The Impact of the Two-Child Policy on the Pension Shortfall in China: A Case Study of Anhui Province

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Abstract: The one-child policy was designed as a basic national policy in China and was written into the Constitution in 1982. The main content and purpose of the policy are to advocate late marriage, late childbearing and fewer births to control population growth in a planned way. Since the implementation of the basic national policy, its positive effect upon China's economic development cannot be ignored, but after entering the 21st century, the problems related to population aging became obvious. Consequently, the basic pension system is confronted with great challenges. Under these circumstances, China initiated the two-child policy in 2016. This paper tries to forecast the change of pension shortfall after the implementation of the "two-child" policy in Anhui Province in China by establishing a pension revenue model, a pension expenditure model and a population prediction model. The prediction results reveal that the "two-child" policy helps to alleviate the pressure on the pension system, but the effect is limited and the "two-child" policy cannot change the trend of increasing pension shortfall in the long run. To reduce the burden on the pension system, the government can consider extending the pension contribution period and retirement age to make pension system sustainable.

Keywords: two-child policy; revenue of the pension system; pension expenditure; pension shortfall

1. Introduction

After the founding of the People's Republic of China in 1949, with the call for "more people, more power", China gradually faced the dilemma of a large population with scarce resources. In the 1970s, China's government has recognized that a high fertility rate is an obstacle for per capita growth, and thus the "one-child" policy was introduced in 1982. The "one-child" policy advocates late marriage, late childbearing and fewer births. Since the establishment of this national policy, the effect has been remarkable, China has entered a period of demographic dividend with higher per capita growth and less unemployment.

However, after entering the 21st century, China is gradually facing the problem of population aging, and the sustainability of the basic social pension system is challenged. On one hand, people's life expectancy increases because of the technical progress in health care and better nutrition, on the other hand, with the implementation of "one-child" policy, the number of young workers and retirees become disproportionate (the ratio of number of retirees to number of workers increase). The consequence is that the workers are confronted with an increasing contribution rate to keep the pension benefits constant, and additionally they are confronted with a higher contribution rate in the healthcare system, because elder people cause over-proportional high healthcare costs. As a solution, China's government initiated the "two-child" policy on 1 January 2016. A "two-child" policy is expected to improve the situation, but there is one big obstacle, people at the age between 20 and 40 have to pay a lot for pensions, healthcare, and now in addition they shall raise one more

child, which is relatively expensive in China (particularly in cities). Based on microscopic survey data, Wang and Liu (2017) use the method of classification and summation to estimate the basic cost of having a second child in the city of Guangzhou, Chongqing, Wuhan, Nanchang, Weifang and Yuxi. They find that the basic cost of having a second child in Guangzhou, Chongqing and Wuhan is more than $100,000, and the basic cost of having a second child in Nanchang and Weifang is more than $70,000. Within the cost of raising a second child, education costs account for a relatively high proportion of the total cost [1].

There is one more line of arguments beyond pure economic thinking, which is rooted in anthropology to explain fertility behavior. Dasgupta and Dasgupta (2017) argue that the number of desired children, is dependent on how many children per household are born in the relevant peer group. They call this conformist behavior [2]. The advantage of this approach is that it explains why many stable equilibria regarding the optimal number of children may exist. Based on this idea Bhattacharya and Chakraborty (2012) built a theoretical model of fertility behavior. They find if all others in the relevant peer-group prefer one child, then it is highly probable that an individual of this group also prefer only one child [3]. This conformist idea combined with the idea of status competition [4] leads to the argument that in a world of status competition expressed in terms of recognizable goods like an apartment, a luxury car, newest mobile and the like, households with two-children are disadvantaged compared to households with one child. Additionally, to have one child will become the norm, because the peers have also only one child. Consequently, the incentive to have a second child is very weak, because it would violate the norm and would lead to a decline of social status. Not surprisingly, even huge child allowances and child support do not alter the behavior of parents, as can be seen in the case of Germany, where the government provides a lot of support for giving birth to child and raising child. The German government offers for example the following benefits: one parent can stay at home for 13 months, while receiving 70% of the previous salary; tuition fees are not required from universities and schools; the monthly child allowance is $250 for the first and second child, $260 for the third, and $290 for each additional child (In the case when someone has 4 children, the total child allowance is 250 + 250 + 260 + 290 = $1050 per month, or above $12,000 a year); additionally the pension benefits of females increase with an increasing number of children. Stauvermann and Wernitz (2019) propose that after the child allowance increases the number of children, it is necessary to prevent the occurrence of a decrease in the income of children due to the lower education level per child, which could have an adverse effect on the future pay-as-you-go pension system [5].

We recognize that research on pension shortfall is relatively detailed, but there are only a few studies on the impact of the "two-child" policy on pension shortfall. The issue of pension shortfall caused by demographic change not only determines whether the basic social pension system can run healthily and sustainably, but also influences the social welfare and stability of the society. Hence, after the implementation of the "two-child" policy, the effect of the policy on the pension system has become an issue worthy paying attention to. By constructing a pension revenue model, a pension expenditure model and a population forecast model, we analyze the effect of the "two-child" policy on the pension shortfall by taking Anhui Province in China as an example. The main reason for focusing only on one province is that every Chinese province has its own and independent pension system, but it has to be noted that the structure of the provincial pension systems is almost identical in all provinces. Our research is based on the background of the "two-child" policy, and we comprehensively consider various factors that affect the balance of the pension system, which makes our analysis closer to reality, and the conclusions are more scientific and credible.

The rest of the paper is organized as follows: in Section 2 we present the literature review; in Section 3 we describe the model and the methods used in the research; in Section 4 we will present the forecast and results analysis; Section 5 is dedicated to sensitivity analysis,

in Section 6 we draw the main conclusions, in Section 7 we discuss the policy implication and thereafter we note some limitations of the current research.

2. Literature Review

The accelerating process of population aging will have an impact on the pension systems of many countries in the world. Scholars have conducted research on issues related to the pension system in various countries in the context of population aging. The research mostly revolves around fertility policy, retirement age, institutional reforms, the relationship between aging and pension system and etc.

2.1. The Impact of Adjusting the Fertility Policy on the Population Size

In the context of an aging society, it is of great significance to pay attention to the impact of fertility policy on the population size. Chesnais (1996) states that the total fertility rate in developed industrial societies has been lower than the replacement level of 2.1, which is necessary to keep the population constant. Thus, it is necessary to adopt fertility encouraging policies to maintain a sustainable population structure [6]. Bongaarts (2004) points out that regarding population aging, it is unfair and unsustainable to transfer the burden from one generation to the next, thus, the current fertility policy should be adjusted [7]. Qiao and Ren (2006) put forward that China should implement a reasonable fertility policy to keep the fertility level at around 2.0, so as to avoid the negative impact brought about by population decline [8]. Cai (2007) points out that the demographic dividend has made a great contribution to the sustained growth of China's economy. Therefore, facing the trend of population aging and the shrink of the working-age population, China should adjust its fertility policy to provide a sufficient working-age population for the stable development of the economy [9].

