How Has the Upward Trend of the Replacement Rate of China's Public Pension Been Incorrectly Concluded as the Sharp Decline?

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Abstract: In recent years, using the benefit ratio as a proxy, the replacement rate of China's earnings-related public pension scheme has been widely incorrectly reported as "a sharp decline from approximately 70% in 2000 to 40% in 2020 due to the population aging". This strategic conclusion has been dominating the agenda of China's current pension reform: significantly expanding privately funded pensions. This paper rectifies this error and offers an alternative perspective to tackling pension challenges. The analysis concludes as follows. First, conceptual differences indicate that "replacement rate" and "benefit ratio" cannot be used interchangeably. Additionally, by decomposition, the replacement rate is a component of the benefit ratio. Second, the true replacement rate has remained stable and high at approximately 60% and has been increasing since October 2014. Since 2016, the reduction in the contribution rate has made the scheme more cost-effective for participants. Third, the decline in the benefit ratio is unrelated to population aging; rather, it arises from overlooked structural changes in pension models and coverage, as well as overestimated average wages. Fourth, in the public sector, the benefit ratio has been approximately double that of the private sector; and the (quasi-) mandatory pension contribution rate has reached 36%, its resulting net replacement rate could be approximately 100%, already excessively high. Fifth, given the significant drop in China's total fertility rate from 1.47 in 2019 to 1.0 in 2023 and the resulting rapidly rising indexed old-age dependency ratio, more resources should be directed toward promoting fertility rather than expanding privately funded pensions.

Keywords: Pension, replacement rate, benefit ratio, population ageing, old-age dependency ratio, total fertility rate

JE codes: H55, J18

1. Introduction[1]

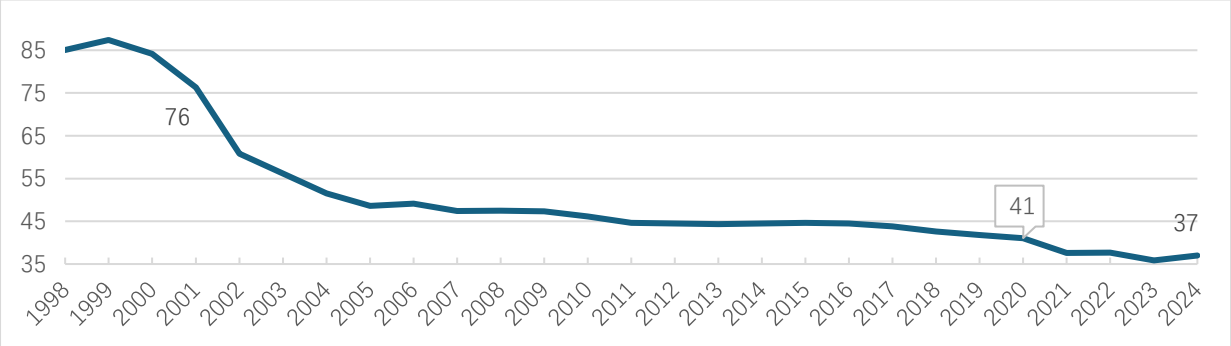
The Earnings-related public Pension (EP) scheme has been the most important pension in China, covering 46% of the population aged 16 and older in 2024 following a rapid expansion of coverage over the past two decades. Its replacement rate was high, approximately 60% for a worker with average

[1] The author greatly benefits from the insightful comments on my presentation from Prof. Takayama Noriyuki and the pertinent discussions from the conference participants in the Hitotsubashi Hall, Tokyo, December 3-4, 2018, where Prof. Takayama was the first to raise the question to me regarding the relationship between a macro ratio and a micro replacement rate. The discussions from Prof. Oshio Takashi (Hitotsubashi University) and Prof. Masato Shizume (Ritsumeikan University) and two workshops held by the Policy Research Institute of the Japanese Ministry of Finance also greatly helped the author improve the paper. Special thanks to Prof. Edward Palmer (Uppsala University) who carefully reviewed the entire paper and provided precise, incisive comments and language corrections. The paper in Japanese version has been published in *Financial Review,* No.163, pp.5-21, (フィナンシャル・レビュー163 号「少子高齢化と自助努力の促進が経済社会に与える影響」：財務総合政策研究所).

earnings over a 35-year career (Chinese Ministry of Labor and Social Security, 2005), and it has been increased further after the official nominal return of individual accounts has been significantly raised since October 2014, as shown in Section 3.1.

However, particularly since 2022, the replacement rate of the EP scheme has suddenly been widely reported as a sharp decline from about 70% to about 40% between 2000 and 2020, and it is expected to decrease further in the future, given the ongoing rapid process of population aging for several decades to come (Ren, 2023; Dong and Zhang, 2025), as shown in Figure 1, here the benefit ratio was taken as a proxy variable of the replacement rate.

Figure 1. Benefit-ratio (Average benefit / average wage), as a proxy variable of replacement rate in China, %



Source: The author's calculations based on *Chinese Ministry of Human Resources and Social Security Yearbook*, various years; and *Chinese National Bureau of Statistical Yearbook*, various years.

This strategic conclusion has been widely spread to the whole country and has dominated the current trajectory of China's pension reform. It has sparked considerable disturbance: many individuals have begun to fear that the replacement rate could diminish to zero in the near future. To address this shortfall in pension benefits, a robust promotion of privately funded pensions, supported by tax incentives and various subsidies, has been deemed urgent and necessary. For instance, there has been a nationwide expansion of individual pension insurances facilitated by the recent establishment of the "Citizen Pension Insurance Corporation" in 2022, which solely manages individual pension insurance. However, despite all these efforts, the growth of funded pensions has fallen far short of the government's expectations. China's pension reform has now fallen into a dilemma.

