

Study on the Impact of Population Aging on Economic Growth

-- Empirical Analysis based on Chinese Provincial Panel Data

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Abstract

Since 2000, my country has officially entered an aging society, and the deepening of the aging degree will also have a profound impact on my country's economy. This paper first briefly introduces the relevant concepts and theoretical basis, and analyzes the development process, current situation and changes of relevant population policies of China's aging. Collecting panel data of 31 provinces in China from 2000 to 2020, selecting a fixed effect model, and using STATA to empirically analyze the impact of China's population aging on economic growth. The results show that the dependency ratio of the elderly population, the level of labor force, the level of physical capital investment and the growth rate of urbanization rate have a certain positive impact on economic growth in a statistical sense, and there are regional differences in the eastern, central and western regions. The current degree of population aging has not had a significant negative impact on China's economic growth, but considering the long-term development trend, the development of an irreversible population aging process will inevitably affect economic growth. Therefore, it is necessary to take precautionary measures in light of China's actual national conditions and formulate active policies to deal with the "cliff-like" changes in the age structure of the demographic dividend in the future and the impact after the "demographic dividend" subsides.

Keywords

Population Aging; Economic Growth; Elderly Dependency Ratio.

1. Introduction

1.1. Background of Topic Selection

According to the United Nations standard, population aging refers to a country's population over the age of 60 accounting for 10% of the total population or the population over the age of 65 accounting for 7% of the total population. The aging of a country's population is not only a change in the age composition of the population, but also affects all aspects of politics, economy and culture. In 1798, the famous British economist Malthus first proposed the intrinsic relationship between population and its means of living in "The Theory of Population". Since then, the relationship between population factors and economic growth has attracted the attention of scholars. There are obvious differences in the economic behavior of different age groups. Population aging means an imbalance in the age structure of the population, shrinking labor resources and aggravating social burdens, hindering the healthy and sustainable growth of the economy. According to data from the seventh census in 2021, China's population aged 65 and above accounts for 13.50% of the total population, an increase of 4.63 percentage points from 2010. Since China has entered an aging society, a series of problems such as the large scale of the elderly population and the rapid aging speed have affected economic growth and other aspects, and have received extensive attention from scholars at home and abroad.

1.2. Research Methods and Data

This paper adopts a combination of theory and empirical methods. Firstly, combined with the changes of China's population policy and the current situation of age structure, theoretical analysis is carried out, and hypotheses are proposed and theoretical derivation is carried out. The provincial panel data of China from 2000 to 2020 are collected, which well guarantees the compatibility and representativeness of the data. Use STATA to establish an empirical econometric model, use the elderly dependency ratio to represent the degree of population aging, introduce factors such as labor force level, physical capital investment level, and urbanization rate that affect economic growth, and study the impact of China's population aging on the economy through theoretical and empirical analysis. growth impact. In addition, considering the regional differences in China's economic development, the three economic regions of the east, the middle and the west are grouped and analyzed to study the impact of population aging on the economic growth of different regions. At the same time, on the basis of the research conclusions, some specific policy suggestions are put forward on how to deal with the problem of aging.

1.3. Research Content and Research Significance

Population aging is a common problem faced by all countries in the world in the 21st century. It first appeared in France. With the development of economy and society, it has appeared in various countries in the world one after another, and it has become increasingly serious. It has also brought many social problems. It has been a long-term problem in the field of economics. Frequently occurring words. The population structure must be adapted to economic growth. On the one hand, the breaking of the balance will lead to a decrease in the proportion of the working-age population, which will affect the GDP and national tax revenue. On the other hand, it will increase the social pension demand and bring pressure on medical care and social security. Under the socialist market economy system with Chinese characteristics, the overall planning of the government plays an important role. In-depth study of the relationship between population aging and economic growth is extremely important for the government to correctly grasp the situation of China's economic development, and provide correct theoretical guidance for economic transformation and sustained and healthy economic growth. realistic.

From the fifth census in 2000, China entered an aging society, to the seventh census in 2021, China entered a moderately aging society. 20 years of economic development have merged, and the social landscape has taken on a new look. During this period, population policies have also undergone major changes, and people's concerns about the negative impact of aging on economic growth have always existed. Based on China's special actual national conditions, it is impossible to copy the experience of other countries' aging process. It is necessary to analyze China's specific data in depth to accurately grasp the country's aging degree and countermeasures.

