Research on the Influence Path of Population Aging on Economic Growth Based on Finite Crowding Theory

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Abstract: The continuous improvement of the aging level of the population has caused insufficient labor supply, reduced the efficiency of labor production and hindered the healthy and sustainable development of the economy. In this paper, This paper probes into the influence of population aging on China's economic development. On this basis, by constructing two models of fixed effect and intermediate effect, the effect of population aging on economic growth is tested. The results show that population aging is not conducive to economic growth, and it is statistically significant. For every 1% increase in the level of population aging, economic growth will decrease by 0.107%. The influence of consumption on economic growth is positive and fails to pass the significance test, so on the whole, the influence of consumption on economic growth is uncertain. China should formulate a reasonable pension policy according to local conditions, so as to speed up the construction of the pension system, increase the birth rate, promote household consumption, realize innovation-driven development, and realize industrial transformation and upgrading as soon as possible to cope with the impact of population aging on economic growth.

1. Introduction

With the gradual extension of the average life expectancy of the population and the slowdown of fertility, the problem of population aging in China has gradually emerged and become prominent. According to the population survey, the elderly aged 60 and above account for 10% of the total population, and the elderly aged 65 and above account for 7% of the total population. That is to say, the elderly aged 65 and above account for 14% of the total population. In other words, this is a "super-aging" society. As a global phenomenon, population aging is a realistic problem faced by various countries or regions, and China is also inevitable[1].

The continuous improvement of the aging level of the population has caused insufficient labor supply, reduced the efficiency of labor production and hindered the healthy and sustainable development of the economy. On this basis, this paper discusses the influence of population aging on China's economic development. On this basis, it tests the effect of population aging on economic growth by constructing two models of fixed effect and intermediate effect.

2. Literature Review

Population growth, industrial specialization and diversification and economic growth. Literature[2] analysis points out that population growth has a positive effect on economic growth. The larger the population, the larger the consumer market, and it is conducive to the specialization of labor division and the professional development of industries, thus gradually improving production efficiency and promoting economic development. Literature[3] holds that higher population density can increase economies of scale and provide infrastructure and services to improve productivity, such as transportation and extension services. Literature[4] points out that population growth has a positive impact on technological innovation. If the proportion of geniuses in the population is constant, then the larger the population, the more geniuses there are in society, which is more conducive to economic growth.

Europe and China are countries with serious population aging. Therefore, many studies have been made on the aging of western developed countries abroad. Literature[5] holds that it has a negative effect on economic growth, but only a few academic studies show that it will increase capital accumulation and per capita capital and then help economic growth. However, most scholars are very pessimistic about its negative effects on the economy. Literature[6] shows through theoretical model that the increase of life expectancy will lead to higher savings rate of people of all ages, and then the national savings rate will also increase. Literature[7] uses an extended iterative-algebraic model, and obtains that the influence of population aging on economic development in China is from positive to negative. In the empirical panel data research, literature[8] attributed the decline of birth rate to the family planning policy and economic and social development changes.

3. Research Method

3.1 Variable Selection and Data Explanation.

Explained variable: economic growth Y, measured by per capita GDP. Relatively speaking, per capita GDP is a more effective tool to reflect the overall situation of macroeconomic operation in a country or region, which can objectively and scientifically reflect the development level and degree of a country or region[9].

Core explanatory variable: population aging POP, measured by the proportion of elderly people over 65 years old. The article is expressed by the proportion of the elderly population over 65 years old to the total population. Technical level PA, measured by the number of patent applications, is generally divided into two categories, one is from the perspective of input, and the other is from the perspective of output. From the perspective of investment, it is mainly measured by the investment in scientific research or the number of researchers.

Other control variables: government expenditure GOV. This paper examines the role of government expenditure in economic growth, using the overall government fiscal expenditure in urban areas as a measure. Industrial structure STR Industrial structure plays a vital role in promoting economic development. Private consumption expenditure PER. Consumption is the main driving force for economic development and plays an important role in promoting economic growth[10].

The data used in this paper come from the statistical yearbooks of official website and other provinces of the National Bureau of Statistics. Considering the analyzability and timeliness of the data, this paper finally chooses the data of 10 provinces in central China from 2012 to 2022 for empirical analysis.

3.2 Model Design

In macroeconomics, economic growth is usually defined as an increase in output, which can be both total output and per capita output. For our country, maintaining moderate economic growth is of great significance for raising the national income level and alleviating the employment pressure, so the issue of economic growth is also one of the most concerned issues of our government and economists.

In macroeconomics, the source of economic growth is usually associated with the input of production factors and the technical situation, and it is expressed as:

$$Y_t = A_t f(L_t, K_t) \quad (1)$$

Among them, Y_t, L_t, K_t represents the total output, labor input and capital input in the t period, and A_t represents the technical situation in the t period. Therefore, the increase of output can be explained by the progress of labor, capital and technology, which means that the source of economic growth can be attributed to the growth of labor, capital and technology.

With the decrease of fertility rate and the extension of life expectancy, population aging has

become an inevitable trend of population age structure change. The proportion of the elderly population to the total population has increased, while the number of young people has decreased. Internationally, the old population coefficient is usually used to measure the aging degree of a country or region. When the old-age dependency ratio of a country or region is on the rise, it shows that the number of labor force in the population age structure is insufficient to meet the population conditions needed for the economic development of the country or region.