This appears to be somewhat a China-specific issue. This paper aims to restore public confidence in the replacement rate of the EP scheme and proposes an alternative approach to addressing pension challenges. Beyond rectifying misconceptions on the trend and level of China's replacement rate, the paper differs from previous research in three further ways: by decomposition, it examines differences in benefit ratios and replacement rates; by examining structural changes in China's pension model and coverage, it reveals the reasons for the sharp decline in the benefit ratio; and by using the indexed old-age dependency ratio, it clarifies the importance of fertility.

The structure of the paper is as following. Section 2 clarifies the conceptual differences between “benefit ratio” and “replacement rate” and examines their interrelationships through decomposition. Section 3 presents the true trend and level of the replacement rate according to various estimations. Section 4 identifies the overlooked factors that have contributed to the sharp decline in China’s benefit ratio: structural changes in benefit policy and coverage, overestimated average wages; it also highlights the differences in the benefit ratio across sectors. Section 5 discusses the severe consequences of the incorrect conclusion regarding the replacement rate, while Section 6 compares the significance of promoting funded pensions with fertility, given the notable decline in China’s total fertility rate and the resulting extremely high indexed old-age dependency ratio. Section 7 concludes.

2. Differences of "benefit ratio” and "replacement rate”

2.1 Conceptual differences between "replacement rate" and "benefit ratio"

Table 1 lists the conceptual differences of "replacement rate" and "benefit ratio" by definition, purpose, target pensioners, variable category, analysis approach, importance for assessing adequacy, and factors determining the value. The explanations are more organized by the perspective of the existing problems in China.

Table 1. Differences between "replacement rate" and "benefit ratio"

	Replacement rate (RR)	Benefit ratio (BR)
Definition	(1) For a *new* pensioner: an individual's *initial* benefit (in cash) compared to his or her earnings during work (excluding earnings in kind). (2) For a pension scheme: A typical employee’s RR. Generally, the RR of an average earner with a full career, particularly in OECD.	Average benefit (*initial* + *in-payment*) of all pensioners relative to economy-average wage.
Purpose	Measuring the effectiveness of consumption smoothing.	Measuring the living standard of the elderly to those of the working population, or a pension system’s ability to relieve elderly poverty.
Target pensioners	Only new pensioners.	Both new and pensioners in-payment.
Variable category	Flow.	Stock.
Analysis approach	Micro, on an individual basis.	Macro, on an economy-average basis.
Importance for assessing adequacy	Vital, essential.	Much less used compared to RR.

Factors determining the value	(1) Benefit formula and its parameter values. Note: A typical employee's RR is independent from the structure changes of average contribution years.	(1) All factors for RR, (2) Indexation for benefits in-payment, (3) Structure changes of benefit policy and coverage, for instance, the resulting changes of average contribution years.

Note: A typical employee, in OECD's publications, means an average earner with a full career, while in some countries a median earner.

Source: The author's summary mainly based on Barr & Diamond (2008), OECD (2012) and Takayama (2023).

A replacement rate indicates an individual's initial benefit divided by the individual's own self earnings during work for measuring the effectiveness of consumption smoothing. Thus, it is a flow variable by a micro approach on an individual basis. In contrast, a benefit ratio represents the average benefit relative to the average wage by a macro approach on an average basis.[2] Since it encompasses all pensioners, both new and those in-payment, it is a stock variable that measures the living standard of the elderly compared to the working population. Even if the values of the two indicators are identical, they do not convey the same meanings.

Depending on earnings' profiles and career lengths, replacement rates can vary significantly among individuals. For a certain pension scheme, it refers to as the case of typical individuals with a full career. In OECD's framework (*Pensions at a Glance*), there are three categories of typical individuals: low, average and high earners, whose earnings are 0.5, 1 and 1.5 times of the average earning, respectively. Generally, unless specified otherwise, a replacement rate for a scheme refers to the case of an average earner.

A government's primary concern lies in the replacement rate of its pension design, rather than the benefit ratio. If the benefit formula and parameter settings remain unchanged for a pension scheme, its replacement rate will also remain constant. However, even if the replacement rate of a pension scheme is stable, its benefit ratio may fluctuate significantly over time due to dramatic changes in the average career length of its pensioners, alongside the rapid expansion of coverage, as observed in China from 2000 to 2020 (see details in Section 4.1). Changes of the average career length and indexation policy for benefit in-payment can greatly affect the benefit ratio, but they do not influence the replacement rate.

In international pension-related literature, there may be instances where the calculation result of "average benefit/average wage" is called as a form of (macro) replacement rate, but no country has been observed to use a benefit ratio as a proxy variable for the replacement rate except China. Some protagonists in China's pension reform have defended this approach by stating that "replacement rates can be calculated in multiple ways" as claimed in Dong & Zhang (2025). However, this argument is

[2] The author is grateful for the insightful discussion from Prof. Edward Palmer for the expression of a macro indicator.

flawed. Dong & Zhang (2025) did not mention why results derived from entirely different definition and calculation methodologies can be considered comparable.

2.2 Decomposition: the replacement rate of a pension scheme is a component of the benefit ratio

To illustrate the relationship of the replacement rate of a pension scheme and the benefit ratio, we decompose the benefit ratio as follows.

$$\boldsymbol{BR_t} = AB_t/AW_t$$

AW_t is the average wage at the time point of t. AB_t is the average benefit, which is the weighted average of the benefit from three type's pensioners at the time point of t: the initial benefit for typical employees, the average initial benefit of other new pensioners, and the average benefit of pensioners in-payment. $\delta_{1t,}$ $\delta_{2t,}$ and δ_{3t} are the weights of these three groups of pensioners, respectively.

$$AB_t = \delta_{1t}\, B_t^{Typical\ employees} + \delta_{2t}\, AB_t^{The\ other\ new\ pensioners} + \delta_{3t}\, AB_t^{Pensioners\ in-payment}$$

Then we get the *BR* as following:

$$\boldsymbol{BR}_t = \delta_{1t} \frac{B_t^{Typical\ employees}}{AW_t} + (\delta_{2t}\, AB_t^{The\ other\ new\ pensioners} + \delta_{3t}\, AB_t^{Pensioners\ in-payment})/AW_t$$

$$\boldsymbol{BR}_t = \delta_{1t}\, \boldsymbol{RR}_t + (\delta_{2t}\, AB_t^{The\ other\ new\ pensioners} + \delta_{3t}\, AB_t^{Pensioners\ in-payment})/AW_t \qquad (1)$$

