 1995 and 2002, both low income group and high income group get positive net benefit from social security system, but the net benefit is increasing with income. There is an adverse income transfer in social security system no matter measured on annual income or lifetime income. Fourth, assuming that the reformed policy were applied to public sector employees, the long-term redistributive effect of the pension system for the working population, as calculated using their lifetime income, would be larger.

JEL classification: E21, H55, P43

Keywords: lifetime income; income redistribution; social security; pension; China

1. Introduction

After 30 years economic growth since 1978, China has made significant progress in raising the living standards of urban and rural residents and decreasing the population of people living below the poverty line. The poverty rate declined from 53% in 1981 to 8% in 2001 (Ravallion and Chen, 2007)¹. On the other hand a dramatic widening of the income gap

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had accompanied. According to the World Bank (2003), the Gini coefficient in China rose from 0.3 in the 1980s to 0.42 in 1993, which was the most rapid in developing countries². Moreover, several studies estimate the long-term income inequality in China and find an upward trend (e.g. Ravallion and Chen, 2007; Meng et al, 2010). Li and Luo (2011) use the latest household survey data to correct the potential biases caused by problems such as the difference living cost between urban and rural area, under-representative of high income households in the sample and get a Gini coefficient as high as 0.485. As pointed by Chen et al (2006), certain sub-groups have been adversely affected or have been unable to participate in the new economic opportunities due to their lack of skills, long-term illness or disability. Some of the “left behind” households started poor and some became poor, even though aggregate poverty rates have tended to fall over time. As a redistributive policy, the effect of social security system in current China becomes an important topic concerned by scholars and policymakers.

Social security system generally includes social insurance system, social assistance system and social welfare system. Social insurance requires the insured persons to pay certain insurance premiums or taxes in order to obtain corresponding rights, which is generally not for the purpose of income redistribution. For some social insurance plans, however, benefits actually received have little to do with contribution and the benefits may not depend

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¹ For studies on urban and rural poverty in China, see Chen and Ravallion (2004, 2007, 2008), Ravallion and Chen (2007), Chen et al (2006), Xia et al(2007), and Luo (2010).

² The estimation of income inequality depends on the definition of income. Ravallion and Chen (2007) make adjustment for the cost-of-living difference to get a lower Gini coefficient. Before the adjustment, it is 0.42 and 0.447 respectively in 1993 and 2001. After adjustment, it is 0.367 and 0.395 respectively. Li and Luo (2007) include all implicit income of all kinds of social security programs and make adjustment for the cost-of-living difference between urban and rural area and obtain a Gini of 0.44 in 2002.

completely on the amount paid. Thus social insurance plans also contribute to income redistribution to a certain extent. Funded by public finance, social assistance and social welfare, on the other hand, are direct income redistribution plans. If social security system in one country mainly targets at providing social insurance, it has less income distribution effects; if social assistance and social welfare, funded by public finance, constitute the major part of social security system, the system has relatively strong income distribution effects. In addition, the scopes of population covered by social security and the extent of protection provided by social security also have direct impacts on its income distribution effects. Therefore, the role which the social security system plays in income distribution depends on the composition and specific designs of the system. Its effect on income distribution of social security is an empirical issue.

Generally speaking, there are two perspectives to test the redistributive role of social security. One is to investigate the effect of certain program in the system. The other is to estimate the overall effects of income transfers made by all kinds of programs in the system. Annual household or individual data is always used. However, annual data might not reflect the real economic situation of the household or the individual (Rosen, 2008). Especially when evaluating the redistributive effect of public pension plan, life cycle data is needed to compare the total contribution and benefit. During working age period, one contributes to pension system and hence the net benefit is negative in each year in this period of life cycle. By contrast, one gets positive net benefit after retirement if based on annual income. Therefore, we have to predict and estimate the contribution and benefit and obtain the net benefit in life cycle. Nelissen (1998) compares the differences using annual income and life cycle income in detail. There are several literature to evaluate the redistributive effect of public pension using life cycle income for various countries, for instance, Nelissen (2000) for Italy, Coronado et al.(2000, 2002) and Liebman (2002) for US, Oshio (2002,2005) for Japan.

For developing countries, Barrientos(2007) concludes that emergent tax-financed social security holds the promise to make an impact on global poverty and vulnerability. Kaseke (2010) argues that the role of social security in South Africa is to prevent and reduce poverty and to promote reintegration. For Chinese system, He (2004) investigated regional and occupational disparities in pension benefits. Wei and Gustafsson (2005) found inequality in

medical expenses between urban and rural residents and among China's eastern, middle, and western regions. Ren et al. (2004) conducted a macro study on the intergenerational imbalance of the pension system using generational accounting. He (2008) utilized one year's micro data to examine differences in the income transfer effects of public pension plans. However, these studies addressed only one separate program the social security system and were based on data of one year. They did not examine the overall redistributive effect of social security system.

He and Sato (2008) preliminarily estimate the redistributive effect of social security. But there are biases in estimation of income and the more discussion is needed to justify the redistributive function of Chinese social security system. This paper will redefine income by taking tax and private and public transfer into consideration. The database used is drawn from the micro data obtained from the 1995 and 2002 urban household surveys (China Households Income Project, or CHIP) by the Institute of Economics, Chinese Academy of Social Sciences. First we use annual data to estimate the transfers by a variety programs including public pension, minimum living allowance and investigate the redistributive effect on various income groups and age groups. Secondly, we are projecting life cycle income to estimate the income redistributive effect of public pension program and we will compare its effect on improving income inequality under the different scheme.

This paper proceeds as follows. Section 2 introduces the institutional context and the data used; moreover, we capitalize on the official macro data and micro survey data to consider the role of social security system on income distribution in urban China. After introducing relevant concepts and empirical methodologies, Section 3 presents the social security's redistributive effect based on individual income in a certain year. Section 4 estimates redistributive effects of public pension system with life cycle income and compares the different degree of income redistributive effects of various pension plans . Section 5 concludes the study.

2. Institutional Background and Data

2.1 Institutional Context

In 1951, China issued the *Insurance Provisions of Republic of China*, which included pension, medical, and work related accident insurance provisions. This document became the embryonic form of the social security system during China's planned economy era. Prior to the economic reforms, Social security for urban employees in public sector³ and enterprises was provided through work units (*danwei*). The benefits, including pension, medical care, housing, and other income subsidies, were financed by enterprises or fiscal budget, the employees had no necessary to pay for their benefits.

With transition to a market economy, the original social security system will no longer meet the demands of rapid economic development. China started to reform its original social security policies after the 1980s; in the late 1990s, the urban employees' pension system, medical insurance, and other social security policies, among others, were adjusted substantially. Up to now, urban social security system has been established, consisting of social insurance (public pension, medical care, unemployment insurance) and minimum living allowance.

The most important pension reform were introduced in 1995 and revised in 1997, the State Council issued a new document, No 26, in July 1997 and established a new pension system for urban employees in enterprises, to be called the Basic Pension Insurance⁴. The Basic Pension Insurance is available for all employees of all urban enterprises, including state-owned enterprises, collective enterprises, foreign-owned enterprises etc.⁵ The new

³ Public sector here refers to institutions and state organs that are mainly financed by fiscal spending, such as government sector, education sector, health sector etc.