The "two-child" policy was introduced in China in 2016. Until now, the relevant research focusing on this topic is still limited. Yuan (2016) et al. estimate the future population of China by making assumptions about the fertility rate under the "two-child" policy, and forecast the trend of China's total population size in the future under different fertility rates [10]. Yang (2016) uses the cohort factor method to predict the future population under the "two-child" policy, and concludes that a baby boom will occur in the short term, but there will not be a sharp rebound in population growth in the long run. The effect of policy adjustment on improving the population structure is relatively weak [11]. Luo et al. (2014) set relevant parameters based on the current population size and development trend of Yunnan Province, and calculates the impact of the "two-child" policy on the population size of Yunnan Province. They conclude that the trend of population aging in Yunnan is irreversible, thus the fertility policy should be further improved [12]. Yang et al. (2014) use the three-dimensional analysis framework to evaluate and analyze the effect of "two-child" policy on the demographic dividend in Hubei Province, and note that "two-child" policy could increase population quality measured in terms of human capital, but the effect on demographic dividend is small [13]. In addition, some scholars have studied the relationship between "two-child" policy and fertility rate from country view. Based on the 2013 China's fertility willingness survey report, Zhuang et al. (2014) analyze and conclude that after the implementation of "two-child" policy, China's fertility rate will increase, but the time period of having a second child will not be overly concentrated [14]. Zeng (2006), through a comparative study of different birth policies, find that the "two-child" policy increases the working-age population, lowers the dependency ratio of the elderly population and reduces the ratio of male to female babies [15]. Regarding the long-term impact of the "two-child" policy on fertility rate, Qiao (2014) argues that the fertility rate may drop to a minimum soon, and the implementation of the "two-child" policy will only delay this time [16]. Zhai et al. (2014) note that the total fertility rate of women will eventually be expected to remain around 1.8 [17].

However, in general a consensus regarding the factors affecting population size does not exist. Besides fertility policy, some scholars believe that economic development and the

level of productivity play a more decisive role. Peng and Hu (2011) point out that not only the fertility policy needs adjustment, it is more important to find out the contradictions arising from the incongruity between population aging and the socio-economic system from the perspective of public policy [18]. Zhang and Li (2021) argue that economic growth is the foundation and source of pension sustainability [19]. Cao and Cheng (2014) state that the fertility rate of urban and rural residents will not increase significantly after the implementation of "two-child" policy, since there is a difference between the willingness to get a child and the ability to get a child [20]. Mao (2013) points out that changes in population structure and social dependency ratio are the result of a combination of factors, such as the level of economic development, subjective consciousness, traditional culture, etc., and are not only affected by the fertility policy [21].

2.2. Different Countermeasures to Ease the Pressure of Pension Benefits

Borsch-Supan (1992) shows that due to the strong impact of population aging, the pension system will inevitably face a payment crisis in the future. How to ease the payment pressure on pension system is worthy of in-depth discussion [22]. Corbo V. (2004) finds out that appropriately delaying the retirement age of employees has a significant effect on increasing the revenue of the pension system. At the same time, raising the fertility rate and promoting the immigration of young well-educated individuals from abroad can also increase the revenue of the pension system and ease the payment pressure [23]. Breyer and Hupfeld (2010) also agree with Corbo. V and advocate that the sustainability of the pension system should be improved through policies which delay employees' retirement age [24]. Nicholas Barr (2000) focuses on analyzing related constraints in pension system design [25], while Holzmann and Stiglitz (2004) mainly investigate how to promote the sustainable development of the pension system, and analyze the misunderstandings in the pension reform [26]. Posel and Casale (2003) points out that the revenues of the pension system in most countries rely heavily on government subsidies. In the context of population aging, the government is under great pressure and should reduce subsidies for the pension system [27]. Holzmann (2005) conducts research on the pension system in the United States and concludes that the balance of the pension system will be exhausted around 2030, and the reform of the pension system in the United States is imminent [28]. Feldstein et al. (2001) conducts research on the investment method of the pension system, and suggests that the government should invest the pension system in stocks, bonds, etc., to prevent the depreciation and shrinkage of the pension system [29]. OECD (2005) analyzes China's pension system and points out that due to China's "one-child" policy and the prolongation of average life expectancy, China's pension accounts are bound to run short. He suggests scientific and effective management of pension system [30]. Cabo (2014) points out that population aging has a profound impact on most national pension system. In order to prevent pension deficits due to population aging, the retirement age should be postponed, and the government should design a reasonable incentive mechanism to make employees more willing to delay retirement to reduce the financial pressure of the pension system [31].

2.3. Fertility Policy, Population Structure and Pension Shortfall

The pension shortfall is closely related to the population structure and fertility policy. Yin and Huang (2012) points out that under a pay-as-you-go pension scheme, the age structure of the population can significantly affect revenue of the pension system and pension benefits, and the old-age dependency ratio is closely related to the pension shortfall [32]. In recent years, China's population aging has accelerated, with the number of retired workers increasing while the number of young workers decreasing. Stauvermann and Kumar (2016) use an overlapping generation model with endogenous fertility, endogenous lifespan, and human capital accumulation to theoretically explore whether the pay-as-you-go pension system will be sustainable under a declining population structure and a longer life expectancy. They find that if parents' investment in human capital is beneficial, the revenue of the pension system will always increase in the future. Furthermore, the ratio between

pension benefits and the consumption of younger generation will reach a positive limit value, and therefore the pay-as-you-go pension system will not suffer from insolvency problems due to increased life expectancy and declining fertility rate [33].

From the perspective of fertility policy, the research on birth policy is mostly focused on the prediction analysis of birth rate and birth peak, while the research on the impact of increasing the total fertility rate on the financial status of the pension system is limited. Using macro data analysis, Lee and Miller (1990), Blake and Mayhew (2006) take the United Kingdom as an example and find out that the financial burden of the pension system can be reduced by increasing the total fertility rate [34,35]. Through population forecast, Sun et al. (2011) concludes that in the long run, releasing the two-child policy will help to solve the payment crisis of the pension system and narrow the pension shortfall [36]. In general, most scholars believe that the release of the fertility policy can help to ease the aging of China's population and achieve sustainable development of the pension system. Chen and Song (2013), Zeng and Ren (2015) take urban employees' pension system as an example to study the effect of the "two-child" policy on solving the pension crisis. They find that the "two-child" policy increases the number of contributors, improves the financial situation and eases the payment pressure of the pension system [37,38]. Zhang (2014) and Mou and Yu (2016) propose that the "two-child" policy is desired for social and economic development and is an effective means to alleviate the imbalance of the population structure and the aging of the population. Full application of the "two-child" policy will inevitably have an impact on China's social dependency ratio [39,40]. Wang (2014) notes that there is an advantage and an disadvantage associated to the full application of the "two-child" policy with respect to the balance of the pension system. On the one hand, it can effectively reduce the pension deficit, but on the other hand, it may also have a negative impact on employment rate and wages and the social security system [41]. Sun (2013) points out that China's pension system crisis is rooted in an unreasonable population structure, in order to cope with the pension crisis, it is necessary to moderately increase the fertility rate [42]. Liu (2013) points out that population aging in China has a great impact on savings, investment and labor productivity, the liberalization of the "two-child" policy will help to solve these problems [43]. Kang (2014) remarks that according to historical data and forecast data, the level of pension expenditure increases, while the fertility rate decreases, thus, it is necessary to apply the "two-child" policy [44].

