# Working Longer in China: Implicit Tax or Subsidy?[1]

Jing Xu and Xinmei Wang

**Abstract:** Using the conventional concept of implicit tax, we investigate pension incentives to retire for private sector employees in China. The social security pension consists of pay-as-you-go defined benefit (DB) and defined contribution (DC) systems. Based on Chinese official parameters and the revised OECD models, our studies conclude that the DB system discourages people from working more, but the DC system offers considerably greater incentives at the expense of financial sustainability. If the annuity factors in the DC scheme were linked to the probability of retirees' mortality, then both constant incentives to work longer and financial sustainability could be achieved.

**Keywords:** implicit tax, incentives, pension wealth, social security pension, working longer

**JEL Classifications:** C53, C54, H55

Jing Xu: School of Public Economics and Administration, Shanghai University of Finance & Economics. Email: xu.jing@mail.shufe.edu.cn.

Xinmei Wang: Institute of Population and Labor Economics, Chinese Academy of Social Sciences, 10 floor, Zhongye Dasha 28 Shuguangxili, Chaoyang District, Beijing, China. Email: wangxm@cass.org.cn.

[1] We would like to express our hearty thanks to Edward Whitehouse and Andrew Reilly at the OECD for offering the APEX model and their helpful advice and discussions that helped us to understand pension modeling. We are indebted to members of our Two Country Joint Pension Project, Takashi Oshio and Noriyuki Takayama of Hitotsubashi University, for fruitful discussions, comments, and advice. The authors are grateful for the support from the JSPS-CASS joint research project of "Pension Reform in the PRC: Searching for a New Framework Based on Japanese Experiences" and from the "Economic Impact Evaluation of Social Security: A Systematic Framework" funded by the National Natural Science Foundation of China (71673295).

## 1. Introduction

Working longer is one of the most decisive solution to dealing with the fiscal pressure under population ageing (Ogawa and Takayama, 2006). Over the past two decades, as part of their pension reforms, many countries have strengthened the link between contributions and benefits in order to encourage people to work longer (Whitehouse 2012).

Social security pensions in China confront the similar financial pressures as elsewhere. China's old-age dependency ratio 65+/(15–64) increased from 8.6% in 1990 to 13.3% in 2015 and is projected to be 44% in 2050 (United Nations, 2017, in the medium variant).[2] At present, the total expenditures on the social security pension for private sector employees exceed contributions every year in vast majority of provinces. This is an earning related pension program, thus the expenditures should be 100% financed by the contributions from employers and employees in general. However, for the past 10 years, unexpectedly about 18% of these expenditures have to be funded out of general revenues, mainly from the central government and a small part of them from local governments (Wang 2017).

To alleviate the fiscal pressure, postponing the normal pensionable age (NPA) has been discussed and proposed several times over the past decade. However, this proposal sparked strong resistance from the public. Therefore, earning the support of workers will require a well-designed mechanism to motivate people to work longer; however, little has been explored on this topic with respect to China.

Using the typical method of comparing net pension savings at different ages of retirement, this paper investigates pension incentives to retire for current private sector workers in China.

[2] The old-age dependency ratio, here, is the number of people 65+ divided by the number of people aged from 15 to 64.

We assume that workers are allowed to retire and receive social security pensions between ages 45 and 64. Then, based on official data, we calculate the tax impacts from working longer: a financial loss or a financial benefit.

The paper is organized as follows. Section 2 introduces the design of the public pension system for private sector employees. Section 3 explains our methodology: the concept of an implicit tax (ITAX) and simulation modeling. Section 4 applies the simulation results of ITAX in the baseline model. Section 5 compares the baseline model with various other scenarios. Section 6 concludes the paper.

