

Has aging reduced the impact of consumption on GDP? ——Empirical Testing Based on Threshold Regression

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Abstract. Based on the threshold regression model, from the perspective of per capita consumption, this paper explores whether the degree of aging reduces the driving effect of consumption on China's GDP, and examines the impact of consumption structure on GDP. It is found that per capita consumption has a positive effect on regional GDP, and aging plays a threshold role in the impact. As the aging worsens, the driving effect of per capita consumption on GDP begins to strengthen, and the impact of the aging dependency ratio is the largest when it is between 10.44 and 13.10. The impact of per capita health consumption is not significant, and the per capita consumption of education, culture and entertainment has a restraining effect on GDP. Finally, this paper puts forward relevant suggestions based on the above conclusions.

1. Introduction

China's economic growth has been slowing since the first decade of this century. In 2022, China's GDP growth was 3%, 5.1 percentage points lower than in 2021. At the same time, the household consumption rate also continues to decline. In 2022, China's per capita consumption expenditure will be 24,538 yuan, a nominal increase of 1.8 percent over the previous year, but a real decrease of 0.2 percent after deducting the impact of inflation. In terms of consumer spending, spending on clothing, education and entertainment declined significantly. In 2022, the per capita consumption expenditure on clothing was 1,365 yuan, down 3.8 percent, accounting for 5.6 percent of the per capita consumption expenditure; Per capita consumption expenditure on education, culture and entertainment was 2,469 yuan, down 5.0 percent, accounting for 10.1 percent of per capita consumption expenditure. As one of the three carriages driving the economy, the decline of consumption will naturally lead to the decline of economic growth. In addition, the continuous trade frictions between the United States and China have made China's exports face many obstacles. Therefore, it is urgent to realize the new development pattern with the major domestic cycle as the main body.

At the same time, with the improvement of China's economic development level, the continuous improvement of the social security system, and the general extension of people's life expectancy, China's aging process has been accelerating. The growth of the elderly population has an important impact on China's economic development, and to some extent, aging is the

inevitable result of economic development. According to the World Population Prospects 2022 report recently released by the United Nations, the annual growth of the global population is likely to drop to about 0.5% by 2050 due to the continuous decline of fertility rates; On the other hand, global average life expectancy continues to increase, from 63.8 years in 1990 to 72.8 years in 2019 and is expected to reach 77.2 years by 2050, when 16 percent of the total population will be over 65 years old. Worldwide, there is an increase in the demand for elderly care, which will affect the labor market and the national pension system. China is one of the most aging countries in the world and has the largest elderly population. Under such circumstances, how to promote economic growth and achieve high-quality development has become a major challenge for China.

From the perspective of consumer demand, in recent years, the consumption intention of the elderly population in China has shown a reverse trend with the consumption data of the whole population, and the consumption power of the elderly is constantly accelerating. Therefore, how to effectively guide the consumption of the elderly, so as to improve the income level and quality of life of the elderly, stimulate China's consumption and develop China's economy is an important issue. Based on this, this paper first sorts out the academic research results on the impact of aging on economic growth. Secondly, based on the threshold regression model, this paper analyzes the impact of China's aging and consumption on economic growth. Finally, relevant policy recommendations are put forward according to the above research conclusions.

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2. Literature review and research hypotheses