Thus, we conclude that the replacement rate of a pension scheme is a component of the benefit ratio, and RR and BR cannot be interchangeable with each other at all. It is also incorrect to deem "the benefit ratio" as a proxy variable of "the replacement rate ". It is essential to estimate the replacement rate for assessing policy for an earnings-related pension, in which generally the averages of the parameters (such as wage growth, prices, return rates of pension funds, etc.) are estimated first, as has been done by the OECD.[3]

3. The true trend and level of the replacement rate in China in 1997-2020

3.1 The trend

[3] Some influential Chinese pension experts do not know how to estimate the replacement rate of a pension system when faced with variations among individuals. Consequently, they believe that the benefit ratio can serve as a proxy, as Prof. Dong Keyong stated in his presentation titled "Accelerating the Development of a Multi-Pillar Pension System" at "The 2nd Pension Forum of China Inclusive Aging Finance Exploring the 'Chinese Model' of Public-Private Pension Coordinated Development," held at the China Financial Information Center, No. 18 Dongyuan Road, Lujiazui, Shanghai, on June 28, 2025.

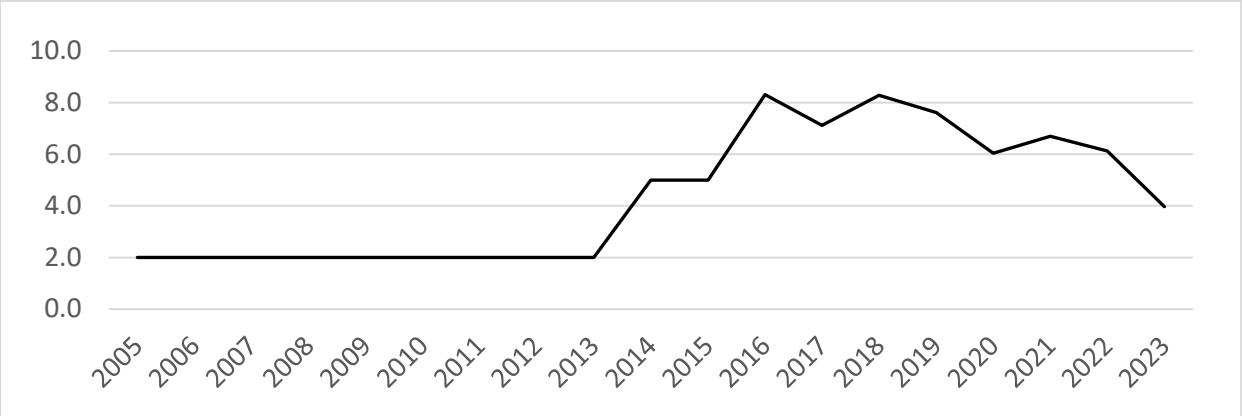
The current EP scheme comprises two components: defined benefits on a pay-as-you-go basis and individual accounts essentially on a pay-as-you-go basis. This model was initiated in 1997 and significantly revised in 2005.

During the period from 1997 to 2005, there was no decline in the replacement rate for the 2005 model compared to the 1997 model, because for a typical employee (an average earner with a 35-year career), the replacement rate is 58.5% for the 1997 model and 59.2% for the 2005 model, estimated by Chinese Ministry of Labor and Social Security (2005).

Since 2005, for the defined benefit portion, the benefit formula and the accrual rate have remained unchanged. The replacement rate for a typical employee is equal to the percentage of the years of contribution. For instance, if a typical employee has a total of 35 contribution years, the replacement rate will be 35%. Regarding individual accounts, the annuity factors have been constant, thus the trend of return rate plays a key role. Figure 2 illustrates the official nominal rate of return for individual accounts. From 2005 to September 2014, we take it as 2%.[4] Since October 2014, it has significantly surpassed previous levels. Consequently, the replacement rate for individual accounts has risen in 2020 compared to 2000.

Therefore, the replacement rate of the EP scheme has shown an upward trend from 1997 to 2020, despite the aging population. Along with the reduction of the contribution rate from 28% to 27% in 2016, and further to 24% in 2019, the EP scheme has become more cost-effective for participants since 2016.

Figure 2. Official nominal rate of return of individual accounts in the EP Scheme in China, %



Source: For the years 2005 to 2013, see footnote 5. For the other years, from each year's specific document on the rate of return of individual accounts issued by the Chinese Ministry of Human Resources

[4] The government has not released data on the rate of return up to September 2014. The reason in this paper for using 2% is based on two reasons. One is that "it had been less than 2%," said Hu Xiaoyi, then Deputy Minister of the Chinese Ministry of Human Resources and Social Security, in a presentation at a large academic conference in 2013. The contents of that speech could previously be downloaded from the web but are no longer available. The other is indirectly based on another of his presentations in 2018: "China's public pension fund has been more than 4 billion Yuan, but less than 10% of it has been invested. The other has been placed in banks, receiving only interest on demand deposits, lower than CPI" Hu (2018). Before 2014, the interest rate on demand deposits was less than 1%.

and Social Security.

3.2 The level

In the document of Ministry of Labor and Social Security (2005), the replacement rate for the 2005 model is 59.2% (35% from the defined benefit scheme and 24.2% from individual accounts), assuming a typical employee as an average earner with a 35-year career; however, the parameter values were not disclosed, nor was it specified whether the replacement rate is gross or net. According to the OECD definition in *Pensions at a Glance*, the gross replacement rate is calculated using the initial benefit and the individual's wage before tax and social security contributions, while the net replacement rate is calculated after deducting tax and social security contributions.