2.4. Prediction and Analysis on the Balance of Payments of the Pension System

By simulating the fertility rate, Luo and Jiang (2015) find that the increase in the fertility rate in the short term will not have a significant impact on the revenues and expenditures of the pension system, but it facilitates long-term balance of payments for the pension system [45]. Sun et al. (2011) compare the changes in the pension shortfall under the "one-child" and "two-child" birth plans, and conclude that the impact of the adjustment of the birth policy on the pension system will appear after 2039. The application of the fertility policy can effectively offset the pension shortfall [36]. Liu (2014) simulates an increase of the total fertility rate from 1.45 to 1.6, and compares the pension shortfalls. His results show that increasing the fertility rate has little effect on the balance of future the pension system [46]. Wang (2000) points out that the balance of the pension system is very important for the sustainable development of pension system, and analyzes the impact of changes of contribution rate, replacement rate and wage growth rate on the balance of the pension system [47]. Regarding the research on the balance of the pension system in the case of Anhui Province, by applying relevant data in Anhui, Guo (2011) forecasts urban employees' pension income and expenditure. The results show that starting from 2026, there will be a gap in the balance of the basic pension system for urban employees in Anhui Province. From that year on, the gap will continue to expand year by year [48].

In general, most of the mentioned studies are focused on the study of the balance of the pension system, and the variables introduced are relatively simple, a quantitative research that comprehensively considers the application of the "two-child" policy and other

relevant variables (like demographic changes, delayed retirement, changes in replacement or contribution rates, etc.) is thus needed at present. Therefore, we analyze and predict the impact of the "two-child" policy on the demographic changes and the shortfall of the pension system in Anhui Province.

3. The Model—Taking Anhui Province as a Case Study

3.1. Pension Revenue Model

In general, the revenues of China's pension system consists of two parts, a pay-as-you-go part and a personal account part. The pay-as-you-go part is equal to corporate payments plus government subsidies. From another perspective, it is also equal to the number of insured employees multiplied by the average salary of the insured employees multiplied by the corporate contribution rate.

Let I_n be the income from the pay-as-you-go part of the pension system in the nth year; $\overline{Q_k}$ is the average annual wage of the employees in the kth year, which is the base period; g_t is the annual growth rate of average wage; C_t is the corporate contribution rate; $R_{x,n}$ is the number of insured employees at the age of x in the nth year. Then $\sum_{a}^{b-1} R_{x,n}$ is the total number of insured employees, where a is the age when the employees begin to contribute to the pension system, and b is the employees' retirement age. We assume that the average beginning time of employment age in Anhui Province is 20 and μ is the contribution rate of the pay-as-you-go part. We assume the latter is fixed to 20% like it is assumed in the literature referenced above.

$$I_n = C_t * \overline{Q_k} * g_t * \sum_{a}^{b-1} R_{x,n} \tag{1}$$

3.2. Pension Expenditure Model

China's pension expenditure generally consists of the following two parts. One part is the payment of monthly pension benefits to retirees, and the other part is to distribute pension benefits in personal accounts to retirees.

Suppose E_n is the pension expenditure in the nth year; $L_{x,n}$ is the number of retired employees at the age of x in the nth year, then $\sum_{x=b}^{w} L_{x,n}$ is the total number of retired employees, where w is the age of death of the employees; $Q_{m,t}$ is the average basic pension level of retired employees at the age of m in year t; θ_t is the pension adjustment rate.

$$E_n = \theta_t * Q_{m,t} * \sum_{x=b}^{w} L_{x,n}. \tag{2}$$

3.3. Population Forecast Model

The revenue of the pension system and its expenditure are closely related to the number of insured employees, the number of retirees and the trend of demographic change. Therefore, in order to calculate the revenue of the pension system and pension expenditure of Anhui Province, we should consider the population and pension policies of Anhui Province and predict future population structure, specifically, we should focus on the impact of the "two-child" policy on the fertility rate.

There are many types of population prediction models, including Logistic model, Leslie matrix population prediction model, gray GM (1.1) population prediction model and etc. The problem with the above mentioned models is that the implementation of the "two-child" policy will have a great impact on various parameters in each model, making the model difficult to be accurate, and the prediction result will inevitably be biased. We use in this paper the cohort element method—which can improve the accuracy of population prediction. We use data from the Anhui Provincial Statistical Yearbook and apply MATLAB software to calculate and predict the demographic change of Anhui Province until 2050.

Let $x_a(t)$ denotes the population size of a cohort of age a in year t, a = 1, 2, 3, ..., 100, and at the same time; $d_a(t)$ denotes the mortality rate of people aged a in year t; $m_{n,a}(t)$ represents the increase in the number of registered households at the age of a in year t, $m_{n1-n,a}(t)$ represents the increase of the migrant population aged a in year

t; $b_a(t)$ represents the fertility rate of prolific females at the age of a in year t, assuming $15 \leq a \leq 49$, the total fertility rate is $\sum_{a=15}^{49} b_a(t)$; $g(t)$ represents the sex ratio (male to female) of newborns in year t; f represents females and m represents males; the assumptions here are all vector assumptions, $X(t) = \begin{bmatrix} x_0(t) \\ x_1(t) \\ \cdots \\ x_{100}(t) \end{bmatrix}$ represents the population structure in year t,

$M_n(t) = \begin{bmatrix} m_{n,0}(t) \\ m_{n,1}(t) \\ \cdots \\ m_{n,100}(t) \end{bmatrix}$ denotes the increased population structure of the registered population

in year t, $M_{n1-n}(t) = \begin{bmatrix} m_{n1-n,0}(t) \\ m_{n1-n,1}(t) \\ \cdots \\ m_{n1-n,100}(t) \end{bmatrix}$ denotes the increased population structure of the im-

migrant population in year t, $A(t) = \begin{bmatrix} 0 & 0 & \cdots & 0 & 0 \\ 1-d_0(t) & 0 & \cdots & 0 & 0 \\ 0 & 1-d_1(t) & \cdots & 0 & 0 \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ 0 & 0 & \cdots & 1-d_{99}(t) & 1-d_{100}(t) \end{bmatrix}$

represents the survival rate in year t, $X_b(t) = \begin{bmatrix} x_0(t) \\ 0 \\ \cdots \\ 0 \end{bmatrix}$ is the number of newborns in year t.

The population in year t + 1 can be expressed as follows:

$$x_a(t+1) = (1-d_{a-1}(t)) \times x_{a-1}(t) + m_{n,a}(t+1) + m_{n1-n,a}(t+1), \ 1 \leq a \leq 99, \ 0 \leq t \leq T \tag{3}$$

$$x_{100}(t+1) = (1-d_{99}(t)) \times x_{99}(t) + (1-d_{100}(t)) \times x_{100}(t) + m_{n,100}(t+1) + m_{n1-n,100}(t+1) \tag{4}$$

The number of male newborns and female newborns in year t + 1 can be expressed as follows:

$$x_n^m(t+1) = \left(\sum_{a=15}^{49} x_a^f(t+1) * b_a(t+1) \right) \times \left(\frac{g}{100+g} \right) + m_{n,0}^f(t+1) + m_{n1-n,0}^f(t+1) \tag{5}$$

From the above formulas, we can get the population model as follows:

$$X(t+1) = A(t) \times X(t) + M_n(t+1) + M_{n1-n}(t+1) + X_b(t+1) \tag{6}$$

In China, pensions are received in accordance with the territorial principle. If an individual participates in the pension system, it must be processed in the place where the household registration is located, that is, it cannot be insured in another place. Therefore, this article does not consider the number of immigrants and their pension payments in all following calculations.

3.3.1. Basic Assumptions

As noted above, China's pension fund is divided into two parts. The individual contributes 8% of its salary to the personal account; the enterprise contributes about 20% of the employees' salary to the pay-as-you-go part. We mainly focus on the pay-as-you-go part, and the personal account is not calculated here, because all funds in the personal account will be returned when the individual retires, therefore the impact of personal accounts on the overall account is weak. At the same time, the impact of state subsidies on pensions is not considered.