## 2. The Social Security Pension for Private Sector Employees

The social security pension for private sector employees was a pure pay-as-you-go (PAYG) system started in 1951. The current framework was established in 1997 with the World Bank's technical and financial support. By the end of 2017, it had 110.26 million beneficiaries and 292.68 million contributors. The system has two parts. The first part is a PAYG defined benefit (DB) scheme (called basic pension or social pooling), and the second part is a funded defined contribution (DC) program (called individual accounts). Large revisions followed in 2005 and 2017, and in the latter, twenty years after the funded DC plan was established, China formally began to refocus its system toward a PAYG system, with a 8.31% notional interest rate.[3]

### *Contribution and Benefit Policies*

The contribution rate is 28% in total, 20% for the DB pension by employers, and 8% for

[3] This rate is only for 2016, and no definite formula on how to decide it in the future has been set up yet.

the DC scheme by employees. Therefore, benefits come from two sources: DB and DC, and the formulas for calculating them are as follows.

In the DB part:

$$Benefit_{DB} = n \cdot 1\% \cdot \overline{W} \cdot \frac{1+\alpha}{2} \qquad (1)$$

$\overline{W}$ is the local average wage, $n$ is the number of years of contribution, and $\alpha$ is an individual's wage level ($\alpha$ = 1 means that the employee receives an average wage, $\alpha$ = 0.5 means half the average wage, and so on). We assume that a worker's wage level remains unchanged over the course of his career. The accrual rate is 1%. Therefore, the level of basic pension benefits depends on the employee's wage, the local average wage, and the number of contribution years.

In the DC part:

$$Benefit_{DC} = \frac{Account\ \ Balance}{\text{Annuity factor}} = \sum_{i=0}^{n}[W_i \cdot c \cdot (1+r)^{n-i}]\ /\mathrm{A} \qquad (2)$$

$W_i$ means employee wages in the $i$th year of a career, $c$ is the contribution rate for individual accounts (8%), $r$ is the rate of return on individual accounts, and $A$ is an annuity factor, which takes a constant value for each retirement age, as shown in Table 1.

(Table 1 is about here)

If the balance is more than zero at the death of insured persons, individual accounts can be inherited by their family. On the other hand, if a pensioner is still alive when the balance in an individual account is depleted, then the government will continue to fund the benefits. Therefore, the following two aspects of the Chinese DC program violate the basic principal of social security pensions.

First, official annuity factors are supposed to be calculated in a manner similar to that in commercial life insurance.[4] For a retiree at age 60, the annuity factor is set at 139 (11 years and 7 months), whereas life expectancy at age 0 in 2000 is 71.4 (National Bureau of Statistics 2012).[5] As a result, the official annuity factors are much lower than actual life expectancy for the elderly both now and in the future. The actual values could almost double the official annuity factors if they were based on the United Nations' mortality rate projections for the elderly for 2055. Therefore, using these official annuity factors, the DC system is not financially sustainable, as the Chinese government has promised to finance shortfalls from social pooling account when a pensioner depletes his individual account.

Annuity factors for social security pensions should be based on the age of retirement, not age 0 (at birth), and at a future point in time, when insured persons start to claim benefits, not at the current point in time when workers start make their contributions. These two points make the calculations of annuity factors for social security pensions entirely different from the calculations for commercial life insurance.

[4] In government documents (State Council 2005), these numbers are simply described as being based on life expectancy and interest rates, etc., with no any further detailed explanation.

[5] The data on life expectancy at age 0 in 2000 were severely underestimated (Guo 2012).

Second, if an insured person dies before his/her individual account is depleted, the balance can be inherited by his/her family. The inheritability of individual's contributions is quite unique compared to a general case in the world, because it makes the social security pension lost the basic characteristics of mutual-help.

*Normal pensionable age (NPA)*

The NPA is 60 for men, 50 for women in blue-collar jobs, and 55 for women in white-collar jobs. People in higher-level jobs (e.g., associate professor and above, technician, engineer, etc.) may be allowed to postpone their retirement age, to 60 for women and 65 for men, in a few cases. People making special contributions or in important positions can delay their retirement to 70 or later.

Early retirement is allowed for the disabled and/or those in particular job categories. For the fully disabled who have worked for more than 10 years, the NPA is 50 for men and 45 for women. For people who have worked in high-risk, and physically demanding jobs continuously for 10 years, the NPA is 55 for men and 45 for women. If a worker satisfies all those conditions, the NPA could be 40.