⁴ The note on the pension system here is mainly based on Feng, He and Sato (2008). Drouin and Thompson (2006) had more detailed explanation on the social security system in China.

⁵ Some public institutions began to take part in the insurance system since 1999, but the percentage was very small. For insured staffs in public institutions, the percentage was 6.7% in 1999 and 9.8% in 2007 among all the participated employees. (The China Statistical Yearbook, 2008)

system has three pillars: a pooling account to redistribute to all beneficiaries, compulsory individual accounts, and voluntary supplementary pensions provided via commercial insurance. The first pillar imposes a payroll tax of 17% (paid by employers) to ensure that employees who have worked more than 15 years have a replacement ratio of 20%. The second pillar (paid jointly by employers and employees) establishes an individual account for each employee. The contribution rate for this is 11% of an individual's wage, of which the employer contributes 3-8%. After retirement, the employee gets a monthly benefit from this account amounting to the accumulated value divided by 120. But a change was made in December 2005 to adjust the percentage that goes to the individual account and the ways to calculate and receive pension payments. There were two changes in 2005's reform, one is the contribution rate of individual account declined from 11% to 8%. The other adjustment is to change the benefit obtained from first pillar (basic pension) and the second pillar (individual account pension). Benefit from the first pillar depends on the amount and years of contribution instead using a uniform replacement rate for average income (20% in 1997's version). The benefit from individual account has been changed to be more actuarial (See appendix table1 for details). On the other hand, employees in public sectors experience no reform and the benefit is a percentage (75-100%) of the wage just before retirement. It is worth noting that, in Chinese pension system, the beneficiary is the contributor himself. There is no consideration for disabled workers and their families, for young children of a deceased worker and for elderly spouses and surviving spouses, which is different from the case in some other countries, such as Japan and the US.

In December 1998, the State Council selected a new model for urban workers' health insurance, to be called the Basic Medical Insurance System (BMI)⁶. The BMI program replaced the old health insurance system for urban workers and dependents and the

⁶ The China Statistical Yearbook referred to this system as the Basic Medical Insurance before 2007 and thereafter as the Basic Medical Care Insurance. Following Drouin and Thompson (2006), this system is referred as the Basic Health Insurance in this paper.

Government Health Insurance System for civil servants and public worker. The implementation of the BMI has begun in almost all areas of the country, but is not yet complete in that many of the employers that are supposed to be covered by the new system are still operating under one of the old systems. Moreover, medical insurance covers government employees whereas pensions do not (ILO, 2006). The BMI is designed to rely on a combination of individual accounts to finance out-patient care and social pooling to finance in-patient care. The contribution rate of BMI for employees is 2%.

The reform of unemployment insurance started in 1998. The contribution rate was 1% of an employee's wage in order to be insured. Employees were not required to pay contributions until the unemployment reforms in 1998. In addition, the minimum living allowance sponsored by the Ministry of Finance was implemented in 1999.

We use official macro data to show the coverage of social security system after reform (Figure 1). There has been a rapid extension of the coverage, among which BMI rose most rapid, from 7% in 1998 to 46% in 2007. Pension insurance coverage rose from 38% in 1995 to 51% in 2007. Unemployment insurance coverage fluttered around 40%. Although the number of urban employees covered by the social insurance had increased in the past decades, half of them were not included until 2007.

(Insert Figure 1 here)

In general, the extension of the social security coverage will strengthen the income redistributive effect of social security, narrowing income inequality. As mentioned above, however, individual contributions to the social security programs were low before the social security reforms in the late 1990s, because people could receive various subsidies from their work units and retirees could draw benefits equaling a percentage of preretirement wages. It seems that during that period the net benefit of social security was always positive for high- and low-income groups. However, an individual's expenditure had increased on the aspect of

social security after the reforms for pension, medical insurance and other kinds of insurance. Also, some workers did not receive their entitled benefits because of various flaws in the system. For example, the original living allowance was replaced by a severance payment for laid-off workers. However, Xia et al. (2007) found that only 18% of the laid-off workers' families received this subsidy in 2002. The research also indicated that only 11% of laid-off workers' families received unemployment benefits and only 8% of the laid-off workers' families enjoyed the minimum living standard guarantee. Moreover, Cai, Giles, and Meng (2006) found that pension arrearages had emerged in some areas. Therefore, compared with the pre-reform system, the relationship between an individual's social security benefit and his contribution was uncertain after the reform. An empirical test is required to determine how the social security improved income distribution in urban China by income transfer. We use the CHIP data to estimate the social security system's redistributive effect.

2.2 Data

The data used in this paper are from the China Households Income Project (CHIP) survey, which was conducted in 1996 and 2003 by the Institute of Economics at the Chinese Academy of Social Sciences. The samples of CHIP data were drawn from the large sample used by the NBS in its annual household survey⁷. The NBS's sampling method is that the respondent households are selected using a two-stage stratified systematic random sampling scheme. In the first stage cities and county towns are selected; in the second stage households within the selected cities and county towns are chosen. The procedure to select cities and county towns is designed as follows. First, all cities and county towns are classified into five categories on the basis of their population size. At the second stage, the households are selected in each sample city by a multi-phase sampling scheme. The above sampling method yields about 35,000 households selected for the NBS annual household survey in 1995 and

⁷ Based on Li et al. (2008); see the article for more details.

45,000 in 2002. These samples represent total urban populations of approximately 350 and 450 million in the two years, respectively.

The 1995 and 2002 the CHIP data cover 6,931 families (21,696 individuals) from 11 provinces and 6,835 families (20,632 individuals) from 12 provinces, respectively. Survey questions included individual characteristics, individual incomes, and family assets. Information about each respondent's age, sources of income, employment status, and ownership and industry of his/her employer are included. One of the advantages of CHIP data is that it has more items of income, such as subsidy for the laid-off, minimum living allowance, subsidy from enterprises, the in-kind transfers. The CHIP data were widely applied in research on income distribution, and many relevant studies have been published. Recent works include Gustafsson, Li, and Sicular (2008), Khan and Riskin (2005), Sicular et al. (2007), and Yin et al. (2006). These studies provided insights into changes in China's income distribution structure, urban-rural and regional income disparities, and mobility. For example, in their re-estimation of income disparity between urban and rural China, Li, and Luo (2007) included all types of invisible income (e.g., social security transfers) in urban residents' total income. Xia et al. (2007) analyzed the trend and pattern of Chinese urban poverty. We are going to quantitatively measure the redistributive effect of the social security reform in urban China, especially the degree of income inequality under pension reform, using these data sets. Table 1 compares income-related statistics of surveys conducted in 1995 and 2002 with data from the China Statistical Yearbook with. Table 1 shows that, based on the CHIP data, the results of the average wage, the household disposable income per capita, and the pension replacement rate were all very close to the ones based on the national statistics.