1.4. Innovation Points of the Thesis

First, most of the research on the factors affecting economic growth considers technological progress, physical capital accumulation, labor force scale, etc. On this basis, this paper introduces aging factors for analysis, and discusses population aging from both theoretical and empirical aspects. impact on China's economic growth.

Second, regarding the selection of indicators of population aging, different indicators will also lead to differences in results. Some scholars have selected indicators such as the proportion of the elderly population and life expectancy. This paper selects the dependency ratio of the elderly population as an indicator to measure the degree of population aging, which reflects the relationship between the working population and the elderly population and is more representative.

Third, this paper chooses to explore the impact of population aging and economic growth through an empirical study of inter-provincial panel data, collects data from each province in China for nearly 20 years, and analyzes it separately by dividing it into three major economic regions, east, middle and west, which is more in line with the Chinese reality.

2. Theoretical Analysis of the Impact of Population Aging on Economic Growth

2.1. The Concept of Population Aging

With the development of society and economy to a certain extent, the social security system has become more and more perfect, the level of medical and health care has been continuously improved, and the average life expectancy has increased significantly. Coupled with the change of modern people's concept of fertility, the birth rate in developed countries has generally declined and even negative population growth has occurred. , the relative number of the elderly population increased. The Population Aging is a dynamic phenomenon that is affected by the changing age structure of the population, such as birth rate, death rate and life expectancy. The population can be divided into three categories according to age: the children population, the working population and the elderly population. For a country, the larger the proportion of the elderly population in the total population, the deeper the degree of aging. At present, the index of the elderly population coefficient is generally used in the world to measure the degree of population aging. The elderly population coefficient refers to the ratio of the population aged 65 and above to the total population. If the coefficient of the elderly population in a society is between 7% and 14%, it belongs to mild aging, if it is between 14% and 20%, it is general aging, and if it exceeds 20%, it is super aging.

2.2. A Review of Related Research

Scholars do not have a unified understanding of the impact of aging on economic growth for the time being. They are mainly divided into three views: the first one believes that aging has a negative impact on economic growth, such as Su Jian's (2021) year-by-year decrease in the juvenile dependency ratio and The year-on-year increase in the old-age dependency ratio will lead to a yearly decline in China's medium and long-term economic growth rate. Du Yang (2021) estimated through data that China's economic growth rate from 2020 to 2025 will slow down by an average of 1.07 percentage points per year simply due to the rapid aging of the population. The second is that aging has a positive impact on economic growth. For example, Wang Shu (2020) believes that China's aging has a positive impact on household savings at this stage, and the "second demographic dividend" makes the preventive savings effect of households caused by aging greater than that of old age. burden effect. Feng Jianfeng (2017) believes that population aging can achieve rapid economic growth by improving labor productivity. The third type believes that the impact of aging on economic growth is complex and uncertain. For example, Wang Wei (2016) believes that China needs to play the positive role of aging on technological progress, avoid the negative impact of aging on technological progress, and make technological progress a A strong driving force for relieving the pressure of the aging population and promoting long-term economic development. Li Jun (2006) believed that the factors of population aging have positive, negative or zero effects on economic growth, and the relevant policy choices will affect the effects of population aging.

2.3. The Development Status and Characteristics of China's Population Aging

2.3.1. The Process of Changing the Age Structure of China's Population

In the years before the founding of the People's Republic of China, due to wars and low medical living standards, China's population is mainly characterized by high birth rate, high death rate and low growth rate. After the founding of the People's Republic of China, with the development of the economy and society, the improvement of people's living standards, the improvement of the medical and health security system, and the increase in the overall life expectancy of the people, the characteristics of China's population development show a high birth rate, low death rate, and high growth rate. Since the implementation of the basic national policy of family planning in 1982, China's population has turned to a low birth rate, low death rate, and low growth rate.

