Research on the Influence of Population Age Structure on Economic Growth in Guangdong Province

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Abstract: In recent years, the population age structure in Guangdong Provincehas been gradually aging, and the growth rate of the national economy has been slowing down. In order to analyze the relationship between population age structure and economic growth, this paper starts from the path of the impact of population age structure on economic growth, and uses the Cobb-Douglas production function model based on population age structure to empirically analyze the impact of population age structure on economic growthin GuangdongProvince. The research found that for every one unit increase in the total dependency ratio, per capita real GDP will decrease by 0.309 units, and the negative effect of the total dependency ratio on economic growth is more pronounced, indicating that the higher the total dependency ratio, the slower the economic growth. Finally, based on the research results, this paper puts forward policy suggestions for optimizing the population age structure in Guangdong and promoting economic growth.

Keywords: Population Age Structure; Total Dependency Ratio; Economic Growth

1. Introduction

In recent years, the total economy of Guangdong Provincehas been continuously growing, ranking among the top in the country for many years. In addition to implementing reforms and development strategies, the "population dividend" has been an important driving force for economic growth in Guangdong Province. However, data from the seventh national census shows that China's population has grown slowly in the past 10 years, and by 2020, with a population of 1.41 billion, the proportion of people aged 65 and above reached 13.5%, marking the disappearance of China's demographic dividend and the entry into the period of population burden. Changes in population structure will have an impact on the economy to a certain extent. Clarifying the relationship between population age structure changes in Guangdong Province and regional economic development is conducive to better understanding the dynamics of economic development and improving its level. At the same time, correctly understanding the impact of Guangdong Province's population age structure on economic growth can enable Guangdong Province to explore population policies according to local conditions, properly handle the relationship between population and economy, and promote economic growth in Guangdong Province.

Regarding the impact of the population age structure on economic growth, it is generally believed that the population age structure plays a particularly important role in the process of economic growth. For example, Li Chao and Ni Pengfei et al. (2015) pointed out that the population structure is a factor affecting China's economic development, as the population age structure will affect people's housing needs, causing turbulence in the real estate industry and leading to economic fluctuations[1]. Lu Xiaowen (2022) conducted an empirical study on the impact of the population age structure on economic growth in China, established fixed-effect panel regression models for different regions, and the research results showed that the total dependency ratio of the population in each region has a negative impact on economic growth, and the degree of impact varies in different regions[2]. Zhang Han (2022) pointed out that the proportion of the working-age population in the population age structure is an important variable affecting economic growth. Empirical data analysis shows that the proportion of the working-age population in Henan Province has a significant positive impact on economic growth[3]. From the existing research, most scholars usually analyze the impact of the population age structure on economic growth from the perspective of population aging, and the research direction is mostly

concentrated on the demographic dividend and savings rate, without fully considering the working-age population, and the division structure of population age is not detailed enough. Moreover, most of the domestic research starts from the macro level, focusing on the overall population age structure of the country and studying the relationship between the two from the perspective of China as a whole. Guangdong Province is one of the provinces with the largest population in China, but there is relatively little theoretical research, and there is a need to supplement and deepen the research on the impact of the population age structure on the regional economy.

This paper comprehensively considers various factors affecting economic growth, starts from the perspective of total social dependency ratio, uses the population data and economic indicators data of 21 cities in Guangdong Province in 2010, 2015, and 2020, constructs an empirical model, analyzes the population age structure in Guangdong Province, explores the impact of total social dependency ratio on economic growth, and provides theoretical basis for Guangdong Province to formulate relevant population policies in the future, actively exert the population advantages of Guangdong Province, and promote economic growth.

2. Path Analysis

The age composition of the population is the main factor in the proportion of the working population in the total population, and the working-age population is the productive population, which plays an important role in social and economic development. Laborers in different stages have different educational levels, work experience, etc., and have different human capital, thus resulting in different labor productivity. The working population needs to support the non-working population, so the change in the population age structure will inevitably affect the level of family savings. The age structure of the population has a certain impact on technological progress, and then affects social economic growth.