(Insert Table 1 here)

Figure 2 describes some basic information about public pension and medical insurance system in urban China. The figures indicate that both in 1995 or 2002, majority of people

aged 60 and over could receive pension. If we focus on the retirees aged 60 and over, in 1995 95.95% of retirees aged 60 and over received pension payments, and in 2002 98.07% received. Pension-R3 indicates that in 2002, 2.14% of retirees did not receive their pensions on due. This issue did not appear in the 1995 questionnaire because pensions were rarely in arrears in 1995. On the other hand, the percentage of people covered by public health insurance declined from 61.5% in 1995 to 47.16% in 2002. The decline of the percentage can be further separated according to employment status: for active employees the change is from 76.2% in 1995 to 63.09% in 2002, and for retirees, from 81.76% in 1995 to 71.88% in 2002. The numerator and denominator of Health-R1 and Health-R2 included all enterprise and public sector employees. Enterprise employees probably received public medical and health services in 1995 and did not participate in the new medical insurance system, leading to a decline in these two ratios. In addition, the CHIP data indicate that the percentage of unemployed or laid-off workers aged 16–59 rose from 2.68% in 1995 to 6.18% in 2002, but only 28.37% received unemployment insurance benefits or minimum living allowance. The main sources of income for the elderly are pension income, salary and private transfer. The average ratio of these three items to total income for the retirees aged 60 and over was 85.39%、6.05%、3.83% respectively in 1995 and 92.83%、3.18%、1.75% respectively in 2002. Clearly, pension was the major and increasing source of income for retirees in urban China and played an essential role in old-age income security.

(Insert Figure 2 here)

3. Redistributive effects of social security on different income groups

We employ the CHIP data to divide individuals into different income groups to estimate the income redistribution effects of China's social security system. First of all, it is necessary to discuss the measurements of income and benefit from social security.

3.1 Relevant Concepts and Definitions

The main idea of estimating the redistributive effect is to compare the inequalities of initial income and redistributed income. Initial income is an individual's total earnings prior to redistribution, which is derived from either labor or returns on assets, and includes income from wages, interest, commercial insurance, income-in-kind, etc., whereas redistributed income, in addition to including initial income and net of taxes, also includes the individual's social security benefit. The social security benefit includes not only cash benefits such as pension payments but also noncash benefits such as medical treatment, education, and services. In China, subsidized public housing is considered an in-kind payment. The taxes mentioned include income tax, asset taxes, and social security payments (e.g., pension contributions and medical insurance payments). By comparing initial and redistributed incomes, we can observe the effects of redistribution policies.

Two indicators can be used to measure the redistributive effect. One is MT index, which was generated by Musgrave and Thin (1948).⁸ The expression of MT index is:

$$MT = G - G^*$$

Where G is the Gini coefficient of initial income and G^* is the Gini coefficient of redistributed income. It compares Gini coefficients before and after redistribution. If the Gini coefficient of initial income distribution is larger than that of redistributive income distribution, the policy is said to improve the income inequalities and has a positive effect on income distribution. Otherwise, the policy makes income inequalities worse and has negative effect on income distribution.

The other indicator is called redistributive coefficient, which is to measure the relevant variation of income inequalities. The expression of the indicator is as following equation.

⁸ Coronado et al. (2000) derived a measurement from this index to estimate the effective progression (EP) of social security.

$$R = MT/G \times 100$$

Because our study focuses on the redistributive effects affecting workers and retirees in urban China, we selected urban residents above 16 years of age (samples of 4024 in 1995 and 3378 in 2002 were excluded), and eliminated samples classified as “currently a full-time student,” “awaiting job assignment or school admission,” (1207 in 1995 and 1529 in 2002) and those whose income or current status information was missing (717 in 1995 and 34 in 2002)⁹. The sample size after the adjustment was 15,748 for 1995 and 15,691 for 2002.

The measurements of initial income and redistributed income are as follows¹⁰:

Initial income = salaries + net income of private businesses + property income + private insurance benefits + monetary value of income in kind + other minor sources of income.

Redistributed income = initial income – personal income tax + social security benefits (pension benefits, social relief that includes the minimum living standard guarantee, unemployment insurance, medical expenses paid by public sources) – social security payments

Table 2 shows the summary statistics of initial income and redistributed income. Compared with 1995, in 2002, both social security benefits and social security contribution increased, however, social security benefits increased only by 74.31% while the contribution

⁹ Considering the income information of the unemployed might be missing, in order to keep the unemployed in the sample, for these samples with current status being unemployed and no income information recorded, we would change the income to zero.

¹⁰ It should be noted that the composition of the initial and redistributed incomes used here is different from the “gross income” used in Atkinson et al. (1995). Our initial income does not include transferred income from public policy and social security. And since private transfers such as alimony tend to respond to negative shocks experienced by the recipients (Cai, Giles, and Meng 2006) and would confound the redistributive effects of public transfers. The CHIP data identify two main sources of private transfer income: required cash transfers by relatives (alimony income) and cash voluntarily transferred by relatives (donated income). Both sources of income are likely to respond to income shocks (such as pension arrearages, lay-offs, or unemployment); therefore, our analysis excludes them from initial income.

increased by 645%.

(Insert Table 2 here)

3.2 Social Security's Effects on Different Income Groups

First, we examine social security's redistributive effects on reducing poverty. Adopting the approach of Cai, Giles, and Meng (2006), we calculated the proportion of families below the poverty line. The poverty line is based on the minimum living standard consumption per capita calculated by the Ministry of Labor and Social Security for each province's capital city. The average annual poverty line across the 12 capital cities of the CHIP provinces was 2454 Yuan per capita in 2002. Household per capita initial income below 2454 Yuan accounted for 17% of total households, but if measured by per capita redistributed income, the poverty households accounted for only 2%. Clearly, social security contributed enormously to reducing poverty.

We use the relative poverty rate as a measurement without the data of minimum living standard consumption per capita line.¹¹ According to Förster and Mira D'Ercole (2005), the relative poverty rate is defined as:¹²

$$PR = N_p/N \times 100$$

where N refers to the number of whole population, and N_p is the number of population that earns less than half the median income.

In 1995, the median initial income was 4,876 Yuan. 18.2% households' reported income was below half the median total household income, whereas the percentage of households receiving redistributed income under 2,438 Yuan decreased to 3.2%, showing a decline rate of

¹¹ Since the minimum living allowance program was not in effect in 1995, the share of household benefited from the program can't be used to measure poverty.

¹² They use this method to analyze income distribution in 27 OECD countries.

82.4%. Similarly, we calculated that the relative poverty rate based on initial income was 23.6% in 2002, yet the relative poverty rate based on redistributed income was only 6.6%, showing a decrease rate of 72%. However, the 2002 PR indexes for both initial and redistributed income increased relatively to the 1995 indexes, indicating that population of the lowest-income group had increased.

Using initial income per capita and redistributed income per capita, we divide individual into quintile groups according to initial income and redistributed income respectively to examine income distribution of initial income and net benefit distribution of social security. Table 3 reports the mean age and sample sizes in each income group.