The gross replacement rate has also been estimated by other Chinese pension scholars with similar results. One estimate was 61.1% for an average earner with a 35-year career, assuming that the nominal rate of return for individual accounts are the same with the nominal wage growth rate (2013-2015: 8.6%, 2016-2020: 7.0%, 2021-2025: 5.9%, 2026-: 5%) (Wang and Mi, 2013).

In the OECD's estimation for China, a different set of parameters for modeling is applied: a 38-year career, 2% price inflation, and a 2.5% real rate of return for individual accounts (4.55% nominal rate of return for individual accounts), along with a 1.25% real wage growth rate (3.275% nominal wage growth rate) (OECD, 2023). The gross replacement rate is 68.3%, with 38% derived from the defined benefit scheme and 30.3% from the individual account scheme. When controlling for differences in career length, the difference in results between OECD and Chinese scholars are quite similar.[5]

Therefore, we conclude that the "gross replacement rate" for an average earner with a 35-year career in China is approximately 60%. Additionally, the net replacement rate in OECD modeling for China's EP scheme is 88.3% for a typical worker with a 38-year career. The very high net replacement rate stems from two factors: the zero-income tax on public pension benefits and China's high social security contribution rates (mandatory employees' contributions are 8% for public pensions, 2% for public health, 1% for unemployment and injury, 5-12% for housing provident funds).

3.3 Why have all these estimation results been ignored?

Other Chinese pension experts and actuarial statisticians have also estimated the replacement rate of the 2005 model using international standard methodology, and they generally reached similar results. Some have pointed out that the replacement rate should not be calculated by the way of a benefit ratio. However, they insist that "there are multiple ways to calculate the replacement rate, and the benefit ratio

[5] In some country calculations individual earnings are represented by an average of e.g. the last for example 5 years of earnings prior to full retirement. So, using OECD calculations is important because the OECD data is based on the same modellings for all countries).

is one of them" (Dong and Zhang, 2025). This is an egregious error, but unfortunately, this strategic conclusion has dominated the current agenda of China's pension policy and has been widely disseminated to the public.

3.4 Evaluating the benefit level and the contribution rate of China in an international comparison

For the benefit level, the current net replacement rate of 88.3% (OECD, 2023) positions China among the highest globally. This figure is based on a 38-year career, which is at least 5 years shorter than in many developed countries, such as Japan, the US, and Sweden. Since 2025, China has begun to raise the pension age, and as a result, the net replacement rate is anticipated to surpass 88.3% in the future. Considering that a replacement rate of 70-75% is sufficient for retirees to maintain a standard of living comparable to when they were working (Whitehouse, 2014), China's replacement rate is considerably higher than what is deemed adequate.

China is also among the group with the highest contribution rate for public pensions globally at 24%, exceeding the combined levels of public and occupational pensions in many developed countries, such as Sweden, Japan, and the US. This contribution rate has been adequate to ensure sufficient benefits for old age, as demonstrated by the relationships among contribution years, contribution rates, and years for benefit payment illustrated by Palmer (2024). Therefore, for China, there is no need to regard the expansion of funded private pensions as an absolute necessity; simply maintaining it as an additional option for individuals is enough.

3.5 The compatibility of the high replacement rate and population ageing in China

Here a question arises: How has the high replacement rate of the EP scheme been sustained amid rapid population ageing and the lack of a delay in the pension age thus far?

Indeed, there was a significant decline in the support ratio (the number of contributors relative to the number of pensioners) of the EP scheme, falling from 3.3 in 2000 to 2.6 in 2020. Furthermore, the total benefit expenditure as a percentage of GDP increased from 2.3% in 2000 to 5.0% in 2020. Three factors can be identified: high contribution rates, high economic growth, and transfers from general revenues, which accounted for 17-21% of the total benefit expenditure of the EP scheme each year from 2000 to 2019, making up about 80% of the total government transfers for public pensions in recent years. (All data in this paragraph are calculated by the author based on official data).

In principle, an earnings-related pension should be self-financing. However, because of the incorrect conclusion on its replacement rate in China, rather than exploring ways to shrink the transfers, further subsidies or tax privileges have been asked, for example, to help workers pay more premiums for privately funded pensions.

4. Overlooked factors led to the sharp decline of the benefit ratio in China

Chinese scholars who conflate the benefit ratio with the replacement rate simply attribute the reasons of its sharp decline after the year of 2000 to population aging, without discussion on any detailed changes in aging-related pension policies. However, factors which affect replacement rates and benefit ratios are different. As shown in the analysis of Section 3.1, the trend of the replacement rate has nothing to do with population ageing. As for the benefit ratio, the structure changes of pension model and coverage after 1997 should have greatly influenced the values of δ_{1t} and the second term in formular (1) in Section 2.2. These factors have been entirely neglected to date and nothing to do with the population ageing either.

4.1 Structure changes of pension model and coverage after 1997

The EP scheme began in 1951 and primarily covered tenured employees of public sectors and publicly-owned enterprises until 1997. Consequently, by around 2000, nearly 100% of participants came from the original formal sectors; they were high earners with lengthy careers, and their benefits were largely based on old policies prior to 1997, featuring very high replacement rates, typically ranging from approximately 70% to 100% of their final wage according to government-related documents (China's State Council, 1978; Chinese Insurance and Welfare Department of the Ministry of Labor and Personnel, 1983; China's State Council, 1986; China's State Council Office, 1993; Chinese Ministry of Labor, 1993). As a result, the benefit ratio was also quite high in 2000.

In 1997, structural changes occurred. To address the needs arising from the transition from a planned to a market economy, a new model was introduced in which anyone who reaches the earliest pension ages (women: 50 for blue-collar and 55 for white-collar; men: 60) or older, and accumulates a minimum of 15 years of contributions, is eligible to claim benefits based on the 1997 model. Here, the minimum contribution base has been taken as 60% of average wage. Here, the minimum contribution base has been set at 60% of the average wage regardless of the person's actual situation.

Since then, coverage has begun to expand into new formal and informal sectors.