***Labor Force Participation Rates***

Statistics on retirement behavior in urban China are shown in Figure 1. Urban labor force participation rates for men are about 85–90% before age 55 and 80% for women before age 45. Women gradually started to retire beginning at age 45 and men at age 55. Labor force participation rates show sharp declines at ages 50–60 among women and ages 58–63 among

men. After age 60 for women and age 63 for men, labor force participation rates are about 15% and 25%, respectively. One reason might be that, according to our calculations based on the Chinese Household Income Project surveys (CHIPs) data for 2013, 13% of the urban elderly are not covered by any social security pensions, so they need to continue working in old age.

Except some special cases stated above, current Chinese social security pension systems do not offer workers a range of retirement ages—for example, allowing people to retire freely with smaller benefits five years before the NPA or later with larger benefits. Therefore, in general, the labor force participation rates show a sharp decline around the NPA. As a result, compared to Japan (Usui, Shimizutani, and Oshio 2016) and probably many developed countries, labor force participation rates among the elderly in urban China are much lower.

At the same time, pension incentives matter, as shown in studies on the effects of implicit taxes on labor-force participation rates among the elderly (Oshio, Oishi, and Shimizutani 2017). We assume that, in the near future, employees in China will be able to claim social security pension benefits over a range of years around the NPA, as it is in many developed countries. Then, under the current system design, would they then have an incentive to work longer?

(Figure 1 is about here)

## 3. Methodology

### *ITAX*

ITAX is the implicit tax for a worker to work an additional year, a typical concept widely used in studies on retirement pension incentives (Dekkers 2007; Diamond and Gruber 1999;

Gruber and Wise 1998; OECD 2011; Oshio et al. 2017). It compares the relative changes in pension wealth at different retirement ages.

$$ITAX_t = (PW_t - PW_{t+1})/W_t \qquad (3)$$

*PW* is the total value of the discounted pension benefits, *W* is the net wage, and *t* is retirement age. The net wage is the gross wage minus income tax and all kinds of contributions to social insurance (pension, health, unemployment, and so on). $ITAX > 0$ means an implicit tax (i.e., individual loss) for working an additional year, and $ITAX < 0$ means an implicit subsidy (i.e., individual gain).

***Simulation Modeling***

We assume that:

- Workers make pension contributions every year from the time they enter the labor market until they reach a pensionable age;
- Wage growth for individuals is in line with overall average wage growth, which is constant over time;
- Tax systems remain unchanged in the future: tax payments are adjusted annually in line with average wages;
- The pensionable age range is 50–64;
- Three different earners are simulated: high earners, whose pay is twice the economy-wide average wage, average earners, and lower earners, whose pay is half the economy-wide average.

## 4. ITAX in the Baseline Model

### *Parameter Setting*

The parameter setting is as follows. All the parameters are constant over the simulation period, shown in Table 2. According to official data and accounting for future changes in economic conditions, parameters partly converge from a high value to an international average over 40 years. In this case, we use the average value.

- Price inflation: from 4% per year, converging steadily to 2.5%, yielding an average of 3.25%. The 4% inflation rate is based on the consumer price index from 2010 to 2016 in the *China Statistical Yearbook*.
- Real returns on DC pensions are 0%. The nominal return was less than 2% in 1997–2015 according to the vice minister of Human Resources and Social Security (Hu 2013), but, in 2017, the Ministry for Human Resources and Social Security announced that the nominal return for 2016 was 8.31%. Therefore, we use 0%, just covering inflation and administration costs, as the average in the baseline model.
- Real wage growth was 7% per year, converging steadily to 2%, yielding an average of 4.5%. The 7% growth rate is the approximate average based on data from 2009 to 2016 in the *China Statistical Yearbook*.
- Official annuity factors are used for benefit calculations for individual accounts as shown in Table 1.
- The average nominal wage in 2015 was RMB 62,029 a year.
- Indexation of pensions in payment: 0.6 * nominal wage growth, in part according to

government documents in 2005.[6]

- Probability of mortality: based on the mortality rates of the United Nations (UN) projection for 2055 by gender and age in calculations of pension wealth.