We assume that male employees and female employees begin to work at the age of 20. In recent years, the government releases a progressive delayed retirement plan, but only a few places (Shandong province and Jiangsu Province) have implemented the scheme since the beginning of 2022. Thus, for conservative estimation, the retirement age for male employees is still set at the age of 60 and for females at the age of 55 (In the robustness check part, we will assume an increase in the retirement age and check whether the conclusions still hold). In addition, it usually takes on average 20 years for a newborn baby to be included in the pension system after birth, so we will consider the period 2016–2050.

With reference to the forecast of the average life expectancy of population in China, we refer to the United Nations "World Population Outlook", and assume that the average life expectancy of the population in China is 80 years, that is, the age of death is 80.

3.3.2. Parameter Introduction

(1) Average wage growth rate

Table 1 displays the average wage growth rate of Anhui Province from 2001 to 2018, we observe from the table that the trend of growth rate of average wage is nearly the same as the growth rate of GDP. However, as the economy continues to grow, its growth rate will definitely decline, and accordingly, the growth rate of average wages will also decrease.

Table 1. Average wage and index of employees in Anhui Province from 2001 to 2018.

Year	Average Wage (Yuan)	Average Wage Index (First Half Year = 100)
2001	7908	113.1
2002	9296	117.6
2003	10,581	113.8
2004	12,928	122.2
2005	15,334	118.6
2006	17,949	117.1
2007	22,180	123.6
2008	26,363	118.9
2009	29,658	112.5
2010	34,341	115.8
2011	39,352	118.0
2012	44,601	113.3
2013	47,806	107.2
2014	50,894	106.5
2015	55,139	108.3
2016	59,102	107.2
2017	65,150	110.2
2018	74,378	114.2

Data comes from "Anhui Statistical Yearbook".

It can be concluded from the table that the average wage index ranges between 100–120. Considering China's future economic situation and GDP growth target, we refer to the CGE model constructed by Xiao (2012) and use the method of changing a certain percentage at regular intervals to define k, the growth rate of average wage per year in Anhui Province [49], where k is 9% before 2020, 6% from 2021 to 2030, 4% from 2031 to 2040, and 3% from 2041 to 2050.

(2) The average replacement rate of the pension system

We use the ratio of the average pension benefit of retired employees to the average salary of in-service employees to calculate the average replacement rate of the pension system.

Average replacement rate of the pension system = average pension income of retired employees/average salary of in-service employees.

It can be observed from Table 2 that the average replacement rate of pension system in Anhui Province from 2001 to 2018 basically showed a declining trend (except for 71.26%

in 2018). The average replacement rate from 2001 to 2009 was 53.41%, and the average replacement rate from 2010 to 2018 was 47.21%. According to the data of the "Pension Development Report" over the years and consider the actual situation in Anhui Province, we use the value calculated by Yang (2017), where the future pension replacement rate is 45% [50].

Table 2. The average replacement rate of the pension system in Anhui Province from 2001 to 2018.

Year	Average Salary of Employees (Yuan)	Average Pension Income for Retired Employees (Yuan)	Replacement Rate (%)
2001	7908	5472	69.20
2002	9296	6180	66.48
2003	10,581	6336	59.88
2004	12,928	6732	52.07
2005	15,334	7320	47.74
2006	17,949	8904	49.61
2007	22,180	9912	44.69
2008	26,363	12,444	47.20
2009	29,658	12,984	43.78
2010	34,341	15,259	44.43
2011	39,352	17,444	44.33
2012	44,601	19,354	43.39
2013	47,806	21,394	44.75
2014	50,894	23,418	46.01
2015	55,139	25,597	46.42
2016	59,102	27,006	45.69
2017	65,150	25,137	38.58
2018	74,378	53,005	71.26

Data comes from "Anhui Statistical Yearbook".

(3) Participation rate

It can be recognized from Table 3 that the number of employees participating in the pension system in Anhui Province continues to increase, and the increase in the participation rate reflect the growth rate of revenue of the pension system. The average annual increase of the participation rate for the pension system in China as a whole over the years is 1.66% [51], on the basis of this value, this article adopts a conservative estimate and assumes that the participation rate in Anhui Province will increase by 1% annually.

Table 3. Basic pension situation of employees in Anhui Province from 2001 to 2018.

Year	Number of Employees (Ten Thousand People)	Number of Insured Employees	Employees' Participation Rate (%)
2001	641.5	3,242,376	50.54
2002	659.1	3,295,412	50.00
2003	683.2	3,430,677	50.21
2004	694.4	3,450,517	49.69
2005	730.5	3,469,852	47.50
2006	755.9	3,614,088	47.81
2007	818.1	3,855,442	47.13
2008	901.9	4,202,763	46.60
2009	936.2	4,586,947	49.00
2010	973.5	4,920,498	50.54
2011	1038.3	5,377,490	51.79
2012	1141.0	5,784,030	50.69
2013	1226.2	5,922,049	48.30
2014	1277.4	5,969,045	46.73
2015	1292.1	6,108,539	47.28
2016	1327.5	6,343,078	47.78
2017	1378.5	7,541,145	54.71
2018	1385.3	7,988,093	57.66

Data comes from "Anhui Statistical Yearbook".

(4) Number of retirees

The data in Table 4 shows that the number of retirees in Anhui Province fluctuated, but the general trend is an increase of the number of retirees. At the same time, pension expenditure in Anhui Province increased as the number of retirees rose, and the growth rate of the number of retirees reflects the growth rate of pension expenditure.

Table 4. The number of retired people in Anhui Province from 2001 to 2018.

Year	Number of Retired Employees (Persons)	The Growth Rate of Retired Employees (%)
2001	955,122	
2002	1,027,929	7.62
2003	1,135,507	10.47
2004	1,188,445	4.66
2005	1,247,613	4.98
2006	1,338,138	7.26
2007	1,447,758	8.19
2008	1,581,377	9.23
2009	1,694,577	7.16
2010	1,774,880	4.74
2011	1,915,225	7.91
2012	2,053,564	7.22
2013	2,191,238	6.70
2014	2,323,449	6.03
2015	2,466,593	6.16
2016	2,579,290	4.57
2017	3,228,587	25.17
2018	3,429,090	6.21

Data comes from "Anhui Statistical Yearbook".

(5) Contribution rate of the pension system

According to national regulations, the enterprise contributes about 20% of the employees' salary to the pay-as-you-go part in the pension system. However, the executive meeting of the State Council on 13 April 2016 stipulated that the contribution rate of pension system for the enterprise part should be reduced stepwise to reduce their financial pressure, and could be adjusted from 20% to 19% in the first step. We refer to the practice of other regions in China in 2022 (Fujian Province and Shandong Province in particular) and set the average contribution rate of Anhui Province in the future as 19%.

(6) The revenue and expenditure of pension system

Because of the continuous improvement of the pension system and economic development, we can observe from Table 5 that the income of the pension system in Anhui Province has increased year by year, from 4.7 billion RMB in 2001 to 210.5 billion RMB in 2018. At the same time, the expenditure of the pension system in Anhui Province increased from 5.9 billion in 2001 to 181.7 billion in 2018.

(7) Pension adjustment rate

Beginning in 2005, China has repeatedly increased the payments for enterprise employees after retirement. The growth rate in 2006 was 23.7%, since then, the annual growth rate has been around 10% for nearly ten years, and the growth rate was about 6.5% in 2016. Based on related research, this paper adopts the following pension adjustment formula: $\omega_{it} = \alpha c_{it-1} + \beta w_{it-1} + e_t$, where we use α and β values calculated by Yang and Shen [52]. Then we have $\omega_{it} = 0.21 \times c_{it-1} + 0.79 \times w_{it-1}$. Among them, ω represents the basic pension adjustment ratio, c is the inflation rate, and w is the growth rate of the average wage.