In this paper, the definition of the original formal sector includes public sectors and large enterprises. And, the "new formal sector" is comprised of private medium-sized and small enterprises with more than 6 employees. The Informal sector includes enterprises with fewer than 6 employees, and the self-employed.

As a result, the coverage of the EP scheme for enterprise workers among the population aged 15 and above rapidly increased from 13% in 1997 to 34% in 2020 and 39% in 2023. The number of pensioners rose from 32 million in 2000 to 128 million in 2020 and 142 million in 2023. The newly increased participants mainly come from new formal sectors (small and medium enterprises) and informal sectors, because during the intensive privatization period, particularly around 2000-2004, the number of publicly-owned enterprises diminished considerably (Liu, 2008).

A notable feature of many of them is that they have finally escaped from the previous situation of having no access to public pensions, despite having much shorter contribution years and lower earnings, resulting in consequently lower benefit levels compared to their counterparts from the original formal

sectors.

Governments also launched various policies to help more people to get covered and meet the minimum eligible conditions as follows.

(1) People have been allowed to make 15-year contributions on a lump-sum basis. For people who have already reached or passed the pension age, but the person's accumulated contribution years are less than 15 years, governments will show the person the total amounts for the rest of the year who should pay further to be eligible to claim the benefit. Many people like to finish the rest of the payment either by themselves, or (partially) helped by families or by subsidies from government and so on, on a lump-sum basis, then they immediately start to receive benefits. While, in July 2017, this policy ended for participants on an individual basis.

(2) For workers who joined the original formal sectors without making contributions prior to 1997, their careers are also credited.

(3) For farmers whose lands were occupied during urbanization, lump-sum contributions to the EP scheme by land-buyers have been mandated (China's State Council, 2004; Chinese Ministry of Labor and Social Security, 2007).

(4) Governments implemented various subsidy policies to assist laid-off workers during the privatization of publicly-owned enterprises in paying premiums to the EP scheme.

(5) For low-income earners of enterprises, contribution rates have been allowed to switch to lower ranks and correspondingly their benefits in the future are also relatively low (China's State Council, 2006), as, for example, has been done in the Zhejiang province according to the author's field works.

All these changes in pension model and coverage contributed to the decline in the benefit ratio. During the period from 2000 to 2003, the sharp decline may also have had another cause: China had failed to pay all benefits on time. This issue was ultimately resolved in 2004 according to the yearbook of Ministry of Human Resources and Social Security (2005).

4.2 Overestimated average wage

There were substantial structure changes of the composition in contributors from 2000 to 2020 due to the expansion of the coverage. The share of original formal sector workers in the EP scheme changed from nearly 100% to about 50%, as the number of the employee share from the original formal sector in the urban sector was approximately 50% in 2020. The remaining 50% of workers primarily consist of individuals from new formal sectors and informal sectors.

Despite such a substantial structural change, throughout the whole period in Figure 1, the average wage used in the calculation of the benefit ratio is that of the original formal sectors, which has been the highest in China.

It is no problem to represent the average wage within the original formal sectors for the calculation for the year 2000, as nearly 100% of the participants in the EP scheme were from these sectors. However,

as we approached 2020, for instance, in 2018, the share of employees from the original formal sectors among the total number of contributors to the EP scheme fell below 50%, which is clearly a biased result.

From 2010, the Chinese government started to release the data on average wages and the number of employees for the new formal sector as well as the original formal sectors, but the government to date does not publish the average wage data including both the original and the new formal sectors. Here, we create the data using the number of employees in the two sectors as weights. Table 2 presents a comparison of the benefit ratios under two different average wages.

This calculation illustrates that the benefit ratio in 2018 rose from 43% to 55% when the average wage has been adjusted. This is a significant gap. Given the relatively shorter contribution years due to the immaturity of the EP scheme, this represents a fairly good standard of living for the elderly relative to workers. Moreover, the benefit ratio could increase in the future with the postponement of potential increases in the pension age with the continued maturation of the scheme, and assuming other factors remain unchanged.

Table 2. Comparisons of the benefit ratios under different average wages in 2018

Formal sector	Original	Original + new
Average wage, annually, Yuan	82413	64255
BR: Average benefit / average wage	43%	55%

Note: The definition of the original formal sector includes public sectors and large enterprises. And, the "new formal sector" is comprised of private medium-sized and small enterprises with more than 6 employees.

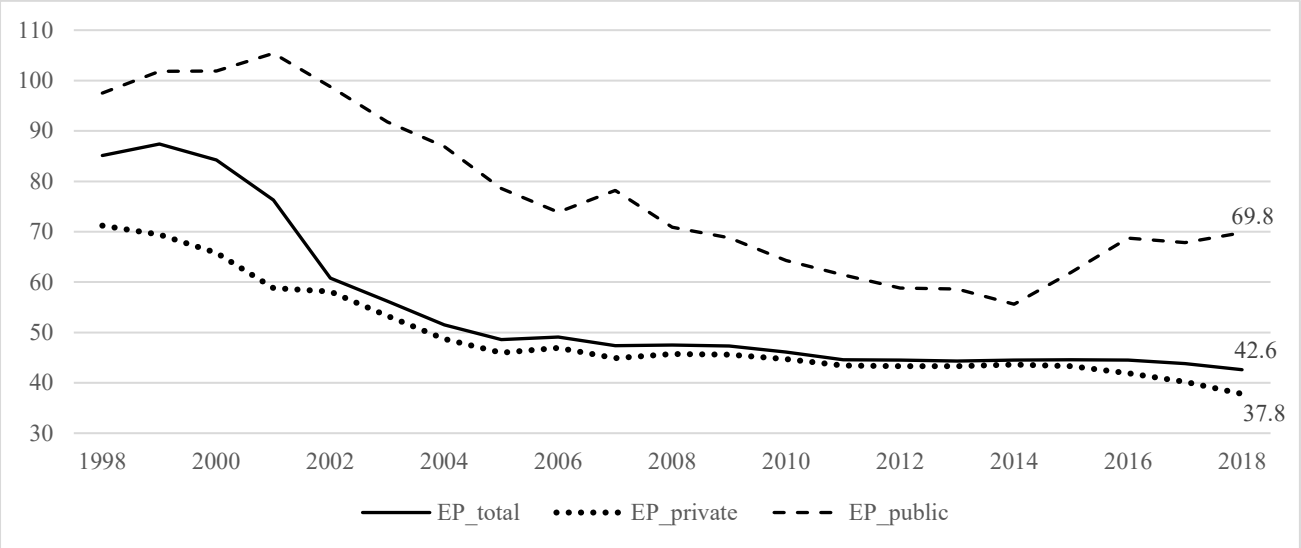
Source: The author's calculations based on data from *Chinese National Bureau of Statistical Yearbook* (2019).