(Table 2 is about here)

***Baseline Model Results***

We discuss *ITAX* in the baseline model during the pensionable age range 50–64 as shown in Figure 2: three kind of earners (low, average, and high) for men and only average earners for women. Total social security pension benefits consist of DB and DC, which are entirely different, so we simulate them separately and then examine the total benefit. We apply the same average wage to both men and women. Thus, the gender differences in *ITAX* only reflect the different life expectancy between men and women.

In terms of total benefits, *ITAX* values are all negative: people always have incentives to work longer at each age from 50 to 64, but with varying dynamics over ages. The incentives show an inverse U-shaped curve, with age 59 as the peak, declining from age 50 to 59, then increasing from age 59 to 64.

The changes in incentives show a very different pattern between the DB and DC systems.

In the DB system, the incentives to work longer are linear over ages and across wage levels, with negative values before around age 60 and positive values after about age 60. Before

[6] The central government simply announced that pension indexation will be decided according to wage and price growth (State Council 2005). In the OECD APEX model, the proportion for China is 0.6.

age 60, this pension system encourages people to work longer, while, after age 60, it encourages people to retire earlier.

In the DC system, the pattern of incentives shows almost no difference before age 55 and an increasing trend after age 55, mainly due to the accelerated decline in annuity factors over ages. Low earners among men have stronger incentives than high earners to work longer before age 61 but fewer incentives after age 62, mainly due to income redistribution effects in the benefit formula in the DB system. Women at the same wage level as men have more incentives than men to work longer, because their longer life expectancy would bring them relatively greater pension wealth.

(Figure 2 is about here)

Despite the incentives over age 50-64 shown in the total pension benefits in Figure 2, in 2013, the vast majority of people left the labor market at age 50–60 for women and age 55–62 for men, as shown in Figure 1. This contradiction might arise for the following reasons. First, the pension system that started in 1997 was not yet mature. In 2013, the majority of the elderly received their pension benefits mainly based on the previous system, which is a pure DB program. Second, according to the rules of either system, when workers reached the normal retirement age, they did not have the choice to retire later if they wanted to do so.

## 5. Discussion

We compare the baseline model with three situations, confining the case of men to that of

the average wage.

### *Comparing Current Situations*

The new private sector pension system started in 1997 and is not yet mature, and the minimum contribution period is 15 years at present. Figure 3 shows a comparison between the current situation in 2018 with a 20-year career and future scenarios in 2055 with a 40-year career. The corresponding mortality rates in 2055 and 2020, respectively, are used for estimating pension wealth.

Incentives to work longer will be fewer in the future than they are at present. Although pension benefits from the total, DB, and DC models show that at present people prefer to work longer, in the future, the DB system will discourage people from working longer. This trend is important for policy makers to consider.

(Figure 3 is about here)

### *Annuity Factors Linked to the Probability of a Retiree's Mortality*

Chinese official annuity factors were revised in 2005, based mainly on life expectancy at age 0, which is about half the life expectancy at age 60 in 2055. As a result, the DC system fails to be self-financing, because the government promises to continue to pay the benefits if the accounts are depleted. Therefore, sooner or later, the annuity factors need to be linked to the probability of (future) retiree mortality. Figure 4 shows a comparison of ITAX between the official annuity factors and the new annuity factors based on UN mortality rates in 2055 at each

age during retirement.

Under these new annuity factors, ITAX in the DC system turns out to offer an almost constant incentive for later retirement,[7] even though the incentives are much lower than those under official numbers. The most important effect is that the new annuity factors inherently make the DC system financially sustainable, but it is impossible under the official annuity factors. Furthermore, compared with the DB system, which discourages people from working longer after age 60, the DC system under the new annuity factors encourages people to work longer.

In terms of total benefits, the model using UN mortality rates has fewer incentives for working longer than those using official annuity factors; at age 63, in the new model people will prefer to retire, but the old model encourages them to work longer.