Table 5. The basic situation of income and expenditure of pension system in Anhui Province from 2001 to 2018.

Year	Revenue (Ten Thousand Yuan)	Expenditure (Ten Thousand Yuan)	Year	Revenue (Ten Thousand Yuan)	Expenditure (Ten Thousand Yuan)
2001	472,902	593,444	2010	3,432,478	2,708,340
2002	725,628	695,937	2011	4,594,510	3,341,022
2003	873,533	832,462	2012	5,084,201	3,974,490
2004	1,026,149	917,557	2013	6,249,422	4,688,128
2005	1,247,813	1,052,615	2014	6,807,025	5,441,083
2006	1,639,319	1,304,720	2015	7,917,525	6,313,752
2007	2,076,644	1,540,523	2016	8,394,118	6,965,752
2008	2,648,464	1,975,524	2017	10,202,349	8,115,654
2009	3,006,151	2,334,678	2018	21,051,657	18,176,103

Data comes from "Anhui Statistical Yearbook".

It can be derived from Table 6 that the average wage index of urban employees in Anhui Province from 2001 to 2018 ranged between 100 and 120, and the growth rate of wages was relatively stable, the inflation rate fluctuated from 2001 to 2010, but remained relatively stable from 2011 to 2018. Taking into account the actual situation in China and referring to Tang and Wu's work [51], we assume that the subsequent inflation rate stabilize at 3% in China.

Table 6. Basic pension adjustment rate in Anhui from 2001–2018.

Year	Wage Growth Rate (%)	Inflation Rate (%)	Basic Pension Adjustment Rate (%)
2001	11.31	0.72	
2002	11.76	−0.73	9.09
2003	11.38	1.13	9.14
2004	12.22	3.82	9.23
2005	11.86	1.78	10.46
2006	11.71	1.65	9.74
2007	12.36	4.82	9.60
2008	11.89	5.93	10.78
2009	11.25	−0.73	10.64
2010	11.58	3.18	8.73
2011	11.80	5.55	9.82
2012	11.33	2.62	10.49
2013	10.72	2.62	9.50
2014	10.65	1.92	9.02
2015	10.83	1.44	8.82
2016	10.72	2.00	8.86
2017	11.02	1.59	8.89
2018	11.42	2.07	9.04

Data comes from "Anhui Statistical Yearbook" and National Bureau of Statistics.

(8)   Fertility rate

We adopt the fertility rate of females at childbearing age in the statistical yearbook of Anhui Province.

It can be derived from Table 7 that the fertility rate has increased after the implementation of the "two-child" policy in 2016, but it is expected to fall back. We refer to Qiao's (2014) research and assume that the fertility rate will remain constant at 0.35 until 2050 [53].

(9)   Sex ratio of newborn children

According to the data of the 2005 sample survey, the sex ratio of newborns was 120.49 nationwide and 133.20 in Anhui Province. According to the data of the sixth national census in 2010, the sex ratio of newborns was 121.21 in China and 131.07 in Anhui Province. Based on the above data and related research, this paper makes the same assumption as Tang and Wu (2016) and the sex ratio of newborns in Anhui Province from 2001 to 2015

is 130. With the implementation of the "two-child" policy, the sex ratio of newborns from 2016 to 2050 will be 115 [51].

Table 7. The fertility rate of Anhui Province from 2001 to 2018.

Year	Fertility Rate	Fertility Rate of Female with One Child	Fertility Rate of Female with Two-child	Fertility Rate of Female with Three Child and Above
2001	/	/	/	/
2002	0.4196	0.3102	0.1089	0.0005
2003	0.4210	0.3036	0.1069	0.0105
2004	0.4386	0.2976	0.1288	0.0122
2005	0.3969	0.2558	0.1303	0.0108
2006	0.3122	0.2063	0.0952	0.0107
2007	0.3113	0.2104	0.0898	0.0111
2008	0.3189	0.2135	0.0932	0.0122
2009	0.3167	0.2131	0.0924	0.0112
2010	/	/	/	/
2011	0.2922	0.2054	0.0788	0.0080
2012	0.3065	0.2079	0.0914	0.0072
2013	0.3048	0.1985	0.0967	0.0096
2014	0.3085	0.1873	0.1115	0.0097
2015	0.3462	0.1920	0.1396	0.0146
2016	0.3669	0.2139	0.1441	0.0089
2017	0.4110	0.1677	0.2211	0.0222
2018	0.4371	0.1811	0.2335	0.0225

Data comes from "Anhui Statistical Yearbook".

(10) Mortality rate

According to Table 8, the overall mortality rate was around 6‰ in the period 2001–2015. Since 2016, the mortality rate was around 5.95‰. Therefore, in order to simplify the calculation, it is assumed that from 2018 to 2050, the mortality rate will decrease by 0.01‰ each year. At the same time, the population of Anhui Province in 2018 by age and sex is shown in Table 9.

Table 8. Anhui Province's total population, birth rate and mortality rate from 2001–2018.

Year	Birth Rate (‰)	Mortality Rate (‰)	Natural Growth Rate (‰)
2001	12.46	5.85	6.61
2002	11.20	5.17	6.03
2003	11.15	5.20	5.95
2004	11.62	5.50	6.12
2005	12.43	6.23	6.2
2006	12.60	6.30	6.3
2007	12.75	6.40	6.35
2008	13.05	6.60	6.45
2009	13.07	6.60	6.47
2010	12.70	5.95	6.75
2011	12.23	5.91	6.32
2012	13.00	6.14	6.86
2013	12.88	6.06	6.82
2014	12.86	5.89	6.97
2015	12.92	5.94	6.98
2016	13.02	5.96	7.06
2017	14.07	5.90	8.17
2018	12.41	5.96	6.45

Data comes from "Anhui Statistical Yearbook".

**Table 9.** Population by age and sex in Anhui Province in 2018.

Age	Population (Person)		
	Total	Male	Female
	642,304	323,721	318,583
0–4	38,585	20,605	17,979
5–9	42,390	23,007	19,383
10–14	40,099	21,765	18,334
15–19	33,341	17,946	15,396
20–24	34,083	17,735	16,348
25–29	45,604	22,105	23,500
30–34	40,112	19,124	20,988
35–39	38,652	18,803	19,849
40–44	45,624	22,778	22,846
45–49	64,872	32,034	32,838
50–54	64,471	31,760	32,711
55–59	36,672	18,308	18,365
60–64	34,492	17,526	16,966
65+	83,307	40,629	42,678

Data comes from "Anhui Statistical Yearbook".