(Insert Table 3 here)

(Insert Table 4 here)

Table 4 shows the distribution of initial and redistributed incomes as a percentage share of the total income in 1995 and 2002. The first two rows display each quintile's percentage share (initial and redistributed incomes) in 1995. The middle two rows display each quintile's percentage share (initial and redistributed incomes) in 2002. For both 1995 and 2002, note that the redistributed income of different quintiles has a more equal distribution because of benefits from social security. In particular, the lowest quintile's share of total income increased by 9.48 percentage points in 1995 and 10.22 percentage points in 2002 (see Change 1 in Table4). Further, compared with initial income, redistributed incomes of groups above the middle quintile accounted for a smaller share of the total income, and the higher the income, the larger is the proportionate decline. Therefore, social security has a greater effect on increasing the income of lower income groups measured by annual income.

Note that the groups ranking below the middle quintile showed a decrease in percentage share between 1995 and 2002, whether measured by changes in initial income (Change 2-I) or redistributed income (Change 2-R). Also, the percentage share increased for the fourth fifth

and the highest fifth. As measured by initial income, the lowest quintile's share of total income declined from 4.12% in 1995 to 2.8% in 2002, but the highest quintile's share rose from 40.16% in 1995 to 45.21% in 2002. This is also the trend for redistributed income. The lowest-income quintile's share declined in 2002 compared with that of 1995, but the trend for higher-income groups was the opposite. This demonstrates that inequality of income redistribution in urban China was growing, as the Gini coefficient in the rightmost column of Table 5 illustrates that the Gini coefficient in 2002 is larger than that in 1995 for both initial and redistributed incomes.

Moreover, the redistributive coefficient R (the last two rows of Table 4), representing the relative change in the degree of inequality, was essentially identical in 1995 and 2002, but the Gini coefficient in 2002 increased over 1995. Social security's income transfers reduced inequality by raising income among low-income groups, but not enough to offset the expanding inequality in initial income.

Besides the possible change of the redistributive effect of the policy rules in social security system, this result can be explained in two aspects: first, income shocks (such as being laid-off, unemployment) faced by individuals in 2002 exacerbated the degree of income inequality. Since 1996, China's labor market reforms have led to a large number of laid-off workers. The number of laid-off workers had a rapid increase from 8,916,337 in 1996 to 14,352,155 in 1997 and to 19,771,986 in 1998. From 1999 to 2001, more than 200 million people were laid off every year, and the number of laid-off workers accounted for about 19% of the total workers in post. The number of laid-off workers in 2002 was slightly down but still up to 19,594,870 people, accounting for 18.56% of the total urban workers in post¹³. Also, Xia et al. (2007), using the CHIP database, found that the percentage of families with laid-off members had increased from 5.55% in 1995 to 20% in 2002. These laid-off workers were

¹³ Source: *China Labor Statistical Yearbook, 1997-2003*.

supposed to get a severance payment for being laid-off, but only 18% of the laid-off workers' families could get this payment in 2002. The average yearly income of these (laid-off or unemployed) people was only 29% of that of the working or employed ones; these income shocks have undoubtedly increased inequality of the initial income distribution.

On the other hand, though the social security system in urban China, including pension insurance system, medical insurance system and other kinds of insurance, was thoroughly reformed in the late 1990s, Figure 1 presents that the coverage of urban employees by social security was still low in 2002, including that the maximum coverage of pension insurance was less than 50%. Furthermore, since the government promised to take responsibility for social security and asked laid-off workers to determine the labor contract with their original work units, the living subsidy provided by work units had reached an extreme low level in 2002. In fact, Xia et al. (2007) found that only 11% of laid-off workers' families enjoyed the unemployment benefits while only 8% enjoyed the minimum living standard guarantee. Moreover, Cai, Giles and Meng (2006) found that pension arrears had emerged in some areas. Therefore, the income transfers of social security reduced the degree of income inequality, but this kind of improvement was limited.

We also compute the Gini coefficients of initial income and redistributed income for working age group (male of 16-59 and female of 16-54) and elderly group (male of 60 and over and female of 55 and over). The results show the Gini coefficients are larger in 2002 than that in 1995 either in initial income or redistributed income. But the redistribution coefficient in elderly group is much higher than that of working age group, which is 55.9% and 11.83 respectively in 1995, 51.63% and 13.53% respectively in 2002. Therefore, the redistributive effect of social security in China is mainly demonstrated in elderly group and its effect on income of working age group is not significant.

(Insert Figure 3 here)

Figure 3 demonstrates the net benefit of social security for each income group and divides the sample into age groups within the income group. Except those younger than 40, the age pattern of net benefit is same in all income groups. In both periods of time, all income groups have positive net benefits. The net benefit is increasing with income increasing and in each income group, the elderly benefit most from the system.

Generally speaking, social security has a positive transfer of income. Various researches based on OECD countries show that social security system in these countries has redistributed income from higher to lower income groups. However, in China, the redistributive effect is inter-generations rather than between income groups. Although the elderly have a positive transfer, the elderly in higher income group gain more. Overall, the net benefit of highest income group is 1.4 times and 3.2 times as much as lowest income groups in 1995 and in 2002 respectively. The net benefit of the elderly in highest income group is 2.6 times and 4 times as much as the elderly in lowest income groups in 1995 and 2002 respectively. This outcome implies that the adverse income transfer of social security was increasing over time.

We obtain the same tendency using aggregate data from statistic yearbooks. Employing annual income of households, figure 4 shows that, the households benefit most from social security system are not the lower income households but the higher income households. During 2002 to 2008, in each year, the net benefit has been increasing with income of the households. The net benefit of highest income households is 7.4-9.3 times as much as that of lowest income households. From year 2002 to 2008, the net benefit of lowest income households was increasing by a small margin, much smaller than that of highest income households.

The above outcomes are based on annual income. For particular social security program, such as public pension, to estimate of redistributive effect requires an evaluation based on life cycle income as we discussed in introduction.

(Insert Figure 4 here)

4. Redistributive effects of different pension design based on lifetime income

As noted earlier, the cost and benefit of the pension system changed at different stages of the lifecycle. Therefore, it takes a lifelong process to uncover its overall effect. It is thus necessary to investigate it from a lifelong perspective. From a theoretical stance, the redistribution through the pension system can be understood as follows. The individual earns the right to receive a pension during his retirement by participating in the public pension system, thus accumulating pension assets. However, under a PAYG system, the level of pension one receives and the contributions one pays are determined by population growth rates and wages growth rate at each time period. As such, the actuarial present value of costs and the actuarial present value of benefits could be different. This margin is called the net benefit, which reflects the lifetime cost versus benefit, and therefore is the total redistribution transfer through the public pension system. The redistribution exists if the net benefit is not zero, and vice versa.

As described in section 2, current public pension system is a partial funded system combined social pooling with individual account. The practical policy rule of benefit for each group is different. In addition, pre-reform pension system before 1997 was applied to urban employees of the Chinese public sector so far, which issued that pension benefits would be calculated at a certain rate of an individual's wages upon reaching his retirement age. If provisions in the 2005 reform were applied to urban employees in the Chinese public sector, how would the pension system contribute to the equalizing effect? If the PAYG part of the system were replaced by a fully funded system, would the result reduce current inequalities? In this section, we estimate the redistributive effects of various pension plans on the basis of lifetime income.