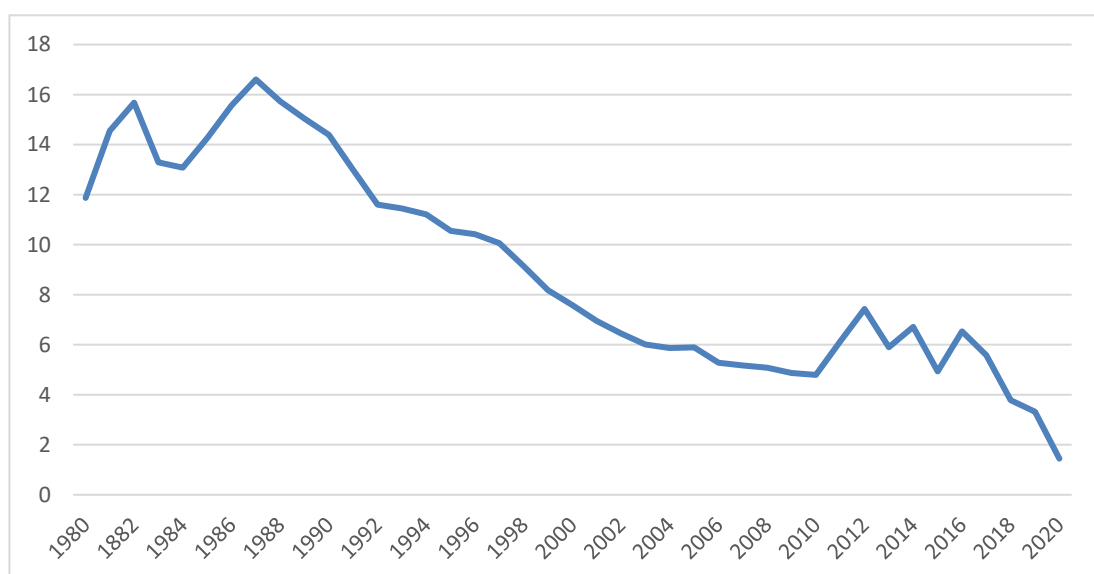


Fig 1. Natural population growth rate since 1980 (%)

Source: China Statistical Yearbook 2021

The aging of the population is deepening, the growth rate of the population is gradually slowing down, and the age structure of the Chinese population is also changing. According to the 2021 Statistical Yearbook, the relevant data on the age structure of China's seven population censuses from 1953 to 2020 are as follows.

Table 1. The age structure of the seven population censuses in China

Proportion of population (%)	1953	1964	1982	1990	2000	2010	2020
0-14 years old	36.28	40.69	33.59	27.69	22.89	16.60	17.95
15-64 years old	59.31	55.75	61.50	66.74	70.14	74.53	68.55
65 years old and above	4.41	3.56	4.91	5.57	6.96	8.87	13.50

Source: China Statistical Yearbook 2021

Due to the policy of encouraging childbirth in the early days of the founding of the People's Republic of China, the population aged 0-14 accounted for 36.28% in 1953, and 40.69% in 1964, and the elderly population accounted for only 3.56%. The huge demographic dividend promotes rapid economic development. With the strict implementation of the family planning policy, the proportion of the population aged 0-14 has been on a downward trend from 1982 to 2010, and the relative proportion of the elderly in the total population has increased. In 2000, China's population aged 65 and above reached 6.96%, an increase of 24.96% compared with 1990, and the growth rate increased by 11.52% year-on-year. It began to enter an aging society. After 2013, national policies began to vigorously encourage fertility. The proportion of the population aged 0-14 in 2020 increased by 8.13% compared with 2010, but was still lower than the level in 2000. The proportion of the population aged 15-64 is still declining, the labor supply is sluggish, and it is no longer enough to be the main force of China's economic growth. The trend of decreasing demographic dividend is obvious, and the need for industrial restructuring is becoming more and more urgent. In 2020, the proportion of the population aged 65 and above will rise to 13.50%, an increase of 52.20% compared with 2010, and the growth rate will increase by 24.76% year-on-year, and the degree of aging will further deepen.

2000 was an important milestone in China's aging process. The number of people over 60 years old exceeded 100 million, accounting for 10.3%, of which 88.21 million people were over 65 years old, accounting for 6.96%.

The proportion of the population aged 0-14 in China has been on the decline. Although the fertility policy has been changed and fertility has been vigorously encouraged, it has only curbed the basic downward trend. Due to the change of modern people's concept of fertility from more children and more blessings to late births and eugenics, the overall The growth effect is still not significant. The proportion of the population aged 15-64 was a small peak in 2010, and has been on a downward trend since 2010. The proportion in 2020 has dropped by 5.9% compared with 2010. The proportion of the population aged 65 and over is increasing, increasing from 7.0% to 13.5% in 20 years.