2.1. Impact of Population Age Structure on Labor Supply and Labor Participation Rate

When the population age structure of a certain region has a relatively large proportion of the elderly, and other conditions remain unchanged, the labor participation rate of that region will also be relatively low. This is mainly because, on the one hand, the elderly have fewer job opportunities, their enthusiasm for work is not high, and they are also affected by retirement policies; on the other hand, due to physiological and psychological reasons, the elderly are less capable of absorbing new knowledge than young people, so the market demand for the elderly is relatively low.

2.2. Impact of Population Age Structure on Human Capital

Different education levels and work experience have different human capital, resulting in different labor productivity. Generally speaking, when laborers first enter the market, their accumulation of human capital and labor productivity are relatively low. However, as time goes by, workers gradually accumulate relationships and work experience, and their human capital will increase rapidly, reaching a peak, and then decline.

2.3. Impact of Population Age Structure on Family Savings

People in the juvenile period are not capable of working, that is, they do not have capital accumulation, so they also do not have savings. And in the youth period, with the ability to work, they can accumulate a certain amount of capital, and savings have also increased. And when it comes to the elderly period, they no longer participate in work and production activities, and the savings accumulated during the youth period are also spent at this time, leading to a decrease in savings. Therefore, the consumption in this period is primarily funded by the savings accumulated during their youth.

2.4. Impact of Population Age Structure on Technological Progress

People in each period have their own mental state. In the youth period, individuals have strong creative will and creative ability, which is the driving force of technological innovation. The creativity level of children in the juvenile period and the elderly period is low, the cultural level of the juvenile period is low, and the independent innovation ability is low. When it comes to the elderly period, the body and spirit gradually age, and most of the elderly retire, and the innovation ability decreases, which

hinders the development of technology.

3. Empirical Analysis

3.1. Model Construction

In order to reduce the impact of some uncertain factors on economic growth, the factors affecting economic growth are considered from the aspects of technological progress, physical capital, and industrial structure, and an empirical model is established using the Cobb-Douglas production function model based on population age structure. The formula of the model is as follows:

$$\ln Y_{i,t} = \beta_0 + \beta_1 \ln DR_{i,t} + \beta_2 \ln X_{i,t} + \varepsilon_{i,t} \tag{1}$$

Among them, i represents the city; t represents the period; Y represents per capita real GDP; DR represents the total social population dependency ratio; $X_{i,t}$ represents the set of control variables; $\varepsilon_{i,t}$ represents the random disturbance term.

3.2. Variable Description and Data Sources

1) Dependent Variable

Per capita real GDP (Y): The ratio of a region's real GDP to its total population. This value can reflect a region's economic growth over a period of time. GDP reflects the economic strength of a region, and the growth rate of GDP reflects the development speed of a region. Per capita GDP can reflect the living standards of the residents in a region, and it is an important indicator to measure economic growth. This paper selects the most commonly used proxy variable of economic growth, namely per capita GDP, as the dependent variable.

2) Core Explanatory Variable

Total Population Dependency Ratio (DR): The ratio of the total number of juvenile and elderly people in the total social permanent resident population. This value reflects the pressure of the working population on the elderly and children in the family. The higher the value, the more people the working population needs to support, and the heavier the family pressure; the lower the value, the fewer people to support, and the lighter the family pressure.

3) Control Variables

Technological Progress (A): In the process of innovation and improvement, technology is constantly being replaced by new technology. This article uses the ratio of the number of invention patent authorizations in 21 cities in Guangdong Province to the total number of authorizations as an indicator, as the number of effective invention patents is the most indicative of the level of technological innovation and technological progress.

Physical Capital Stock (K): The total amount of capital owned at a specific point in time. There are various methods to calculate physical capital stock, with scholars more commonly using the perpetual inventory method to estimate it. This article takes 2010 as the base year, that is, 2010 is a constant price year, and calculates the physical capital stock of that base year. Based on this, the perpetual inventory method is used to calculate the physical capital of Guangdong Province in 2010, 2015, and 2020 at constant prices. Among them, a depreciation rate of 9.6%, which is widely recognized by most scholars, is selected as the depreciation rate for fixed assets.

Industrial Structure (I): The proportion of the third industry in GDP. The third industry mainly consists of various forms of service industries and products. In recent years, the proportion of the third industry in GDP has been increasing, which means that the regional economy is gradually transitioning from an industrial economy to a service economy.