From life cycle perspective, we need information of lifetime contributions and benefits. If the system has a long enough history, then there is complete data of a person during his life

cycle, from which it is convenient to calculate the present value of lifetime contributions and benefits and get the net benefits. However, the partial funded system has been in effect in China only for about one decade, there is no such data. Even in countries with this data available, such as US, Italy and Japan, sometimes it is impossible for the researcher to have access to the data. So in literature, the lifetime net benefits are to be estimated according to cross sectional data and based on certain assumptions.

We use CHIP data, first to calculate the abovementioned lifetime net benefits according to the policy rules of Chinese pension program and then we derive lifetime income distribution index (the Gini coefficient) under various pension program designs. Finally, we analyze the pension system's effect on inequality. The following discussion uses only the data for lifetime wage income and ignores income from all other sources. In short, our concept of lifetime income defines initial income as income from labor and defines redistributed income as initial income plus lifetime net benefits from pension payments.

The procedure of the computation is as follows. First, we use samples of 20-59 male and 20-54 female who have wage earnings in CHIP data of 1995 and 2002 and estimating a wage equation with individual characteristics such as age, education, occupation and regional dummies as explanatory variables.¹⁴ Then, with the aid of the wage equation we predict annual income, hence, the individual's lifetime income distribution assuming a wage growth rate and interest rate hypotheses. The last step is to derive contributions and net pension benefits for each arrangement of pension program according to the policy rules. (See Feng et al 2011 appendix for details)

We consider three possible designs of pension program. Design1 represents the current pension plan, i.e., pre-reform pension provision is applied to the public sector employees, which would be calculated by a certain proportion of the wage income when retired¹⁵, yet

¹⁴ The regression results refer to table 1 in He (2008).

¹⁵ Replacement ratio of pension for employees in public sector is determined by working experience, ranging from 75% to 100% with an average of 90%. We use the average replacement ratio.

other employees' would be calculated according to the policy rules of 2005 plan in the appendix table 1. Those who entered labor market after 1997 are "New participants" and their pension benefits consist of basic benefit and benefit from individual account. Those started to work before 1997 and retired after 1997 are "In-between participants" and their pension consist of basic benefit, transitional benefit and benefit from the individual account¹⁶.

Design2 assumes that the 2005 reform is applicable to the whole samples, i.e., the benefit and contribution of employee in both public sectors and other sectors are calculated using the same formula.

Design 3 represents the fully funded system and it is applicable to the whole samples, i.e., pension benefits consist of only individual account pensions if the employee is a "New participants" and pension benefits consist of individual account pensions and transitional benefit if the employee is a "In-between participants"

We use three indicators to estimate the redistributive effects. The first is the ratio of redistributed income between public sector employees and employees of other sectors (A). The second is the ratio of redistributed income between the highest- and lowest-income groups (B), with groups divided into deciles on the basis of initial income levels. The third is a redistributive coefficient R. Table 5 shows the redistributive effect under three designs.

(Insert Table 5 here)

The results illustrate that Design 2 has the largest effect on redistributing income and narrowing the income gap. Under Design 2, the ratio of redistributive income between public sector employees and employees of other sectors is 1.2992, the ratios are smaller than those from Design 1 and Design 3, indicating that the distributed income gap among public sectors

¹⁶ In addition, those who retired before 1997 are old participants. In reality, due to various entering age in labor market and retirement age, there is no fixed formula to relate age with old, in-between and new participants. For reference, if entering labor market in 20 and retiring in 60, then those of 65 and over in 2002 are called old participants, those of 26 to 64 are in-between participants and those below 25 are new participants. This study uses samples of age 20-59 in 2002, so most sample individuals are in-between participants and a few are new participants.

and others is smallest under Design 2, and distributed income gap between the highest- and lowest-income groups is also smallest. The redistributive coefficient R again demonstrates that Design 2 has the strongest effect on narrowing the income gap.

We divide the sample into deciles ranking from low to high on the basis of initial income. Figure 5 shows the net benefit of each income group under various designs. There is an obvious trend that net benefit is increasing with income, no matter under what design. The results imply that the adverse redistributive effect of Chinese social security exists when evaluating based on lifetime income, especially under current policy rule, i.e., design 1.

(Insert Figure 5 here)

To compare the annual and lifetime income-based effects, we utilize annual income from the same sample to calculate the Gini coefficient for both initial and redistributed incomes 0.3417 and 0.3406, respectively. These results are lower than the lowest redistributive coefficient reported in Table 6. This implies the redistributive effect of the pension system could be negligible if measured by annual income in current workers. However, the effect strengthens if measured by long-term income. This implies the long-term redistributive effect is larger as compared with its short term effect in current workers.

5. Findings and Policy Implications

We use the CHIP data to estimate the income redistributive effects of the Chinese urban social security system from several new perspectives. Our findings are as follows:

1. Public pension is the main income for the elderly in urban China. During both pre-reform and post reform period of time, Majority of people aged 60 and over (72% in 1995, 82% in 2002) have pension, comprising 80% to more than 90% of their total income. Moreover, compared with 1995, share of pension in total income increased in 2002. Other income

sources are salary and private transfers. In contrast, the percentage of employees covered by public health insurance programs declined from 76% in 1995 to 63% in 2002. Among the retirees, the coverage declined from 81% to 72%.)

2. In urban China, social security greatly improved the income of low-income groups and helped to reduce poverty. The proportion of households that earned less than half the median income was reduced after social security transfer payments; Comparing 2002 with 1995, however, inequality of initial income of urban residents expanded and the relative poverty rate increased, indicating that the number of low-income groups had increased.¹⁷ Meanwhile, although the Gini coefficient and relative poverty rate declined in 2002 after redistribution by social security, they remained higher than those in 1995. Since the increase of initial income inequality could also affect the Gini coefficient based on redistributed income, without controlling changes of initial income between 1995 and 2002, it is difficult to draw a conclusion that the Gini coefficient of redistribution income in 2002 was actually higher than that in 1995 due to the weakened redistributive effect of social security. However, we can conclude that the effectiveness of social security in reducing inequality did not offset the increasing initial income inequality from 1995 to 2002, although income inequality decreased through income transfers provided by social security and hence the Gini coefficient of redistribution income in 2002 was higher than in 1995)
3. The redistributive effect of Chinese social security system demonstrates an inter-generational transfer rather than the transfer from high to low income. During 1995 and 2002, both low income group and high income group get positive benefit from social security system, but the net benefit is increasing with income. Overall, the net benefit of highest income group is 1.4 times and 3.2 times as much as lowest income groups in 1995 and in 2002 respectively. The net benefit of the elderly in highest income group is 2.6 times and 4 times as much as the elderly in lowest income groups in 1995 and 2002 respectively.

¹⁷ It is consistent with the finding of Xia et al. (2007) that the rate of relative poverty was increasing.

This outcome implies that the adverse income transfer of social security was increasing over time. Using aggregate data and estimating with lifetime income show the same tendency.