4.3 High benefit ratios of public sectors concealed by average

In the period of 1997 to September 2014, pension reforms in China were only applied to private sectors. (In this paper, the private sector includes state-owned enterprises). In October 2014, public sectors were integrated into the 2005 model, while allowing for a 10-year transition. Therefore, huge benefit gaps have long existed between the two sectors, and consequently huge benefit ratios have also been there, as shown in Figure 3. EP_public and EP_private refer to the public and private sectors, respectively, and EP_total means the entire EP scheme. The average of both sectors in Figure 1 has got the high benefit ratios of public sectors concealed.

Figure 3. Benefit ratio by sector: Average benefit by sector / average wage of the original formal

sector, %



Source: The author's calculations based on data from the *Chinese National Bureau of Statistical Yearbook* and the *Chinese Ministry of Human Resources and Social Security Yearbook*, Various years.

The benefit ratio for the public sector has been significantly higher than that of the private sector, nearly double on average, although both exhibit a declining trend. What do these trends signify?

For the private sector, the analyses in Section 4.1 and 4.2 are applicable.

For the public sector, its average wage is very close to that of the original formal sector according to data from the yearbooks of the Ministry of Human Resources and Social Security. Thus, the benefit ratio of 100% before 2003 was exceptionally high, far exceeding adequacy, and should be reduced. Meanwhile, the 70% ratio in the years leading up to 2020 is also too high in the light of a public pension role. Combined with quasi-mandatory occupational pensions with a 12% contribution rate (8% from employers and 4% from employees) mainly running on a pay-as-you-go basis, a benefit ratio exceeding 100% can be anticipated.

Therefore, for the public sector, there is already no need to worry about a shortage of benefits. Instead of proposing an increase in benefits through additional policy assistance, China should explore ways to reduce the existing transfers to public sector pensions from general revenues - as proposed in the detailed proposals in Palmer, Wang, and Zhan (2023).

4.4 The decline of the benefit ratio and the population ageing

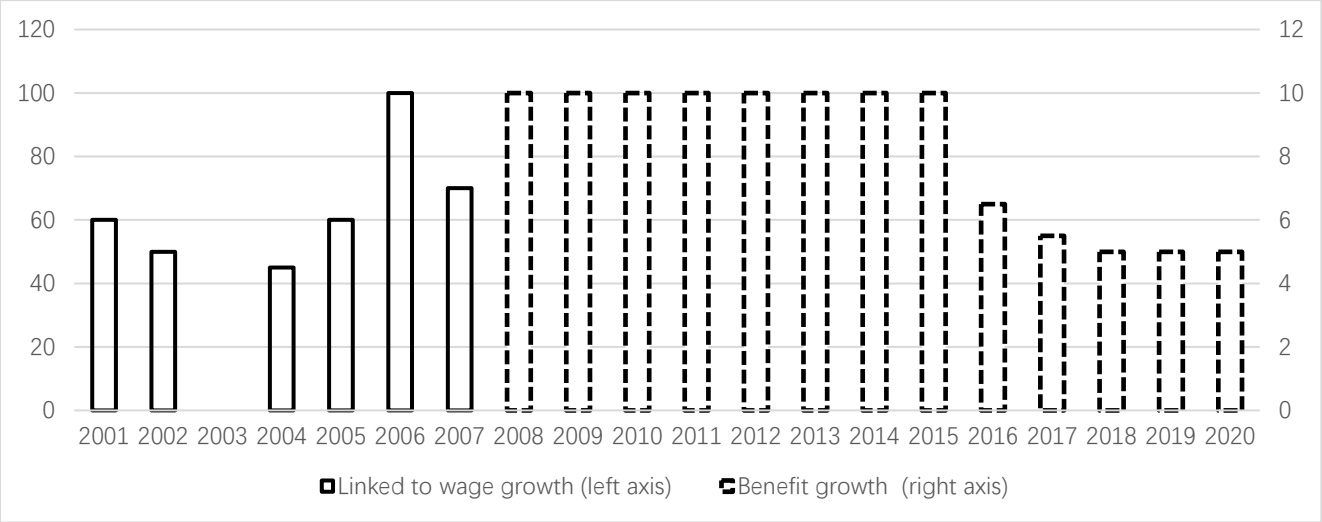
To date, the sharp decline in the benefit ratio from approximately 70% in 2000 to around 40% in 2020 has been directly attributed to population aging without any analysis of the relationship between aging and the corresponding policy changes. This kind of attribution has led to fear among many in the population given that ageing in China is expected to continue for at least another 30 years; consequently, the benefit ratio could potentially diminish to zero in the near future.

However, when we examine the history of China's pension policy, we find that there have been no changes or connections between benefit policy and population ageing. Then, based on the factors determining the value of benefit ratio in Table 1, we analyze them one by one.

For the first factor, population ageing is unrelated to the replacement rate, as demonstrated in Section 3. Therefore, population ageing has not affected the benefit ratio via the replacement rate.

For the second factor, the indexation of benefits in payment has also been notably high, as illustrated in Figure 4. From 2001 to 2007, the indexation was adjusted by approximately 60% of wage growth on average, and after 2008, it was directly linked to benefit growth with high rates. Consequently, this trend of indexation from 2000 to 2020 is also unrelated to population ageing. If it is the case that the decline of indexation after 2016 may reflect the pressure of population ageing – at least to some extent, nevertheless, it cannot be used to explain the declining trend over the entire period in 2000-2020. Therefore, population ageing has not affected the benefit ratio via the indexation of benefits in payment.