2.3.2. Characteristics of China's Aging Population

Population aging is a common problem facing the development of countries all over the world, and there are commonalities that can be referenced and studied. However, based on China's basic national conditions, the development of China's population aging is different from that of many other countries that have entered the aging process.

2.3.2.1. The Elderly Population is Huge and Growing Rapidly.

Based on China's huge population base, the absolute number of the elderly population also ranks among the highest in the world. The total population of China has increased from 1,267.43 million in 2000 to 1,412.12 million in 2020, an increase of 13.78%, while the population of the elderly aged 65 and above has increased from 88.21 million to 190.64 million, reaching 2.16 times the original. The number accounts for 23.35% of the world's aging population. China's elderly population is not only huge, but the aging degree is also expanding rapidly. The growth rate of the elderly population far exceeds the growth rate of the total population.

2.3.2.2. The Problem of Population "Getting Old before Getting Rich" is Prominent

Population aging is a product of economic development, and the overall process is generally synchronized with the level of economic development. Most developed countries have entered an aging society after rapid economic development and accumulation of material wealth to a certain extent. The average international per capita GDP of these countries is about 5,000-10,000 US dollars. "Getting rich first and then getting old" gives the country the economic strength and material conditions to deal with the problem of aging. However, China has entered an aging society ahead of schedule. In 2000, its GDP was only US\$780, which was far below the

world average. The problem of “getting old before getting rich” has made China’s aging problem even more severe.

2.3.2.3. Regional Imbalance of Population Aging

First of all, the degree of population aging is closely related to the level of regional economic development. According to the division of the three major economic belts, the east, the middle and the west, the level and speed of economic development in different regions are different, and the degree of aging is also different. At the same time, within the three economic belts There are also differences in the level of aging between provinces and cities.

The average aging rate in the eastern region is 13.35%, slightly lower than the national average of 13.50%. Six provinces and cities are higher than the domestic average. Liaoning Province is as high as 17.42%, while Guangdong Province is 8.58% lower than the average. The average proportion of aging in the central region is 14.13%, and the five provinces are higher than the national average, and the overall degree of aging is relatively high. The western region accounts for 11.60%, which is lower than the national average of 1.90%, and provinces such as Tibet, Xinjiang and Qinghai are far below the national average. Overall, the central and eastern regions generally have a relatively deep degree of aging, and at the same time, there are large differences in the aging levels between provinces and cities in the eastern and western regions. Secondly, from the perspective of the urban-rural gap, the level of economic development in urban areas is much higher than that in rural areas, and in theory, the degree of urban aging is also much higher than that in rural areas. In China, there is an obvious urban-rural inversion phenomenon.

Table 2. Proportion of urban and rural elderly population in China in 2020 (unit: person)

area	Population				Proportion of the elderly population (%)
	total	0-14 years old	15-64 years old	65 years old and above	
town	899991162	134987981	664720777	100282404	11.14
rural	509787562	98225957	321208729	90352876	17.72

Source: China Statistical Yearbook 2021

According to the relevant data in 2020, it can be seen that the proportion of the elderly population in China's urban areas is 11.14%, while that in rural areas is as high as 17.72%, an increase of 59.01% compared with urban areas. Due to the huge gap in economic development between urban and rural areas, more and more young laborers choose to work in cities from rural areas, resulting in a shortage of rural labor force, an increase in the absolute proportion of the elderly population, and an even more severe problem of aging in rural areas.

2.3.2.4. Showing a Trend of Population Aging

According to the international standard, the 65-69-year-old population is the young-aged population, the 70-79-year-old is the middle-aged population, and the 80-year-old and above are the senior-aged population. In 2000, China's elderly population accounted for 13.51% of the total elderly population, and by 2020, the proportion will rise to 30.68%, and the number will reach 35.8 million. The aging of the elderly population has led to limitations in physical condition, self-care ability, savings status, etc., requiring more care. The accelerated rate of population aging has further increased the burden on society.

2.4. Transmission Mechanism of the Impact of Population Aging on Economic Growth

With the decline in the proportion of the working-age population in the total population and the increase in the elderly population, economic growth will be affected in many ways. The following will analyze from the two aspects of labor supply and savings.

2.4.1. The Impact of Population Aging on Labor Supply

The aging of the population affects the supply of labor, resulting in a reduction in the scale of the labor force, an overall aging of the working-age population, and a reduction in the input of labor factors in production, which will inevitably affect economic growth.