Employment Structure (E): The ratio of the employed population to the total population of a region. This value reflects the employment rate of the region. The higher the value, the higher the employment rate, and the more it can promote economic growth; the lower the value, the lower the employment rate, and the more it can hinder economic growth.

Human Capital (EDU): The ratio of the population with high school education and above to the total population of society. Due to the availability and usability of data, this article selects the

proportion of the population with high school education and above as the measure based on official population census data and population sample survey data, which can roughly reflect the level of education. The larger this value, the higher the education level in Guangdong Province; the smaller this value, the lower the education level.

Foreign Investment Dependence (FDI): The proportion of Foreign Direct Investment (FDI) in GDP. Since the data published by the statistics bureau after 2017 is in billion units, the FDI in 2010 and 2015 is calculated using the exchange rate of US dollars to RMB. This value represents the degree of dependence of a region on foreign investment; the larger this value, the more dependent on foreign investment, and the more open the local economy.

4) Data Source

This article selects data on population age structure and related economic indicators from 21 cities in Guangdong Province for the years 2010, 2015, and 2020. It uses per capita GDP as a proxy for economic growth as the dependent variable, and population age structure is represented by the total dependency ratio as the core explanatory variable. It also considers factors such as technological progress, physical capital stock, industrial structure, employment structure, educational level, and foreign investment dependence as control variables. All data are sourced from the Guangdong Province Statistical Yearbook 2010-2021, Guangdong Provincial Department of Commerce, and other sources. Population data come from the Sixth and Seventh National Population Censuses and the 2015 National 1% Population Sample Survey Data.

3.3. Model Selection

The regression models for panel data generally have three types: pooled regression (OLS), fixed effects regression (FE), and random effects regression model (RE). Since panel data have both time and individual dimensions, model selection is very important. Firstly, the F test is used to determine whether to choose a pooled regression model or a fixed effects model. If a fixed effects model is adopted, it can be determined that there may be a fixed effect, which will appear in the form of a random effect. Therefore, it is necessary to use the Hausman test again to verify whether to use a random effects model or a fixed effects model.

The F test p-value is 0.004, indicating that the pooled regression model is rejected. The Hausman test hypothesis H0: accept the fixed effects model, H1: accept the random effects model. The p-value of the Hausman test is 0.000, and the original hypothesis cannot be rejected. Therefore, this paper adopts a fixed effects regression model.

3.4. Regression Result Analysis

Using the fixed effects model to regress the sample data, the regression results are shown in Table 1:

Table 1: The regression results.

Variable	Regression Result
lnDR	-0.309
lnA	-0.072
lnK	0.183
lnI	0.238
lnE	-0.043
lnEDU	0.028
lnFDI	-0.063
Constant	-1.610
R^2	0.980

From the regression results, it can be found that the coefficient of the total dependency ratio (DR) is -0.309, which indicates that for every 1 unit increase in the total dependency ratio, economic growth will decrease by 0.309 units, and this statistical data has passed the significance test at the 1% confidence level, indicating that the total dependency ratio has a significant negative impact on economic growth.

Since the total dependency ratio is the ratio of the total number of young and elderly people to the working-age population among all social permanent residents, the higher the value, the fewer the

relative number of working-age population, that is, the relative decrease in labor supply and labor participation rate. On the one hand, less labor supply will lead to a decrease in total output, and on the other hand, the higher relative number of young and elderly people will reduce per capita real GDP, resulting in a negative relationship between population total dependency and economic growth.

Since laborers have low human capital accumulation and labor productivity when they first enter the market, their work efficiency will gradually increase with the accumulation of work experience. However, as they get older, their productivity will begin to decline due to physical and other reasons. This also means that the human capital of young and elderly people is relatively low. A higher total dependency ratio will lower the average level of human capital in society, leading to a decrease in per capita output level, which also makes the population total dependency and economic growth have a negative relationship.

Since young people among the young and elderly people who make up the total dependency ratio do not have the ability to work and therefore do not save, and the elderly people no longer participate in work and production activities and have no income sources, the increase in the proportion of this population will bring economic pressure to families, leading to a decrease in family savings, which is not conducive to the improvement of human capital and the formation of investment capital, and thus not conducive to economic growth, which also leads to a negative relationship between population total dependency and economic growth.