Figure 4. The indexation of benefit in-payment, %



Note: For the year of 2003, no official data is available.

Source: Each year's specific document on the indexation of benefit in-payment issued by the Chinese Ministry of Human Resources and Social Security.

For the third factor, we find that there have been structural changes to the benefit policy and coverage since 1997, as noted in Section 4.1, and an overestimation of average wages, as indicated in Section 4.2. These are the fundamental reasons for the decline in the benefit ratio, and none of which are related to population ageing.

5. Consequences arising from the fallacy regarding the replacement rate

The fallacy regarding the trend of the replacement rate—a sharp decline from around 70% in 2000 to 40% in 2020—and its incorrect attribution to population ageing has already led to a series of

consequences in China, as follows.

People's distrust in the EP scheme. The Chinese government has been making significant efforts to expand the coverage of the EP scheme to date. However, many individuals now perceive individual or commercial pensions as more beneficial than the EP scheme, particularly among middle and low earners. Not only has it become more challenging to enroll additional workers in the EP scheme, but some self-employed individuals who are covered are contemplating quitting or have already done so (Hu, 2025).

Excessive contributions to pensions and funds. As successive governments have deemed participation in occupational pensions and/or commercial pension insurances to be essential for nearly everyone, the total contribution rate to pensions has escalated to an excessively high level. The contribution ceiling for commercial pension insurances is 12 thousand RMB Yuan, from approximately 11% of the average wage for workers in the original formal sectors and to 18% of that for workers in *new* formal sectors emerging continuously through the most recent information made available in 2022.

For the public sector and state-owned enterprises, the total contribution rate has reached 36% (combining contributions from employers and employees: 24% for the EP scheme and 12% for quasi-mandatory occupational pensions). This rate is very high, exceeding the total contribution rate of public pensions plus occupational pensions in in a representative European country such as Sweden Sweden by 12.5 percentage points. If an employee additionally participates in commercial pension insurances with an 11% contribution rate, the total contribution rate will rise to 47%, with 23% allocated for funded pensions. For an employee in new formal sectors participating in both the EP scheme and commercial pension insurances, the total contribution rate will be 32%, with at least 18% designated for funded pensions.

Thus, both the total contribution rate and the contributions for funded pensions are significantly higher than is reasonable for most workers and are also abnormal from a global perspective. The rate of 36% is especially high for younger workers with children – and more so for those considering having children.

Contradictions people are caught in. On one hand, most people cannot afford to make additional contributions beyond the existing high premiums of public pensions and the risks associated with capital markets. On the other hand, they have been warned that they would fall short of their future pension benefits if they failed to do so.

Overshadowed concerns about increasing fertility rates. Rising fertility rates are crucial for addressing population aging, particularly in China, because the unexpected sharp decline in the country's fertility rate over the past five years has raised alarms (see details in Section 6). However, there is a trade-off between saving for retirement and allocating resources to boost fertility for both governments and households within limited means. Compared to major developed countries, China occupies two extremes: excessively high savings and generous pension subsidies for earnings-related pensions or high earners

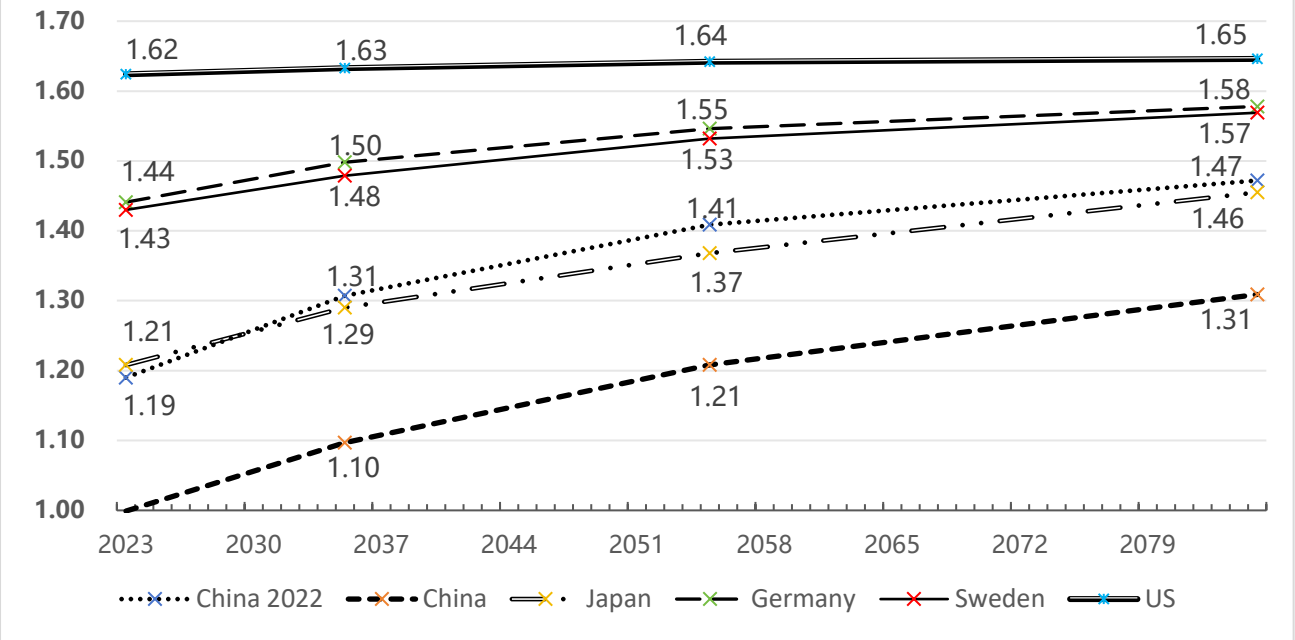
(Palmer, Wang, and Zhan, 2023), while having relatively few policies aimed at increasing fertility where once again we can refer to Sweden as in other (especially the Nordic European countries.