4. We use lifetime income to evaluate the redistributive effect of pension program among current workers and we find that a combination of funded system and a PAYG system has larger effect in improving income inequality. Furthermore, if the current policy is extended to all employees including those in public sectors, the income gap between employees in public sectors and other sectors is going to be declined more, so is the gap between income in highest and lowest income group. In addition, we find that its effect is significantly larger than the short-term effect calculated using one year's income, when measured by lifetime income. China is now discussing how to reform public sector pensions. If the government expects social security to play a bigger role in income redistribution, differences in long-term and short-term effects of pensions should be considered.

In summary, from 1995 to 2002, the social security system in urban China raised the income of low-income and old-age groups and narrowed the income gap. The redistributive effect of the social security system did not offset the expanding income inequality. The 2002 Gini coefficient of redistributed income was higher than that in 1995, and public medical insurance protection was weakened, the adverse income transfer of social security was increasing over time. If the government wishes to improve income distribution, it can strengthen the equalizing effect of social security by improving the public medical insurance system, cutting the benefit from social security of high income groups for changing the adverse income transfer, adjusting the proportion of basic pension and individual account pension in the pension system, and instituting a unified pension system for the entire urban labor market. In addition to these changes in the social security system, inequality in income distribution should be addressed by other policies.

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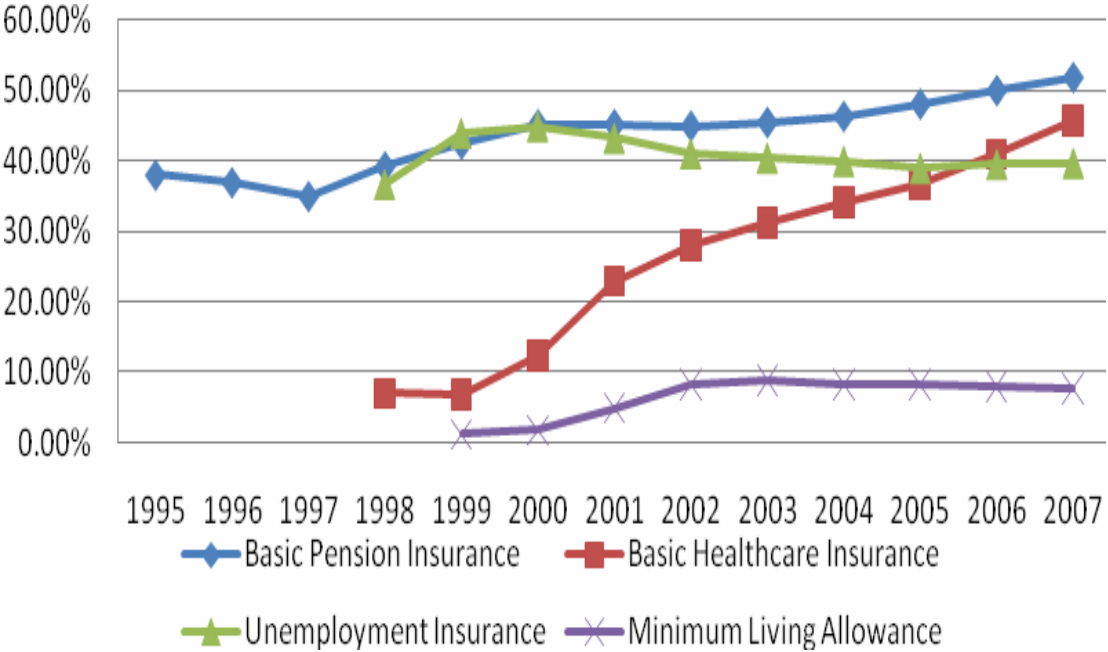
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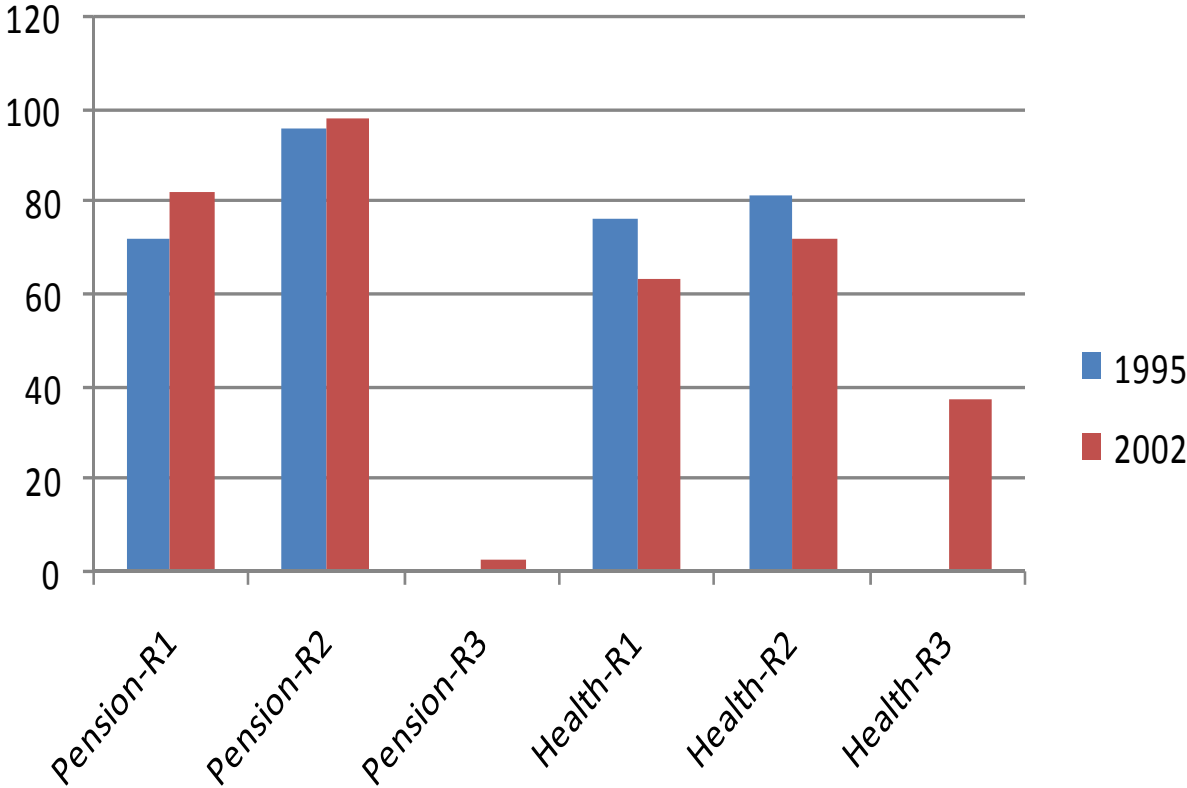
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Figure 1 The coverage of social security system in China (Number of participants / Number of urban employees), 1995-2007



Source: *China Labor Statistical Yearbook, 2003, China Statistical Yearbook, 2008, China Civil Affairs' Statistical Yearbook, 2008.*

Figure 2 Recipients of Public Pension and Medical Benefits



Note: Recipients are calculated as follows.