(Figure 4 is about here)

***Comparison with Various Models***

Parameter settings in the baseline model are based mainly on historical economic data. Other possible scenarios are compared, as shown in Table 2.

In case A, we changed the real return on DC from 0% to 4% (7.25% in nominal terms), because the notional rate of return announced by the Ministry of Human Resources and Social Security for 2016 is 8.31%. Figure 5 shows that incentives for later retirement greatly increase with a higher real return on DC.

[7] The ITAX curve actually shows a slightly upward trend, because of income tax effects.

In case B, the real wage growth rate declines to 2.5%. Then the ITAX curve trends upward, so people have fewer incentives to work longer.

Cases C, D, and E show that shorter careers, lower discount rates, or lower pension indexation will cause people have more incentives to work longer.

As a result, higher returns on DC, higher wage growth rates, lower discount rates, and lower pension indexation encourage people to work longer.

(Figure 5 is about here)

***Comparison with Developed Countries***

The situation of the baseline model in China differs from the general case in DB pension models in developed countries, which usually offers disincentives for working an additional year (e.g., as shown in Canada, Belgium, Luxembourg, Portugal, Slovenia in Whitehouse 2012, p. 92). As shown in Figure 2, the incentives in the DB system in China are the same as in other DB models elsewhere in the world. The unusual results for total benefits come only from the DC portion, in which the unique official annuity factor and the government's promise of lifetime funding has created rapid increases in benefits over time after age 60. This set of official annuity factors is far below what it should be and apparently needs to be adjusted. When the annuity factor is changed to link to reasonable parameters as shown in Figure 4, China has the same features in the general case of social security pensions as many developed countries.

## 6. Conclusion

This paper examined pension incentives to retire in China's social security pensions in various cases using the revised OECD models. Our analysis concluded that, in the future, when the current Chinese pension system matures, fewer incentives to work longer will exist than at present; higher returns on individual accounts, higher wage growth rates, lower discount rates, and lower pension indexation will encourage people to work longer.

In the current pension system designs, the defined benefit pension systems offer some incentives for people to work longer before the normal retirement age, but discourage people to work more after the normal retirement age. In contrast, individual accounts could offer much more incentives for working longer but at the expense of financial sustainability. If the annuity factors of the individual accounts are linked to the probability of retiree mortality, then the individual accounts will offer a constant incentive for working longer in the meantime maintaining financial sustainability.

Therefore, given the contribution rates, for offering incentives to delay retirement, one reasonable policy instrument could be to shrink the size of the defined benefit scheme, but widen the share of PAYG individual accounts, with the annuity factor to be linked to retiree life expectancy. The further benefits of this reform are the more transparency and portability, and easier to rise the pooling level from local governments to the central government than those in the current design.

Table 1. Official annuity factor by retirement age

| Age | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 233 | 233 | 226 | 223 | 220 | 216 | 212 | 208 | 204 | 199 | 195 | 190 | 185 | 180 | 175 | 170 |
| Age | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | |
| A | 164 | 158 | 152 | 145 | 139 | 132 | 125 | 117 | 109 | 101 | 93 | 84 | 75 | 65 | 56 | |

Note: A is annuity factors.