On the one hand, the reduction in the size of the labor force affects the quantity of labor supply. China's long-term economic growth has benefited from the "demographic dividend" brought about by sufficient labor resources. At this stage, based on China's huge population base, the overall labor force is still maintained at the same level. relatively stable level. However, the impact of the age structure of the population is obviously lagging behind. In the long run, the labor force will become more and more in short supply. At the same time, the number of dependents per labor force will increase, and the burden will continue to increase.

On the other hand, the aging of the labor force affects the quality of labor supply. The increase of age leads to the decline of various aspects such as physical function, and it is no longer suitable for high-intensity, high-precision, and high-demand work, which indirectly leads to a decline in labor productivity. But this is not absolute. The increase of age will also bring the accumulation of experience and experience, which will promote labor productivity.

2.4.2. The Effect of Population Aging on Saving

Modigliani's life cycle theory states that consumers measure their total lifetime income to allocate consumption and savings in different stages. When you are young, you are more inclined to consume. When your income rises in middle age, you start saving for your future retirement needs. When you are old, you have no source of income, consume your savings when you are young, and enter a state of negative savings. The proportion of the elderly in an aging society increases, reducing the overall savings rate, while children need to support the elderly, further reducing the savings rate.

Table 3. Changes in China's Savings Level

Indicator (per capita)	2014	2015	2016	2017	2018	2019	2020
disposable income	20167.1	21966.2	23821.0	25973.8	28228.0	30732.8	32188.8
expenditures	14491.4	15712.4	17110.7	18322.1	19853.1	21558.9	21209.9
savings balance	5675.7	6253.8	6710.3	7651.7	8374.9	9173.9	10978.9
savings rate(%)	28.1	28.5	28.2	29.5	29.7	29.9	34.1

Source: China Statistical Yearbook 2021

As shown in the table above, China's savings rate has been on an upward trend since 2014, which is inconsistent with the life cycle theory, and the savings rate has not declined. First, China's current labor supply is still sufficient, and economic growth has increased people's income. In the short term, the burden of aging will not significantly affect the savings rate. Secondly, due to the influence of China's consumption concept for thousands of years, people have a strong tendency to save, their consumption habits will not change in the short term, and the savings rate will remain at a relatively high level. In addition, China's old-age security system still needs to be improved. Coupled with the expectation of the future aging trend, people will choose to save more for future retirement. Affected by China's actual national

conditions in the short term, the level of savings rate will increase. As the number of long-term elderly population increases, coupled with the continuous improvement of the old-age security system in the future, the overall level of savings will decrease, which may limit economic growth.

3. Model Setting

3.1. Variables and Data Description

the explained variable y . The logarithm of the per capita GDP of each province is selected as the explained variable to measure the economic growth level of each province.

Explanatory variable x_1 . Select the ratio x_1 of the population aged 65 and above to the population aged 15-64, that is, the elderly dependency ratio (Odr) as an explanatory variable to measure the level of population aging in each province.

In addition to the core variable of the elderly dependency ratio, the level of economic growth is also affected by many other variables. This paper adds several control variables to better study the impact of aging on economic growth. The ratio of the total labor force aged 15-64 to the total population x_2 , that is, the proportion of the labor force in each province, measures the labor force level. The ratio of social fixed asset investment to GDP x_3 measures the level of physical capital investment in each province. The ratio of urban population to total population x_4 measures the urbanization rate.

The research sample selected in this paper is the provincial panel data composed of 31 provinces, municipalities and autonomous regions in China from 2000 to 2020. The data is collected from the China Statistical Yearbook of the National Bureau of Statistics over the years, the Guotai CAMAR series of research databases and the provincial and local statistical yearbooks.

In order to verify the correlation between the above explanatory variables and the explained variables, the econometric model we use is:

$$\ln pgdp = f(\text{ord}, \text{er}, \text{pc}, \text{ur}, \mu)$$

3.2. Data Processing and Analysis

This paper uses the STATA software to conduct an empirical analysis of the provincial panel data from 2000 to 2020 to study the impact of aging on China's economic growth.