4. Forecast and Result Analysis

4.1. Population Forecast Results

Based on the above models and data, we calculate the total population and the number of newborns in Anhui Province from 2020 to 2050. The results are shown in Figures 1 and 2.
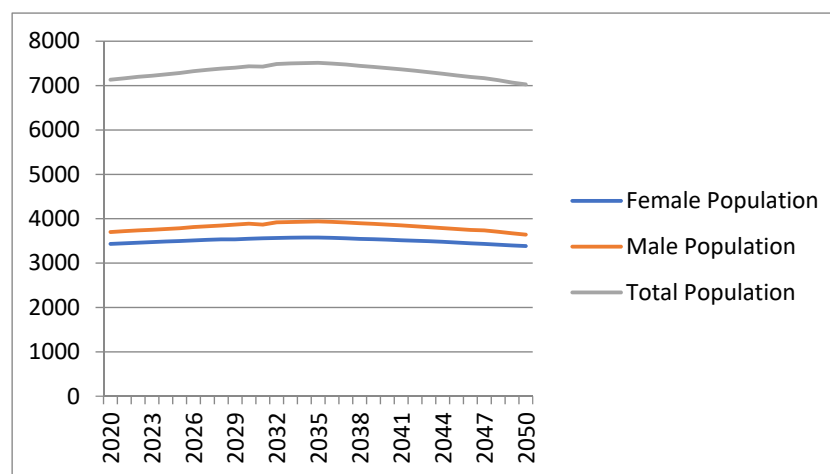
Figure 1. Forecast of the future population of Anhui Province (Unit: 10,000 people).

The total population of Anhui Province increased steadily from 63.25 million in 2001 to 70.83 million in 2018, and the sex ratio was very stable, basically around 108. At the same time, the specific data of newborns in Anhui Province can be calculated from the total population and birth rate in each year. Here we only calculate the number of newborns in 2012–2018, which could give us an intuition. According to the above principles, the total number of newborns was 897,300 in 2012, 892,500 in 2013, 892,000 in 2014, 897,800 in 2015, 914,900 in 2016, 993,200 in 2017, and 879,000 in 2018. The data shows that the number of newborns increased slightly after the implementation of the "Two-child" policy in 2016, but this can be explained by a one-time catch-up effect. This means, some parents particularly older parents want to get more than one child since some time and then they could realize their desire not earlier than 2016. This explains then also why the number of newborns dropped sharply in 2018. Based on this, it can be predicted that the number of newborns will decline steadily thereafter.
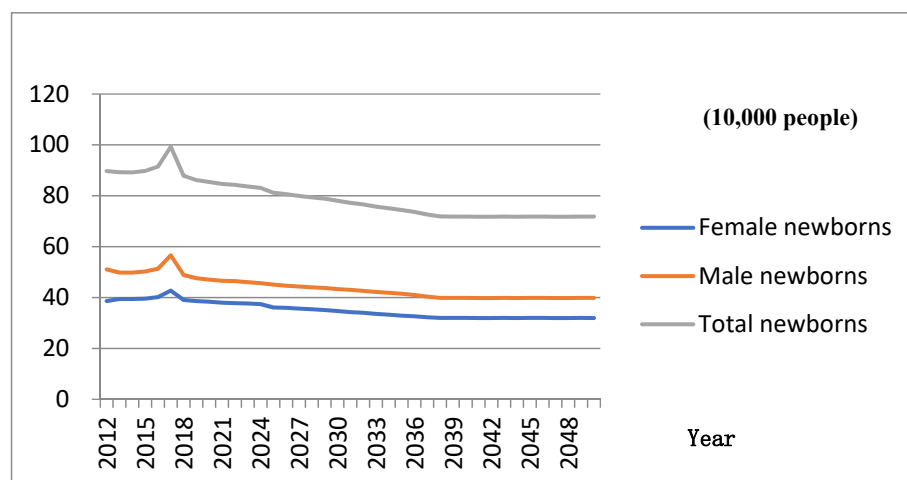
Figure 2. Forecast of the future number of newborns in Anhui Province.

Figure 1 shows that after the implementation of the "two-child" policy in Anhui Province, the population peak will probably be reached around 2035. After that, the total population will gradually decline, and could even be smaller than the total population before the policy was implemented.

Figure 2 depicts the number of newborns in Anhui Province from 2012 to 2050. It is obvious that the number of male newborns, female newborns and the total number of newborns all display a trend of rising first and then falling back. It can be clearly seen from the figure that after the implementation of the "two-child" policy in 2016, the number of newborns shows a steep rise, reaching a peak in 2017, and then steadily declines until 2050.

If the "two-child" policy is not implemented, the population forecast in Anhui will be different.

Based on the data from 2001 to 2015, we draw the first figure in Figure 3 below, where the blue line represents the total population and the red line represents the trend line from 2001 to 2015, and then we added a predicted trend line in Figure 3, which forecasts the change in the total population of Anhui Province by 2050 without implementing the "two-child" policy.

4.2. Forecast Results of Pension Revenue and Expenditure

Combining the results of the population forecast with the pension income and expenditure model, we calculate the future pension revenue and expenditure, as shown in the Table 10 (unit: 100 million).

Comparing the two scenarios in Table 10, it becomes clear that changes regarding the pension revenues until 2036 cannot be expected. The reason is simply that children born in 2016 or later will not enter the labor market before 2036. After 2036, the policy change has a significant influence on the pension revenues, because the calculations show that "two-child" policy will increase the pension revenues. The main reason for this difference is the change in the number of insured persons, and the difference of insured persons is due to the different fertility policies. The number of newborns increases with the implementation of the "two-child" policy, it usually takes at least 20 years on average for newborns to participate in the pension system. Therefore, the number of insured persons in 2036 and beyond will rise, which will increase the income of the pension system.

Children born after the implementation of the "two-child" policy in 2016 have not reached the retirement age within the estimated time limit, so the newborns after the implementation of the "two-child" policy have no impact on the number of insured retirees, or it has no effect on pension expenditure. It should be noted that the calculations show that the pension expenditure will nevertheless increase and this is caused by the increasing life expectancy. However, from a pure logical point of view the "two-child" policy cannot guarantee the long-run sustainability of the pension system, because even in the best case

the number of children per female will remain below two and combined with an increasing life expectancy, additional measures have to be taken.
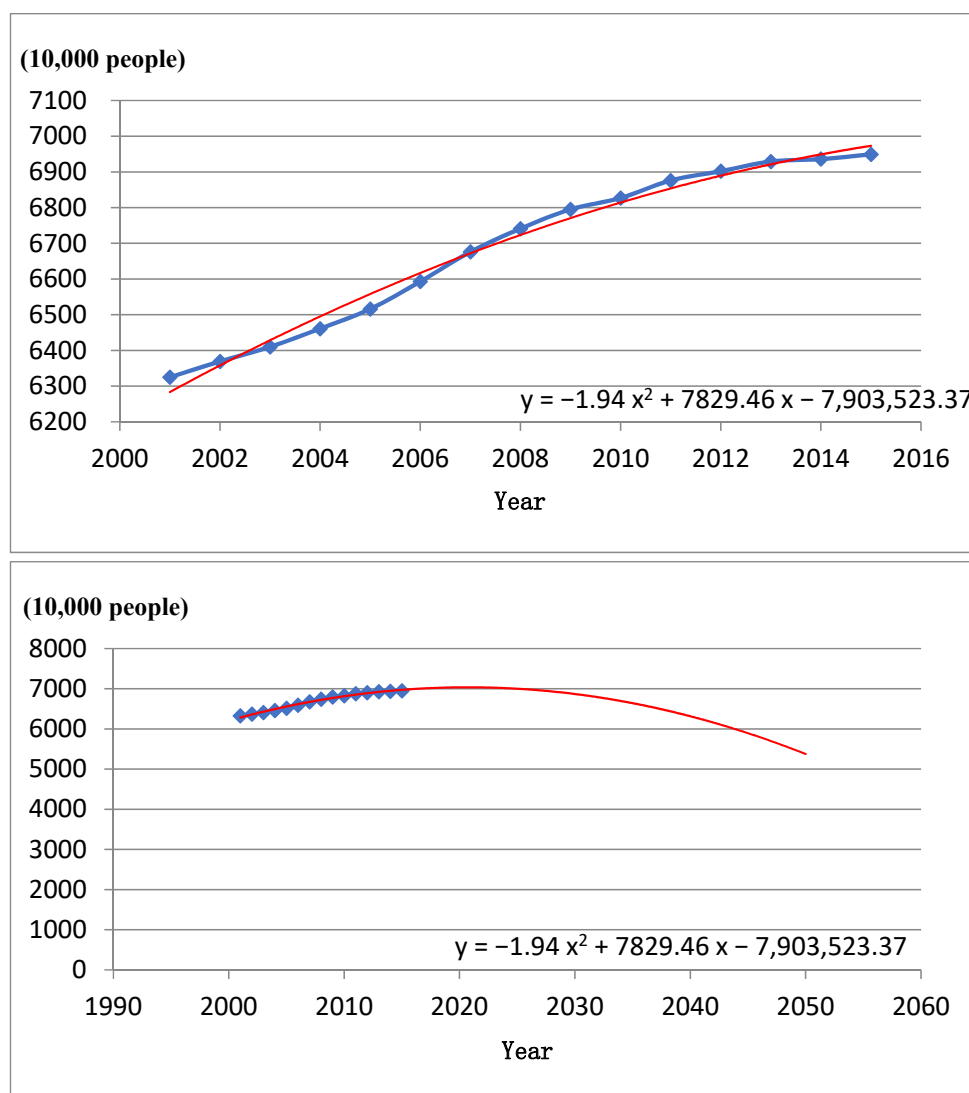