4. Policy Suggestions

Based on the research results, this paper proposes four suggestions:

Firstly, local governments should actively respond to the national "Three Child" policy and accelerate the construction of a childbearing support system. In order to effectively implement the "Three Child" policy, local governments not only need to vigorously publicize it but also improve the supporting systems for subsidies and guarantees, reduce the childbearing burden of families in various regions, build a childbearing-friendly society, construct a new childbearing culture, support young people of childbearing age to dare to have children and be able to raise them, and promote young people of childbearing age to want to have children and be happy to raise them. At the same time, in order to increase the birth rate of our country, we can start from the childbearing policies of developed countries such as Germany, learn from the experience of other countries, increase the subsidies to local governments, establish a special agency for encouraging childbearing, and effectively alleviate the trend of aging society.

Secondly, local governments should make full use of human capital and focus on strengthening the comprehensive quality of talent. It is essential to establish a robust talent market system, promote educational reforms, enhance the level of education, and actively cultivate high-quality talents. On one hand, the government should improve systems for talent training, utilization, evaluation, and incentives. These improvements should be closely aligned with the needs of high-quality development in the manufacturing industry and the construction of a modern industrial system. Additionally, the government should expand the effective supply of talent, thereby playing a greater role in promoting economic growth in Guangdong Province. On the other hand, the government should integrate school education with practical training in an organic way. This integration is necessary to build a scientific talent cultivation system. The government should also actively explore and promote innovative teaching methods and approaches.

Thirdly, local governments should fully tap into the potential of the elderly labor force to extend the duration of the demographic dividend. By continuously engaging the elderly in the workforce, more seniors can participate in social life. The government should strengthen re-education efforts for elderly workers, enhance their knowledge and technical skills, and establish a lifelong learning system. This approach fosters the concept of learning throughout life and improves the human capital level of the elderly. While reforming the pension and wage tax systems, the government should also actively develop more flexible job opportunities. These opportunities will allow the elderly to find work that suits their actual conditions. Additionally, the government should encourage businesses to retain and hire older employees. It should also consider extending the legal retirement age, eliminating barriers that employers may face in retaining and hiring elderly workers, and strengthening pension reforms. By encouraging the elderly population to extend their careers, the government can expand the labor force and prolong the duration of the demographic dividend.

Fourthly, local governments should allocate human resources reasonably to enhance labor productivity. The scientific and rational allocation of human resources by the government requires management innovation as the driving force, with "improving quality and increasing benefits" as the core, and "increasing output and profit, reducing waste, and maximizing potential" and "making the best use of talent and leveraging strengths" as the goals, guided by problem-solving. In addition, the government needs to comprehensively and accurately sort out job requirements, establish positions based on actual needs, determine appropriate staffing ratios, and implement a strategy of "adding and subtracting" to maximize the productivity of labor. At the same time, the government should remove various obstacles and institutional barriers that hinder the flow of human resources, allow the market to play a decisive role in the allocation of human resources, and persist with government promotion. The government should accelerate the establishment of a perfect mechanism for the flow and macro-control of human resources. By optimizing talent and rationally allocating resources, the government can achieve the full utilization of human resources and the improvement of labor productivity, providing a strong driving force for promoting social and economic growth and high-quality development.

5. Conclusion

This paper analyzes the impact path of population age structure on economic growth and takes 21 cities in Guangdong Province in 2010, 2015, and 2020 as research samples. It selects 8 variables and uses the Cobb-Douglas production function model based on population age structure for empirical analysis. The study finds that the total dependency ratio has an extremely significant negative impact on economic growth, verifying the results of theoretical derivation. In order to optimize the age structure and promote economic growth, this paper puts forward corresponding recommendations from the four aspects of encouraging childbearing, cultivating and attracting talents, tapping the elderly labor force, and human resource allocation, hoping to alleviate the aging trend by increasing the birth rate, continuously cultivating and attracting talents, actively developing the elderly labor force, rationally allocating human resources, and promoting economic growth and high-quality economic development.

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