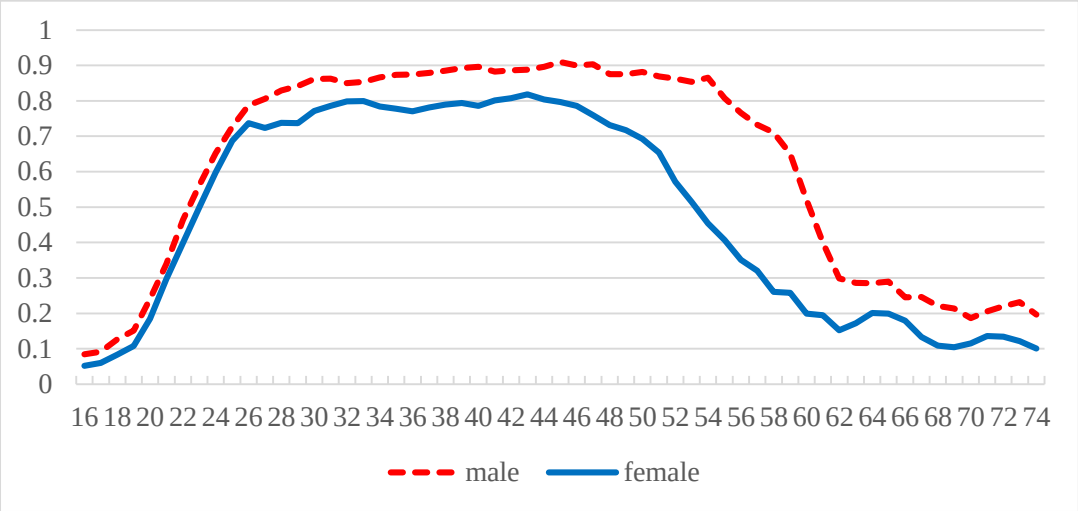
Source: State Council, 2005.

Table 2. Parameters in the baseline and various models

| | Baseline | A | B | C | D | E |
|---|---|---|---|---|---|---|
| Consumer price inflation (CPI) | 3.25% | | | | | |
| Real return rate on DC | 0% | 4% | | | | |
| Real wage growth rate | 4.5% | | 2.5% | | | |
| Career start age | 20 | | | 30 | | |
| Discount rate | 3% | | | | 2% | |
| Pension indexation | 0.6 * normal wage growth | | | | | CPI |

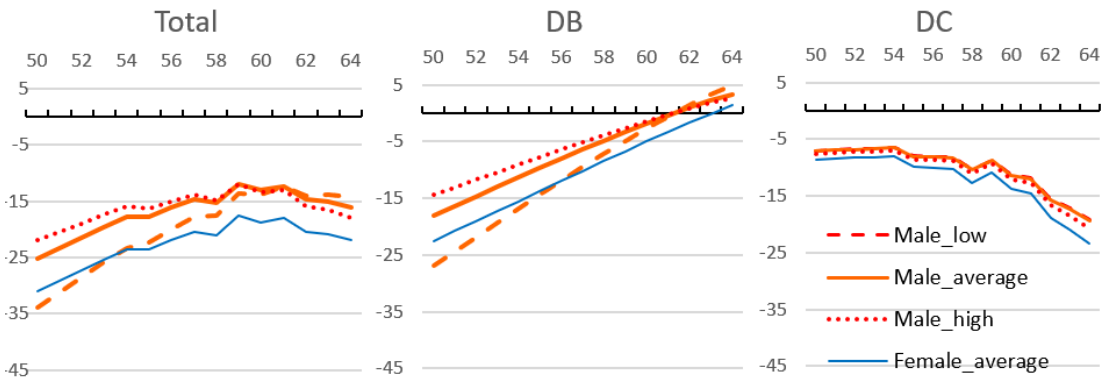
Source: Authors calculations based on official data and possible future changes (see section 4 and 5 in details).