(10,000 people)

$y = -1.94\,x^2 + 7829.46\,x - 7{,}903{,}523.37$

$y = -1.94\,x^2 + 7829.46\,x - 7{,}903{,}523.37$

Figure 3. Population forecast without implementing the "two-child" policy.

Judging from the current balance of the pension, in either case, the current balance has a surplus first and then gradually decreases until it reaches a deficit. Because of the "lag effect" of population growth, there is no difference between the two policies (implementing the two-child policy and not implementing the "two-child" policy) until 2036. In 2036 and thereafter, the "two-child" policy leads to a bigger surplus than the business as usual (BAU) scenario. Additionally, the future deficits are bigger under the BAU scenario than under the "two-child" policy scenario. Generally speaking, the scale of the current balance with the implementation of the "two-child" policy is relatively high.

From the perspective of the cumulative balance of pensions, the cumulative balance of pensions has gradually developed from surplus to deficit. Before 2036, due to the "lag effect", the accumulated balance will not be affected. With respect to the accumulated balance the calculations show that the point of time when the pension system will run into a deficit will be postponed by the "two-child" policy from 2044 to 2045.

Table 10. The impact of the "two-child" policy on the revenue and expenditure of urban employees' pension system.

Year	Without Implementation of the "Two-Child" Policy				With Implementation of the "Two-Child" Policy				Difference (Revenue)
	Revenue	Expenditure	Current Balance	Accumulated Balance	Revenue	Expenditure	Current Balance	Accumulated Balance	
2016	839	697	143	143	839	697	143	143	0
2017	1020	812	209	352	1020	812	209	352	0
2018	2105	1818	288	639	2105	1818	288	639	0
2019	2258	2019	239	878	2258	2019	239	878	0
2020	2386	2171	215	1093	2386	2171	215	1093	0
2021	2547	2425	122	1215	2547	2425	122	1215	0
2022	2733	2681	52	1267	2733	2681	52	1267	0
2023	2874	2820	54	1321	2874	2820	54	1321	0
2024	3016	2963	53	1374	3016	2963	53	1374	0
2025	3162	3100	62	1436	3162	3100	62	1436	0
2026	3289	3263	26	1462	3289	3263	26	1462	0
2027	3507	3422	85	1547	3507	3422	85	1547	0
2028	3627	3588	39	1586	3627	3588	39	1586	0
2029	3743	3761	−18	1568	3743	3761	−18	1568	0
2030	3980	3942	38	1606	3980	3942	38	1606	0
2031	4204	4171	33	1639	4204	4171	33	1639	0
2032	4319	4290	29	1668	4319	4290	29	1668	0
2033	4476	4402	74	1742	4476	4402	74	1742	0
2034	4714	4681	33	1775	4714	4681	33	1775	0
2035	4842	4868	−26	1749	4842	4868	−26	1749	0
2036	5109	5062	47	1796	5199	5062	137	1886	90
2037	5231	5264	−33	1763	5261	5264	−3	1883	30
2038	5335	5473	−138	1625	5387	5473	−86	1797	52
2039	5611	5691	−80	1545	5690	5691	−1	1796	79
2040	5727	5918	−191	1354	5790	5918	−128	1668	63
2041	5836	6153	−317	1037	5900	6153	−253	1415	64
2042	5952	6398	−446	591	5991	6398	−407	1008	39
2043	6075	6602	−527	64	6168	6602	−434	574	93
2044	6191	6813	−622	−558	6358	6813	−455	119	167
2045	6305	7030	−725	−1283	6548	7030	−482	−363	243
2046	6424	7254	−830	−2113	6827	7254	−427	−790	403
2047	6535	7486	−951	−3064	6912	7486	−574	−1364	377
2048	6638	7725	−1087	−4151	7089	7725	−636	−2000	451
2049	6741	7971	−1230	−5381	7100	7971	−871	−2871	359
2050	6834	8225	−1391	−6772	7103	8225	−1122	−3993	269

5. Robustness Check

In order to test whether the conclusions of this paper will be affected by the changes of relevant parameters and produce large fluctuations, a sensitivity analysis is hereby conducted. Considering China has proposed to appropriately reduce contribution rates of the pension system and implement the progressive delayed retirement policy (In January 2022, Shandong Province and Jiangsu Province in China announced to initiate the delayed retirement policy nationwide, for which the time period for the deferred retirement should not be less than one year) and taking into account of the degree of uncertainty in the model parameters, we select the number of population, contribution rate, retirement age and wage growth rate to carry out robustness check. The results show that the basic conclusion of this paper has not changed, that is, the "two-child" policy is conducive to improving the balance of the pension system, but the "two-child" policy alone cannot effectively solve the problem of the pension shortfall.

5.1. Sensitivity Analysis of the Number of Population

Based on different preferences with respect to fertility, we convert data of fertility rate into data of birth rate under three different scenarios, namely optimistic, moderate, and pessimistic scenario.

Pessimistic scenario: The birth rate remained at 11.3‰ before the implementation of the "two-child" policy. The birth rate is 11.8‰ within 2 to 5 years after the implementation of the "two-child" policy. Five years later, it will drop to the level of 11.2‰. Moderate scenario: The birth rate is maintained at 11.3‰ before the implementation of the "two-child" policy. Within 2 to 5 years after the implementation of the "two-child" policy, the birth rate rise to 12.4‰, the birth rate remains at 11.8‰ five years later. Optimistic scenario: The

birth rate remained at 11.3‰ before the implementation of the "two-child" policy. The birth rate is 14.2‰ within 2 to 5 years after the implementation of the "two-child" policy. Five years later, the birth rate remains at 12.3‰.