6. Policy implications in the backdrop of the sharp decline of China's total fertility rate in an international perspective

6.1 The sudden sharp decline of China's total fertility rate

The total fertility rate in China ranged from 1.65 to 1.74 during 2010-2017, which is relatively good by global perspectives. However, despite the abolition of the one-child policy in 2016, there was a sharp decline to 1.47 in 2019, further dropping to 1.19 in 2021 and 1.0 in 2023. As illustrated in Figure 5, in 2023, China's total fertility rate is the lowest among Japan, Germany, Sweden, and the US, and it is projected to remain significantly lower than all these countries through 2085.

Figure 5. Total Fertility Rates in UN population projection



Note: "China 2022" means the data are calculated using the *United Nations Population Projection* 2022 revision, whereas the second curve for China is based on the 2024 revision. Medium variant.
Source: Figure 2 in Palmer, Zhan, and Wang (2025).

6.2 The relationship between indexed old-age dependency ratios and total fertility rates

The old-age dependency ratio is a crucial indicator for pension design, significantly influenced by the total fertility rate over the long term, as shown in Table 3.

Here, the indexed old-age dependency ratio is used, in which the average effective pension age is indexed by assuming that, at that age, remaining life expectancy is 18 to 19 years for all countries (as opposed to a fixed age, as is commonly used, for instance 65). In this way, variations in life expectancy across countries are controlled. Nordic European countries are planning to move towards 67 for the not so distant future.[6]

The indexed average effective pension age is determined based on data from the *United Nations Population Projection*, as shown in Table 3.[7]

Table 3. Indexed average effective Pension Age (IPA) and indexed old-age dependency ratio

	China 2022	China	Japan	Germany	Sweden	US
IPA: the remaining life expectancy is maintained between 18 and 19 years						
2023	65	64	70	67	68	67
2035	67	66	71	68	69	68
2055	69	69	73	71	71	70
2085	72	72	76	73	74	73
Indexed old-age dependency ratio: IPA+ / (age 20 - less than IPA), %						
2023	25	24	39	33	29	25
2035	31	33	40	43	31	30
2055	46	46	49	39	32	30
2085	55	64	40	34	33	31

Note: (1) "China 2022" means the data are calculated using the *United Nations Population Projection* 2022 revision, whereas the second column for China is based on the 2024 revision. Medium variant.

(2) Indexed average effective pension age (IPA) is defined as ages at which the remaining life expectancy is maintained at between 18 and 19 years.

(3) The indexed old-age dependency ratio is defined as the number of populations aged more than IPA over the number of populations aged more than 20 less than IPA.

Source: A revised version of Table 1 in Palmer, Zhan, and Wang (2025).

Given the initial total fertility rates in 2023 and thereafter the trends projected by the United Nations in Figure 5, we find that:

- Despite having the fastest growth in total fertility rate among the countries shown in Figure 5, China's indexed old-age dependency ratio is projected to rise sharply from 24% in 2023 to 46% in 2055 and to 64% in 2085 at the highest rate; in contrast, other countries are expected to remain relatively stable. By 2085, China's indexed old-age dependency ratio could be double that of Germany, Sweden, and the US, and two-thirds of Japan's ratio. This alarming situation

[6] According to Prof. Edward Palmer's comment.

[7] The 18 -19 years of the remaining life expectancy is based on the observation from Prof. Edward Palmer according to announced global pension reforms to date.

highlights the significant impact of the initial disparity in total fertility rates between China and other countries. It underscores the particularly profound consequences of the neglected issue of the very low total fertility rate in China, indicating that fostering fertility is far more urgent and important for ensuring better pension benefits in the future than focusing on increasing subsidies for privately funded pensions.

- The indexed old-age dependency ratio could be sustained at approximately 35% if the total fertility rate exceeds 1.43 in 2023 and rises to over 1.46 by 2085. Japan's indexed old-age dependency ratio is about 8 percentage points higher than that of Germany and Sweden, due to its total fertility rate being significantly lower than those of the two countries throughout the period.

6.3 Policy implications: "Output matters"

Increasing total fertility rates has proven to be a challenging endeavor, even in developed countries with various policies, including in-kind support, such as in Japan.

However, a fundamental principle in pension economics is "Output matters", a conclusion widely acknowledged by pension economists around the world (Takayama, 2002; Barr & Diamond, 2008). Therefore, China's current strategy of primarily focusing on increasing more contributions as a silver bullet may be ineffective given the alarmingly low fertility rate and the resulting extremely high old-age dependency ratio. Chinese policymakers should seriously consider reallocating resources and subsidies from expanding privately funded pensions to promoting fertility.

7. Conclusion

A replacement rate of an earnings-related public pension serves as a strategic indicator for pension policy design. In fact, the replacement rate of the earnings-related public pension scheme in China has been notably high since 1997 and has shown an upward trend since October 2014, rather than declining. Furthermore, it is expected to rise further with the maturation of the scheme and the delay of retirement ages under the current modeling framework.

However, China's specific confusion with the benefit ratio, compounded by underestimated benefit ratios, has entirely stigmatized the earnings-related public pension scheme: Incorrectly transforming the upward trend of the high and more cost-effective replacement rate into a dismal deal. Furthermore, this strategic conclusion has significantly influenced the trajectory of China's pension reform, as it has been used to justify the necessity and importance of expanding privately funded pensions strongly, while neglecting another far more vital element: the sharp decline in the total fertility rate, which has been left with little support or resources.

This is a significant disaster. China must cease using the benefit ratio as a proxy for the replacement rate and promptly return to the international standard in assessing the replacement rate. Given that the indexed old-age dependency ratio could be stable if the total fertility rate can rise to a certain lever, it

should be far more critical in addressing pension challenges for China to redirect resources and subsidies from expanding privately funded pensions to encouraging fertility.

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