3.2.1. Variable Descriptive Statistics

First, descriptive statistics are performed on these data, as shown in the following table:

Table 4. Descriptive Statistics Results for Main Variables

variable	N	mean	p50	sd	min	max
y	651	10.15	10.35	0.875	7.887	12.01
x1	651	12.97	12.39	3.440	6.145	25.48
x2	651	72.49	72.08	3.786	63.38	83.84
x3	651	64.20	61.23	26.70	21.00	150.7
x4	651	50.35	49.77	15.82	13.88	94.15

The table lists the sample size N , mean, median p_{50} , standard deviation sd , maximum value max , and minimum value min of variables. As can be seen from the above table, there are 651 groups of data, the degree of dispersion of x_3 and x_4 is relatively large, and the average value is close to the median. There are significant gaps in per capita GDP, labor force level, physical capital investment level and urbanization rate among regions in China, reflecting the regional imbalance of economic development.

3.2.2. Correlation Analysis

Since the explained variables, explanatory variables and control variables have a certain correlation, the correlation analysis is used to measure the closeness of the correlation between the variables. The analysis results are as follows:

Table 5. Results of Correlation Analysis of Main Variables

	y	x1	x2	x3	x4
y	1				
x1	0.518***	1			
x2	0.470***	-0.103***	1		
x3	0.370***	0.153***	-0.166***	1	
x4	0.755***	0.390***	0.589***	-0.0200	1

*** p<0.01, ** p<0.05, * p<0.1

*** represents p<0.01, and the variables are significant. The level of economic growth (Inpgdp) is positively correlated with the level of aging (odr), the level of labor force, the level of physical capital investment and the urbanization rate. The magnitude of the correlation coefficient is between -1 and 1, and the closer the absolute value is to 1, the higher the correlation. The absolute values of the correlation coefficients between the variables in the above table are all below 0.8, and the initial version judged that there is no serious collinearity problem.

3.2.3. Collinearity Test

The number of explanatory variables and control variables selected by the model is large. In order to prevent the influence of multicollinearity, the variables are diagnosed with collinearity. The results are as follows:

Table 6. Results of Collinearity Test for Main Variables

Variable	VIF	1/VIF
x4	2.240	0.447
x2	1.950	0.514
x1	1.490	0.671
x3	1.050	0.953
Mean	VIF	1.680

According to the test results, VIF<10, there is no serious multicollinearity, and regression analysis can be performed.

3.2.4. Regression Method Selection

The basic models for dealing with panel data mainly include fixed effects, random effects and mixed regression models.

By testing the individual effect, p=0.0000, the null hypothesis is rejected, the individual effect is significant, and the fixed effect is better than the mixed Ols model. Then test the time effect, the p value is also less than 0.05, the time effect is significant, indicating that the random effect is also better than the mixed Ols model. Finally, the Hausman test is used to judge whether to choose a fixed effect or a random effect model. The test results are as follows:

P<0.05, rejecting the null hypothesis, indicating that fixed effects are better than random effects. According to the test results, a fixed effect regression analysis was selected.

Table 7. Hausman test results

VARIABLES	(1) FE
x1	0.141*** (0.00661)
x2	0.126*** (0.00682)
x3	0.0122*** (0.000668)
x4	0.0169*** (0.00138)
Constant	-2.464*** (0.514)
Observations	651
Number of AreaCode	31
R-squared	0.879
Hausman	137.3
p-value	0

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.3. Conclusion of Empirical Analysis

3.3.1. National Sample Model

The regression results are as follows:

Table 8. National sample regression analysis results

	(1) Ols	(2) Fe	(3) Re
x1	0.077*** (0.006)	0.141*** (0.007)	0.126*** (0.006)
x2	0.065*** (0.006)	0.126*** (0.007)	0.110*** (0.006)
x3	0.012*** (0.001)	0.012*** (0.001)	0.013*** (0.001)
x4	0.026*** (0.001)	0.017*** (0.001)	0.018*** (0.001)
_cons	2.298*** (0.412)	-2.464*** (0.514)	-1.225*** (0.459)
N	651.000	651.000	651.000
r2	0.791	0.879	
r2_a	0.790	0.872	

Prob>chi2 = 0.0000

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

x1 is significant at $p < 0.01$ in the three models, indicating that x1 is robust. After the Hausman test $\text{Prob} > \chi^2 = 0.0000$, Fe is finally selected.