Figure 1. Labor force participation rates in urban China in 2013



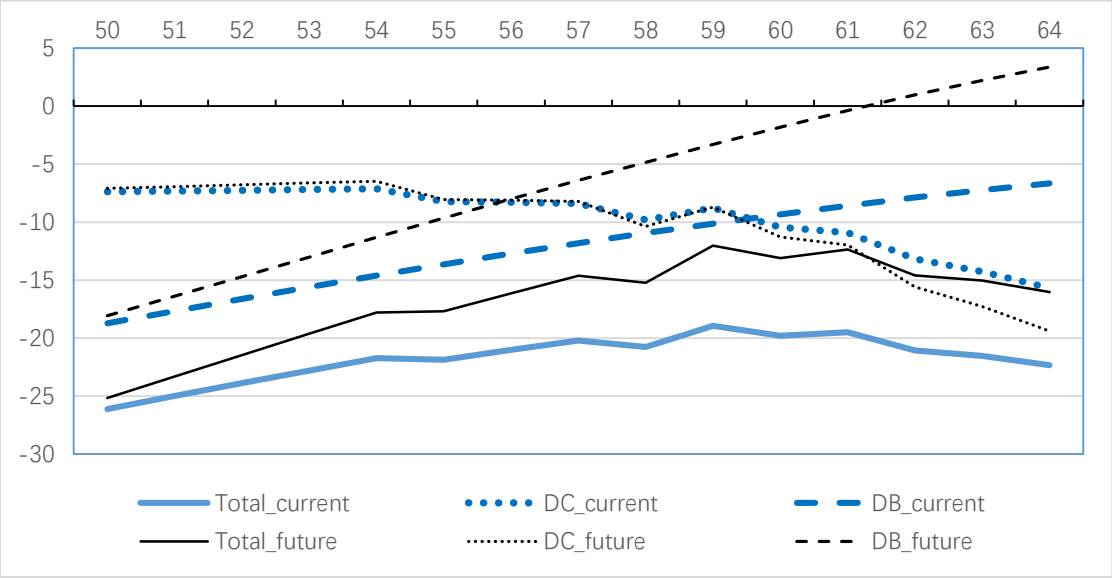

Source: Authors' calculations using CHIPs data in 2013.

Figure 2. ITAX in the baseline model at three wage levels by gender, %



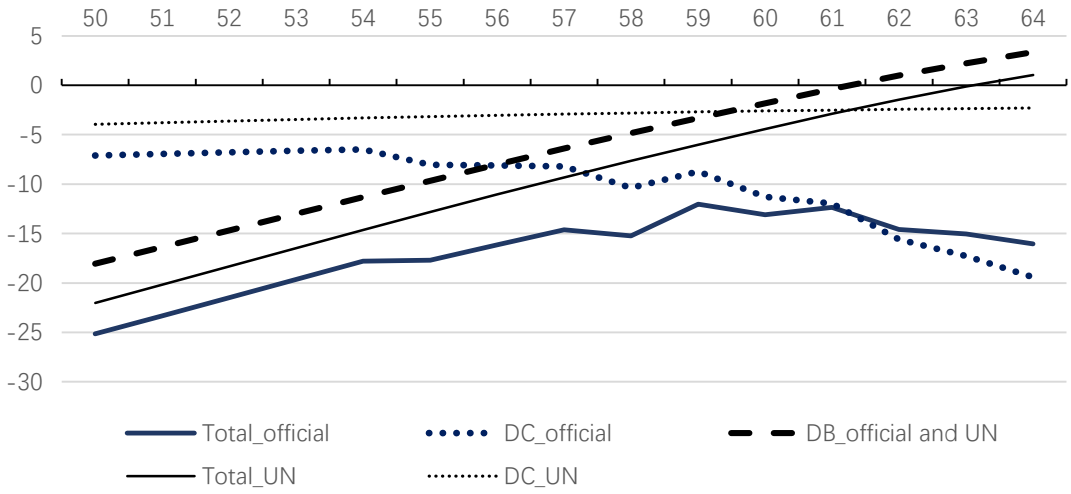

Source: Authors' calculations based on revised OECD models.