Pension-R1= number of people aged 60 and over, with pension benefits /number of people aged 60 and over × 100

Pension-R2= number of retirees aged 60 and over, with pension benefits /number of retirees aged 60 and over × 100

Pension-R3= number of retirees who did not receive pension benefits adequately in time/number of retirees × 100

Health-R1= number of employees covered by public medical and health programs/number of employees × 100

Health-R2= number of retirees covered by public medical and health programs/number of retirees × 100

Health-R3= number of retirees who could not write off the medical expenses adequately in time/number of retirees × 100

Source: CHIP data in 1995 and 2002. Unless otherwise stated, the diagrams from here on are all based on the CHIP data.

Figure 3-a Net Benefits of Social Security for Redistributed Income groups (1995)

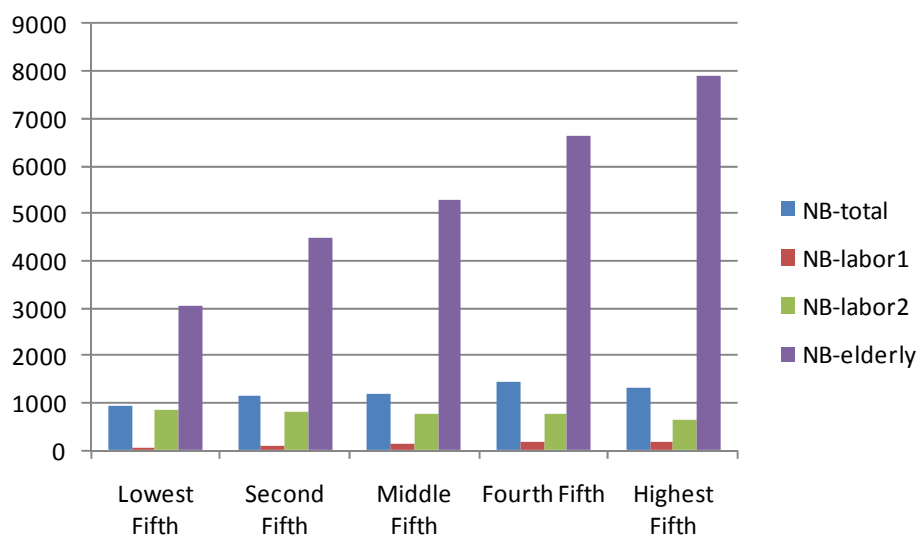
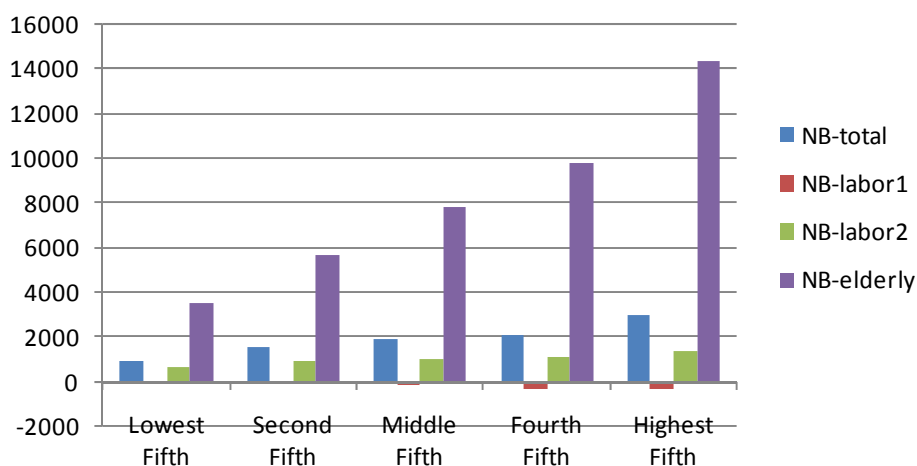
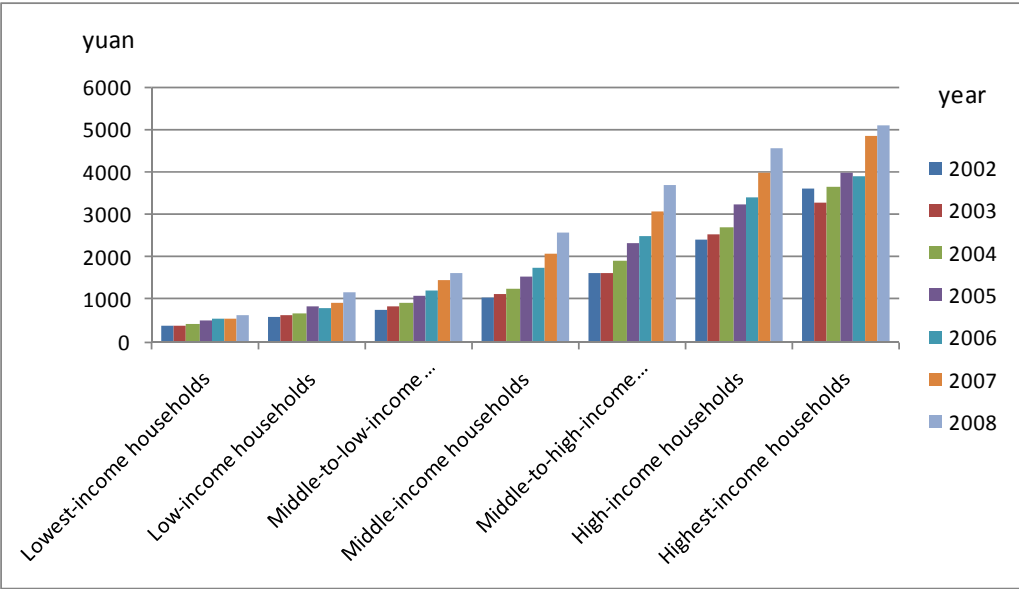


Figure 3-b Net Benefits of Social Security for Redistributed Income groups (2002)



Note: NB = benefit of social security – contribution of social insurance (RMB yuan, 2002 price). labor1:16-39 working age samples. labor2:40 and over working age samples. elderly: male of 60 and over and female of 55 and over based on the retirement age of China.

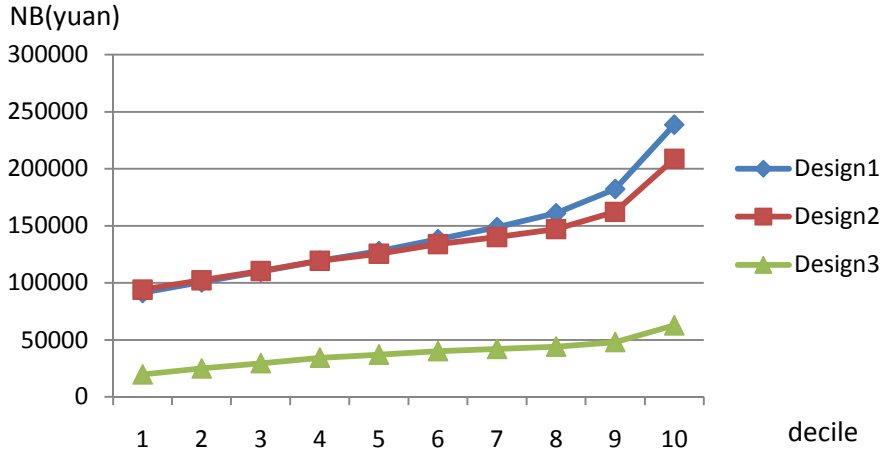
Figure 4 net benefits of social security in urban households of different income groups (2002-2008)



Note: urban households are divided and sorted by disposable income per capita, according to household share of 10%, 10%, 20%, 20%, 20%, 10%, 10%, the households are labeled as lowest income households, low income households, middle to low income groups, middle income groups, middle to high income groups, high income groups and highest income groups, altogether 7 income groups.