Figure 4 depicts the total population in Anhui Province from 2020 to 2050 under three different fertility scenarios. We can observe from Figure 4 that the population peak will probably be reached around 2031, 2035 and 2036 under pessimistic, moderate and optimistic scenarios, respectively. Thus, we conclude that the trend of the number of total population slightly changes under different fertility willingness scenarios, with a rise of number of total population after the implementation of the "two-child" policy, but the effect lasts for only a short period of time and the overall trend remains unchanged and the number of total population drops in the long term.
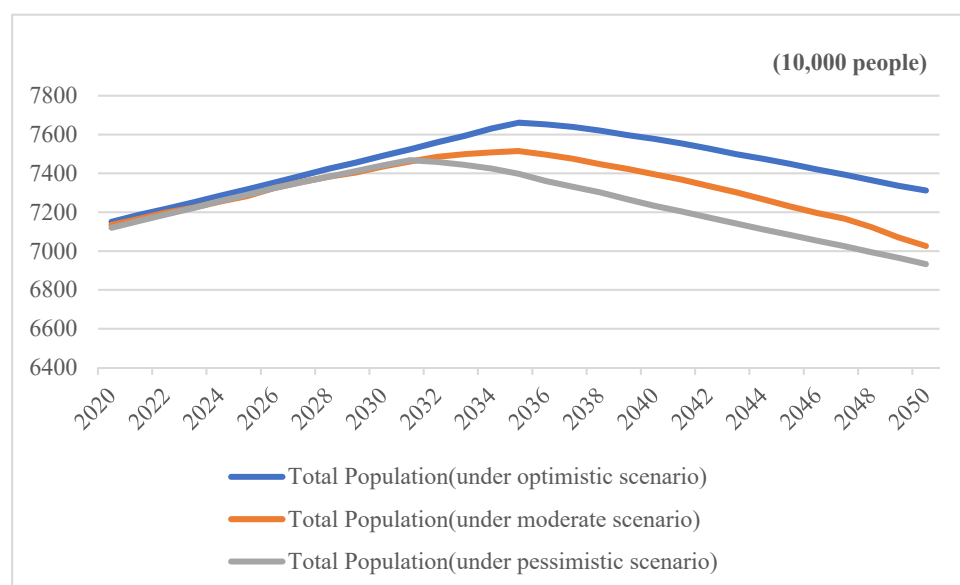

Figure 4. Prediction of the total population of Anhui Province under different fertility scenarios.

5.2. Sensitivity Analysis of the Wage Growth Rate

When other parameters remain unchanged, changes in the average wage growth rate will not only affect the pension contribution, but also affect the pension benefits of the employees. The growth rate of wages is closely related to the level of national economic growth, which is affected by many factors and is difficult to predict accurately. We assume that the average wage growth rate is 5% and 7%, respectively after 2020 (where in previous part, we assumed this number to be 6% after 2020) and conduct a sensitivity analysis, the results are shown in Table 11 and we can conclude from the table that the impact of the "two-child" policy on the pension shortfall is still gradually weakening over time with different wage growth rate.

Table 11. Sensitivity analysis of the wage growth rate.

Wage Growth Rate 5%	Without Implementation of "Two-Child" Policy	Pessimistic Scenario	Moderate Scenario	Optimistic Scenario
First time when pension shortfall occurs	2035	2035	2035	2035
Wage growth rate 7%	Without implementation of "two-child" policy	Pessimistic scenario	Moderate scenario	Optimistic scenario
First time when pension shortfall occurs	2039	2039	2040	2042

5.3. Sensitivity Analysis of the Retirement Age

Other things equal, the change of retirement age will affect the retirement population and the revenue and expenditure of the pension system. In order to alleviate the impact of population aging on the pension system, China has initiated the progressive delayed retirement plan which was officially introduced in 2017, and Shandong Province and Jiangsu Province has already implemented the policy in 2022. We hereby conduct a sensitivity analysis for two different plans. One is to defer the retirement age by one year for every three years, the other is to postpone the retirement age by one year every four years (as shown in Table 12). We can observe from the table that delaying retirement age helps to reduce the pension gap. Under the condition that the "two-child" policy is not implemented, the time for the first shortfall to appear will be postponed to 2049. To clearly examine the influence of the "two-child" policy, we extend the time period until 2060, the results still remain valid. Thus, we can conclude that after the implementation of the "two-child" policy, the impact of which upon the pension shortfall is still weakening over time.

Table 12. Sensitivity analysis of the retirement age.

To Postpone Retirement Age by One Year Every Three or Four Years	Without Implementation of "Two-Child" Policy	Pessimistic Scenario	Moderate Scenario	Optimistic Scenario
First time when pension shortfall occurs	2048	2050	2053	-

5.4. Sensitivity Analysis of the Contribution Rate

Under the condition that other parameters remain unchanged, changes in the contribution ratio of the pension system will affect the revenue and expenditure of the pension system over the years. According to latest policies initiated in China, we assume that the contribution rate of the pension system will be further reduced from 19% to 18% in the future, and conduct a sensitivity analysis test. The results show that the time when pension shortfall occurs under this scenario is 2033, thus, the conclusions of this paper have not changed fundamentally, and the impact of the "two-child" policy on the pension shortfall is gradually weakening over time.

6. Conclusions

In general, due to the "lag effect" of newborns, the impact of the "two-child" policy on urban employee pension's revenue and expenditure has no immediate effect on the pension system. The "two-child" policy will have an impact on the pension shortfall around 2035. While maintaining the policy unchanged, the pension system in Anhui Province will run into a current deficit in 2037. With the implementation of the "two-child" policy, the same problem will occur also around 2037. This means that the policy does not postpone the date of the occurrence of a current deficit. However, the extent of the pension shortfall with the implementation of the "two-child" policy is smaller than the pension shortfall under an unchanged policy regime. Therefore, in terms of the results, the "two-child" policy helps to alleviate the pressure on pension system, but it cannot change the trend of expanding pension shortfall in the long run, and the fundamental problem of the pension system remains unsolved.

7. Policy Implications

The simple forecast shows that the "two-child" policy alone does not make the pension system in Anhui province sustainable. Even in the most optimistic scenario which is very improbable, the pension system will run into a deficit in the long run. Only the date when it will happen will be postponed into the future. The underlying reason is the increasing life expectancy. Therefore, it is necessary to implement other policy measures. Many studies have shown that the high child-rearing cost may be an important reason for many

couples to delay childbirth or even refuse childbirth. However, as we know from other countries child allowances is a policy which can become very expensive and which has no huge impact on the number of children. A compromise would be to lower or abolish cost of education as it is done in many European countries. The advantage is that these educational costs are significant costs for parents and increasing the human capital of people will have a significant positive impact on wages and salaries. As a consequence, the revenue of the pension system will increase. Another approach is to increase the retirement age, but this must be done carefully, because old workers and employees may become unemployed under this approach. In this context, it should be considered to make the retirement age dependent on the working conditions. Particularly, to keep the retirement age of low-skilled workers constant and to increase only the retirement age of skilled workers. The background is that the increasing life expectancy is not equally distributed across the working population. The life expectancy of skilled workers is increasing much more than the life expectancy of low-skilled workers. This measure will on aggregate increase the years of contribution of every population vintage and reduce the years of retirement of every population vintage. Both effects will increase the income of the pension system. However, to emphasize the main result again, the "two-child" policy alone is not sufficient to guarantee the long-run sustainability of the pension system in the Anhui region under the existing institutional setting.

8. Limitations

In our article, some variables, like the contribution rate of pension system, the retirement age of employees, and the growth rate of average wage of employees are uncertain, and reasonable assumptions need to be made based on existing literature research. Thus, the accuracy of these assumptions may affect the predicted results. Nevertheless, we are convinced that even reasonable changes of these numbers will not change our main results and conclusions.

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