According to the estimation results of the fixed effect model, the elasticity coefficient of population aging on economic growth is 0.141, and $p < 0.01$ is significant at the confidence level of 0.01. The adjusted R2 of the equation reaches 0.87, and the fitting effect is good. It shows that if the dependency ratio of the elderly population increases by one percentage point, the economic growth (lnpgdp) will increase by 0.141%. The dependency ratio of the elderly population has a positive effect on economic growth, which is inconsistent with our expected theoretical results. In-depth analysis of the reasons, on the one hand, is influenced by the traditional Chinese concept of saving. The increase in the elderly population means an increase in pension savings, people's propensity to save for precautionary measures is generally enhanced, and the accumulation of physical capital promotes economic growth. Coupled with the increase in life expectancy and retirement age of the elderly, the rich work experience and skills of the human capital of the elderly can also promote economic growth. On the other hand, China's labor force is still relatively abundant, and the burden of social support is generally not heavy, so that more negative effects of aging have not yet appeared.

Among the control variables, the elastic coefficients of labor force level, physical capital investment level, and urbanization rate to economic growth are 0.126, 0.012, and 0.017, respectively, and the results are all significant. This shows that higher labor force level, physical capital investment level and urbanization rate have a promoting effect on economic growth, among which labor force level has the greatest impact on economic growth, while physical capital investment level and urbanization rate have less impact, which is consistent with the reality. match.

3.3.2. Regional Sample Model

In order to further examine the regional differences of population aging, labor force level, physical capital investment level, and urbanization rate on economic growth, the 31 provinces, municipalities and autonomous regions are divided into three regions: eastern, central and western. The estimated results are as follows:

Table 9. Subregional sample regression analysis results

	(1) National	(2) east	(3) Central	(4) west
x1	0.141*** (0.007)	0.162*** (0.012)	0.124*** (0.012)	0.091*** (0.015)
x2	0.126*** (0.007)	0.148*** (0.012)	0.113*** (0.012)	0.102*** (0.011)
x3	0.012*** (0.001)	0.010*** (0.001)	0.016*** (0.001)	0.009*** (0.001)
x4	0.017*** (0.001)	0.017*** (0.002)	0.010*** (0.003)	0.041*** (0.005)
_cons	-2.464*** (0.514)	-4.147*** (0.990)	-1.363 (0.899)	-0.895 (0.761)
N	651.000	231.000	210.000	210.000
r2	0.879	0.810	0.896	0.929
r2_a	0.872	0.798	0.889	0.925

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The elastic coefficients of population aging on economic growth in the eastern, central and western regions are 0.162, 0.124, and 0.091, respectively, and the results are all significant. The elastic coefficient in the eastern region is higher than the national level. For every 1% increase in the elderly dependency ratio in the eastern region, the economic growth level (Inpgdp) increases by 0.164%, and the effect of population aging on economic growth is stronger than that in the central and western regions. The main reason is that the economic level of the eastern region is relatively high, attracting the inflow of high-quality talents, the vigorous development of knowledge-intensive industries such as information technology, artificial intelligence, and high-precision manufacturing, coupled with the faster improvement of labor quality. The elasticity coefficient of the western region is much lower than that of the eastern region, mainly due to the problem of population loss, the savings and consumption of the elderly population, and the gap in human resources of the elderly.

The elasticity coefficients of labor force level to economic growth are 0.126, 0.148, 0.113, and 0.102 respectively. The elasticity coefficient of labor force level to economic growth in the eastern region is the largest and higher than the national level. The improvement of labor force level has a greater effect on promoting economic growth.

The elasticity coefficients of the level of physical capital investment to economic growth are 0.012, 0.010, 0.016, and 0.009 respectively. The elasticity coefficient of labor force level to economic growth in the central region is the largest and higher than the national level. The improvement of the level of physical capital investment greatly promotes economic growth. For every 1% increase in physical capital investment, the level of economic growth (Inpgdp) increases by 0.016%. Sufficient accumulation of physical capital is a necessary condition for economic growth.

The elastic coefficients of urbanization rate to economic growth are 0.017, 0.017, 0.010, and 0.041, respectively. The elasticity coefficient of urbanization rate to economic growth in the western region is the largest and higher than the national level. The migration of rural population to cities increases the urbanization rate and fills the gap. The shortage of urban labor force can achieve more effective allocation and utilization of resources, which will greatly promote the economic growth of the western region.

3.3.3. Conclusion

After the above empirical research, we can see that since China entered an aging society in 2000, the negative effect of population aging on China's economic growth is not obvious at present, and it has a certain promoting effect on economic growth at this stage. At the same time, higher labor force level, physical capital investment level and urbanization rate also promote economic growth. However, there are obvious regional gaps in economic development in the eastern, central and western regions, the degree of aging is regional, and there are also differences in the level of labor force, physical capital investment, and the relationship between urbanization rate and economic growth. It is necessary to adapt measures to local conditions and be more targeted. formulate countermeasures.