The theory of limited crowding out shows that when the government regulates economic growth, it needs to pay attention to the consistency of policies and reduce policy conflicts, thus reducing the cost of policies, while the theory of limited crowding out can increase the benefits of policies.

Based on the above analysis and theoretical basis, the empirical model of this paper is set as formula (2):

$$LnY_{it} = \alpha + \beta_1 LnPOP_{it} + \beta_2 LnPA_{it} + \beta_3 LnGOV_{it} + \beta_4 LnSTR_{it} + \beta_5 LnPER_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (2)$$

Among them, i represents the region and t represents the observation year. $LnPOP, LnPA$ is the core explanatory variable, $LnGOV, LnSTR, LnPER$ is the control variable, and μ_i represents the regional fixed effect, which is used to control the heterogeneity at the regional level. γ_t stands for time-fixed effect, which is used to control related factors that change with time. ε_{it} represents a random error term. α is a constant term.

4. Result Analysis

4.1 Cointegration Test

Co-integration test is to compare and analyze the unified single integral variables and combine them linearly to see whether the random trend of random interference terms can be eliminated and whether the long-term equilibrium relationship between variables can be achieved. By using Johnson discriminant method, the cointegration relationship is discussed. The co-integration test results are shown in Table 1:

Table 1 Cointegration Test

Number of cointegration vectors	eigenvalue	Trace statistics	5% critical level	Maximum eigenvalue statistics	5% critical level
None	0.7621	106.6251**	105.0421	45.6187**	37.7293
At most 1	0.506	65.0679**	92.5431	23.9934	35.1394
At most 2	0.5979	31.174	82.1787	21.4862	29.0342

Note: * * indicates a significant level of 5%.

Through the analysis of trace statistics and the maximum eigenvalue, it is found that when the trace statistics and the maximum eigenvalue are less than 5%, the probability of these two methods does not exceed 5%, which shows that they have adopted the original assumption of "there is only one cointegration vector at most", that is, there is at least one cointegration equation between variables and it has a long-term equilibrium relationship.

4.2 Regression Analysis

By introducing two fixed factors, region and time, the regression analysis of the above model is carried out by using the fixed effect model and the least square imaginary number method. Regression analysis shows that population aging is unfavorable to economic development, and it is statistically significant. For every 1% increase, economic development will decrease by 0.107%.

In China, the development of technological innovation has a positive role in promoting economic growth. Every percentage increase in scientific and technological progress will increase by 0.0023%. There is a negative correlation between fiscal expenditure and economic growth. Every percentage point increase in government expenditure will lead to an economic growth rate of 0.042%.

Consumption has a positive effect on economic growth, but it has not been tested by significance,

so there are still some uncertainties in general. However, this positive trend also shows the role of consumption in stimulating economic growth. The industrial structure is beneficial to the development of China. For every percentage increase in the proportion of the secondary industry, the development speed of China will increase by 0.082%. The least square imaginary number method is used for regression analysis, and the conclusion is consistent with the above model, which shows that the role of population aging and its related factors in economic growth is reliable.

5. Suggestion

Accelerate transformation and upgrading, and intensify scientific and technological innovation. First of all, according to their own advantages, universities and research institutions in China should give full play to their potential and innovate their systems and mechanisms; Secondly, strengthen support for university technology enterprises, encourage private enterprises to participate in science and technology plans and conduct scientific research, support private enterprises to participate in the reform of mixed ownership of state-owned high-tech enterprises, and promote the growth and innovation ability of enterprises. In addition, efforts should be made to create a good market environment, increase the protection of intellectual property rights and increase the cost of infringing intellectual property rights. On this basis, we will vigorously promote scientific and technological innovation, provide impetus for China's gradual transformation and provide new impetus for China's economic development after the "demographic dividend".

Implement an active aging policy. First, we must treat the aging problem correctly and help the elderly to establish a positive image. Let them immerse themselves in a beautiful and happy old age. The second is to establish more platforms for the elderly to participate in social development and improve their social participation. The government should formulate and implement social participation policies for the elderly, and provide them with smooth channels to participate in various social work; The elderly should establish a positive concept of "self-support for the elderly".

Accelerate the improvement of population policy and alleviate the ultra-low fertility rate. In order to reduce the shortage of labor supply as much as possible, the government has adopted a positive birth policy to encourage births and increase the birth rate. In the face of the increasingly severe population aging situation, the government should encourage, publicize and support the "comprehensive two-child policy". From a longer-term perspective, it should also make a transition from the "comprehensive two-child policy" to the "free birth policy" in the future. At the same time, the government should also take measures to relax the restrictions on kindergartens, implement flexible maternity leave, extend maternity leave and increase subsidies for maternity expenses.

6. Conclusions

Population aging is not conducive to economic growth, and it is statistically significant. For every 1% increase in population aging level, economic growth will decrease by 0.107%. The level of technological innovation has a positive impact on China's economic growth. For every 1% increase in technological innovation, economic growth will increase by 0.023%. The influence of government expenditure on economic growth is negative. Every 1% increase in government expenditure reduces economic growth by 0.042%. The influence of consumption on economic growth is positive and fails to pass the significance test, so on the whole, the influence of consumption on economic growth is uncertain.

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