Figure 3. ITAX at present and in the future, %



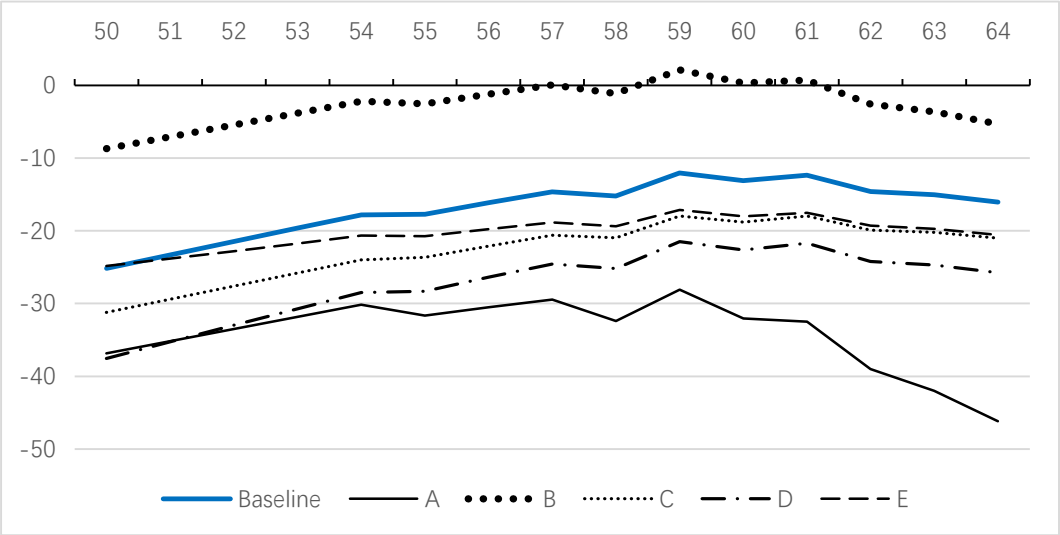

Source: Authors' calculations based on revised OECD models.

Figure 4. ITAX with the official numbers versus the annuity factors based on UN mortality rates in 2055, %




Source: Authors' calculations based on revised OECD models.

Figure 5. ITAX in various models




Source: Authors' calculations based on revised OECD models.

**References**

Dekkers, Gijs. (2007), "The Financial Implications of Working Longer: An Application of a Micro-Economic Model of Retirement in Belgium," *International Journal of Microsimulation*, 1, pp.10–25.

Diamond, P. and J. Gruber (1999), "Social Security and Retirement in the U.S.," NBER Working Paper, No. 6097.

Gruber, J. and D. Wise (1998), "Social Security and Retirement: An International Comparison," *The American Economic Review*, 88, pp.158–63.

Guo, Z. (2012), "Outline of Population Aging in China," a presentation at the International Symposium on Demographic Dividend and Socio-economic Development, in Beijing, August 20–21.

Hu, X. (2013), "On the Design of Pension System," http://www.financeun.com/news/201335/634980987930781250_3.shtml.

National Bureau of Statistics. (2012), *China Statistical Yearbook*, China Statistics Press.

OECD. (2011), "Chapter 3 Pensions Incentives to Retire," in: *Pensions at a Glance 2011,* Paris, OECD, pp.49-102.

Ogawa, N. and N. Takayama (2006), "Demography and Aging," in L. Clark, A. Munnell and J.M. Orszag, eds., *The Oxford Handbook of Pensions and Retirement Income*, Oxford, Oxford University Press, pp.163-182. Available at http://hermes-ir.lib.hit-u.ac.jp/rs/bitstream/10086/14252/1/pie_dp251.pdf.

Oshio, T.; A. Oishi and S. Shimizutani (2017), "Social Security Programs and the Elderly Employment in Japan," a paper presented in the workshop of "Two Countries Joint Project

on Pensions," December 8–9, IPLE-CASS, Beijing.

State Council. (2005), "The Decision on the Improvement of Unified Enterprises Employees' Basic Pension System," *State Council Document, No.38.*

Usui, E., Shimizutani, S. and Oshio, T. (2016), "Are Japanese Men of Pensionable Age Underemployment or Over employment?" *Japanese Economic Review,* 67, pp.150–68.

United Nations. (2017), *The 2017 Revision of World Population Prospects*.

Wang, X. (2017), "Current Chinese Pension Systems," a paper presented in the workshop of "Two Countries' Joint Project on Pensions," September 7, RIPPA, Tokyo.

Whitehouse, E. (2012), "Parallel Lines: NDC Pensions and the Direction of Pension Reform in Developed Countries," in: R. Holzmann; E. Palmer and D. Robalino, eds., *Nonfinancial Defined Contribution Pension Schemes in a Changing Pension World,* Vol. 1: *Progress, Lessons, and Implementation*. Washington, DC: World Bank, pp.85-105.