However, with the increase in the relative proportion and absolute number of the elderly population in the future, the government is bound to increase the expenditure on social pension security and the medical system, which will increase the social pension burden and hinder long-term economic growth. Therefore, we should seize the precious opportunity at this stage, actively adjust policies, attach importance to human capital accumulation and innovative technological transformation, reduce the negative effect of population aging on economic growth, and maintain sustained and healthy economic growth.

4. Policy Recommendations

At present, China's labor force is generally sufficient, and the degree of aging is not high. The aging of China's population has a certain positive effect on economic growth, but with the development of the population structure, the negative impact of aging will become more severe. However, China's population aging is different from other countries and has its own characteristics. This requires us to study and demonstrate carefully, combine China's basic national conditions, pay attention to the actual differences in different regions, actively adjust policy orientation, and grasp the impact of population aging on economic transformation. opportunities and challenges.

4.1. Develop the Aging Industry

With the increase in the number of the elderly population, the growth in consumer demand of the elderly population will also bring new markets and the development of a large number of related products and industries. Therefore, we should take advantage of the trend to vigorously develop the aging industry, accelerate the upgrading and transformation of the industrial structure, and seize the opportunity to find new economic growth points to alleviate the negative impact of aging. The status quo is that the development potential of the aging industry is huge, but the supply of related products and services for the elderly has not kept up very well, and the number is small and the level is uneven. First, the government should formulate policies for the development of the aging industry based on the actual needs of the elderly, actively guide and accelerate the development of the aging industry, and provide necessary safeguards. Second, considering the crowding-out effect of the government's fiscal policy, private capital should also be actively introduced to improve efficiency and give full play to the vitality of the market. This will not only share the social burden of pensions, but also promote the development of related industries, increase employment opportunities, and achieve a two-way good cycle.

4.2. Accelerating the Process of Urbanization

China not only has uneven economic development between the east and the west, but also has a large gap between urban and rural areas, and there are restrictions such as the household registration system. With the acceleration of urbanization, more labor force flows into cities with richer physical and human capital, which improves the utilization rate of labor force, promotes economic growth, and solves the employment problem. After the income level of residents is improved, the pressure of supporting the elderly can be better relieved. Relevant policies should focus on eliminating factors that restrict labor mobility, realizing the combination of labor resources and physical capital levels between urban and rural areas and between regions, and continuing to promote urban-rural integration.

4.3. Attach Importance to Human Capital Investment

The gradual disappearance of the demographic dividend requires China's economy to transform as soon as possible. The development of labor-intensive industries in the past is no longer dominant. It is necessary to pay attention to human capital investment, improve the quality of labor, and turn to resource-intensive labor-saving economic development. The continuous development and improvement of the nine-year compulsory education system has a significant positive effect on China's economic growth. However, compared with developed countries, the gap in the average number of years of education of the Chinese population is still large, and the imbalance of education levels is also significant. First, the government should increase financial investment in education, especially in western and rural areas, to achieve a higher level of per capita education funding, and pay more attention to investment in non-compulsory higher education. Secondly, encourage social capital to start new education,

increase support and guidance, and improve the initiative of individuals and enterprises that donate education.

4.4. Timely Adjustment of Labor and Employment Policies

To deal with the problem of aging, we must first break the stereotyped impact on the elderly. The elderly population is not a simple burden, but also a valuable social wealth. Creating adaptive conditions and environments can also allow the elderly to continue to shine and create value. Considering the positive effect of the rich work experience and skills of the young and elderly population on improving labor productivity, especially the senior intellectuals who are older, have more knowledge and create greater value. On the premise that the physical condition is competent, measures such as flexible re-employment of outstanding talents and promotion of continuing education of the elderly population can be adopted to appropriately guide the selection of the elderly population, and to ensure the employment of the elderly who are willing and able to continue to work, analyze and continuously adjust. A working model more suitable for the elderly. It can not only turn pressure into a driving force, continue to exert the ability of talents, reduce the cost of talent retraining for enterprises, promote economic growth, but also reduce the burden of children's pensions, so that the elderly can continue to realize their life ambitions and live in a more positive and confident state.

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