Sources: *Survey on China’s Price and the Income and Expenditure of Urban Residents, 2002-2003, Yearbook of China’s Cities, 2004, 2005 and China Urban Life and Price Yearbook, 2006-2009.*

Figure 5 Net Benefits of different pension design by lifetime initial income deciles



Note: NB = Present Value of personal lifetime net benefits from pension system in 2002.

Table 1 Annual income and pension benefits, 1995 and 2002

Table1 Annual Income and Pension Benefits				
Data Type	National Statistics Data		Survey Data	
Year	1995	2002	1995	2002
Average Annual Wage of Staff and Workers(Yuan)	5500	12,422	5616	12,123
Per Capita Annual Disposable Income of Urban Households(Yuan)	4288.1	8177.4	4745	8230
Per Capita Annual Pension Benefits of Retirees(Yuan)	4335	8807	4435	8743
Pension Replacement Rate(%)	78.8	70.9	78.9	72.1

Note: Pension Replacement Rate = Per Capita Annual Pension Benefits of Retirees/Average Annual Wage of Staff and Workers \times 100. Average annual wage of staff and workers refer to wages of fully employed staff and workers, which do not include those of township and village and private enterprises.

Source: *China Statistical Yearbook* (2008), CHIP data (Summary statistics are calculated using the entire sample of 21,696 individuals in 1995 and 20,632 individuals in 2002).

Table 2 Summary Statistics of the Total and the Components of Initial-Redistributed Income

	Initial Income		Redistributed Income	
	1995	2002	1995	2002
Salary	5127.810	7575.550		
Net Income of Private Businesses	72.465	314.219		
Property Income	94.967	68.132		
Private Insurance Benefits	NA	6.149		
Others Income	126.042	234.476		
personal income tax			4.633	33.120
social security benefits			1263.838	2203.015
social security payments			43.394	323.361
Total of Initial(Redistributed) Income	5523.452	8198.525	6613.222	9938.591

Note: Per capita annual income (Yuan) at 2002 price is used. NA indicates that the kind of classification did not exist in 1995.

Source: CHIP data in 1995 and 2002.

Table3 The sample size and mean age of quintile groups

Income Group	initial Income Quintile				Redistributed Income Quintile			
	mean age		sample		mean age		sample	
	1995	2002	1995	2002	1995	2002	1995	2002
Lowest Fifth	51.94	54.38	3150	3140	42.51	44.73	3153	3139
Second Fifth	41.01	45.04	3150	3139	42.47	45.60	3147	3138
Middle Fifth	39.80	43.00	3150	3137	42.51	45.71	3151	3139
Fourth Fifth	40.09	42.62	3149	3137	43.31	45.22	3149	3138
Highest Fifth	40.97	42.25	3149	3138	43.02	46.05	3148	3137
Total	42.76	45.46	15748	15691	42.76	45.46	15748	15691

Table4 The distribution of initial income and redistributed income

Item	Percentage Share					Gini Coefficients
	Lowest Fifth	Second Fifth	Middle Fifth	Fourth Fifth	Highest Fifth	
initial income_1995(A)	4.12	12.82	18.38	24.52	40.16	0.3576
redistributed income_1995(B)	13.61	13.38	16.97	21.60	34.46	0.2635
initial income_2002(C)	2.80	10.43	16.80	24.76	45.21	0.4240
redistributed income_2002(D)	13.02	12.41	15.85	21.74	36.98	0.3165
Change1_1995	9.48	0.56	-1.41	-2.93	-5.71	-0.0941
Change1_2002	10.22	1.98	-0.95	-3.02	-8.23	-0.1074
Change2_Initial	-1.32	-2.39	-1.58	0.24	5.05	0.0664
Change2_Redistributed	-0.58	-0.97	-1.11	0.14	2.52	0.0531
Redistributive coefficient 1995	26.31%					
Redistributive coefficient 2002	25.34%					

Note: Change1_1995 = B – A; Change1_2002 = D – C. Change2_Initial=C–A; Change2_Redistributed =D – B. Redistributive coefficient_1995 = (A-B)/A*100; redistributive coefficient_2002 = (C-D)/C*100.

Table 5 Redistributive effects of different pension design based on lifetime income

	Design1	Design2	Design3
Redistributed Income (public sector/others) (A)	1. 3584	1. 2992	1. 3564
Redistributed Income (the highest decile group /the lowest decile group) (B)	4. 5481	4. 3241	5. 8381
Redistributive Coefficient R(%)	11. 5883	14. 6168	3. 1881

Note: The sample consists of workers with labor income between 20-59 (20-54 for female) of age in 2002.

Redistributed Income = Initial Income + Net pension benefits

Initial Income = Present Value of personal lifetime labor income in 2002.

Net pension benefits = Present Value of personal lifetime net benefits from pension system in 2002.

$R = (\text{the Gini index for initial income} - \text{the Gini index for redistributed income}) / \text{the Gini index for initial income} * 100$

Appendix Table 1

Contribution and benefit structure in pension plan 1997 and 2005

Item		Old participants	In-between participants	New participants
Definition		personnel retired before 1997's reform	personnel retired after 1997's reform but started working before 1997's reform	personal started working after 1997's reform
Contribution	Pension plan 1997	N/A	28% of wage (contributed jointly by employee and employer), 11% of which is reserved in individual account	Same as the in-between group
	Pension plan 2005	N/A	28% of wage (contributed jointly by employee and employer), 8% of which is reserved in individual account	Same as the in-between group
Benefit	Pension plan 1997	Same as the pre-reform terms, which is x% of the individual standard retirement wage	Basic pension (20% of last year's average monthly wage of local employees) + Individual account pension (the amount of individual account savings/120)+ Transitional pension (average indexed monthly earnings× modulus× years without an individual account	Basic pension (20% of last year's average monthly wage of local employees) + Individual account pension (the amount of individual account savings/120)
	Pension plan 2005	Same as the pre-reform terms, which is x% of the individual standard retirement wage	Basic pension (Years of contribution*1%*0.5(average indexed monthly earnings + last year's average monthly wage of local employees))+ Individual account pension (the amount of individual account savings / months of payment scheduled(depends on average life expectancy of urban population at the time of retirement & age of retirement))+ Transitional pension (average indexed monthly earnings × modulus× years without an individual account	Basic pension (Years of contribution*1%*0.5 (average indexed monthly earnings + last year's average monthly wage of local employees))+ Individual account pension (the amount of individual account savings / months of payment scheduled(depends on average life expectancy of urban population at the time of retirement & age of retirement))