There are many studies on the relationship between population aging and consumption by domestic and foreign scholars. Modigliani and Brumberg (1954) proposed the life cycle theory, which believed that consumers would smooth their consumption in the life cycle according to their expected lifetime income in order to achieve maximum utility.^[1] Zheng, W. T. et al. (2022) found that the increase in the proportion of the elderly population in the family can promote the upgrading of the consumption level of the family structure, but it hinders the increase of the expenditure on culture, education, entertainment, transportation and communication in the family consumption structure.^[2] Most scholars believe that there is a negative correlation between population aging and household consumption, which inhibits economic development. Using Belgian household micro data, Mathieu (2004) found that there was a negative correlation between population aging and medical consumption expenditure as well as some work-related consumption expenditure.^[3] Liu, X.C. and Xu, X. J. (2021) empirically studied the significantly negative impact of population aging on the per capita consumption expenditure of urban residents.^[4] Zheng, W. et al. (2021) proposed that there is a negative correlation between the old-age dependency coefficient and the consumption level.^[5] However, some scholars have discussed the possibility of population aging driving economic development by stimulating consumption. For example, Liu, Z. (2020) pointed out that population aging can promote regional consumption power and have a positive impact on economic construction and development.^[6] Zeng, Y. (2022) believed that the aging population will give rise to new consumer demand, form a demand-driven supply, and force enterprises to carry out technological innovation, thus realizing the upgrading and development of industrial structure and promoting economic development.^[7] Wang, A. (2023) found that population aging has a significantly positive impact on the average living consumption expenditure of all residents, the average consumption tendency of residents and the consumption structure.^[8]

Whether an aging population makes consumption a boost or a drag on the economy remains to be seen. On the one hand, the elderly have more savings and more leisure than the young, which provides strong support for the consumption behavior of the elderly. However, on the other hand, the elderly have reduced their income sources, are unable to participate in many emerging consumption methods (such as major online platforms and mobile apps), and are restricted by physical and mental reasons from some risky sports and entertainment projects, which all lead them to reduce their consumption. Based on the above two aspects, this paper proposes the following two opposing hypotheses:

H1: The aging phenomenon promotes the impact of consumption on the economy.

H2: The aging phenomenon damps the impact of consumption on the economy.

3. Model setting and variable description

In order to test the role of aging in the consumption-driven economy, this paper uses the threshold regression model for econometric test. The threshold model was proposed by Hansen (1999), which uses rigorous statistical methods to estimate parameters and test hypotheses, and effectively identifies the number and value of thresholds. The specific forms are as follows:

$$y_{it} = \begin{cases} u_t + \beta'_1 x_{it} + \varepsilon_{it}, & q_{it} \leq \gamma & (1) \\ u_t + \beta'_2 x_{it} + \varepsilon_{it}, & q_{it} > \gamma & (2) \end{cases}$$

Table 1. Description of variables.

| symbol | Variable name | nature | Description |
|-----------|--|-----------------------|---|
| GDP | Gross domestic product | Variable explained | Unit: 100 million |
| perconsum | Consumption per capita | Explanatory variables | Unit: Yuan/person |
| oldratio | Aging dependency ratio | Variable of threshold | Elderly population over 65 years old/working age population 15-64 years old |
| Gov | Public finance expenditure | Variable of control | Unit: 100 million |
| Popu | Permanent resident population | | Unit: ten thousand people |
| perincome | Per capita income | | Unit: Yuan/person |
| perhealth | Per capita health care consumption | | Unit: Yuan/person |
| perentert | Per capita consumption of education, culture and entertainment | | Unit: Yuan/person |

Where y_{it} is the explained variable, x_{it} is the explanatory variable, u_t is the disturbance term, q_{it} is the threshold variable used to divide the sample, γ is the threshold value with estimation, and the disturbance term ε_{it} is independent and identically distributed. The explained variable in this paper is regional GDP, which measures regional economic development. The main explanatory variable is regional per capita consumption, which measures consumption in the triad of pull economies. The threshold variable is the dependency ratio of the elderly (over 65 years old) in a region, which measures the degree of regional aging. Government

public financial expenditure, regional resident population, per capita income, per capita health and medical consumption, per capita education, culture and entertainment consumption are control variables. See Table 1 for specific variables. The data samples come from China Statistical Yearbook, which is divided into 31 provincial-level administrative units in China, and the time span is from 2013 to 2021.

4. Empirical results

This paper uses STATA software to conduct threshold regression. According to the regression results (see Table 2), there are double threshold values of the aging dependency ratio, which are 10.44 and 13.10 respectively, passing the significance level of 5% and 1% respectively. However, the triple threshold is not significant, so it can be considered that there are two threshold values in the model (see Figure 1 for LR test). When the aging dependency ratio is less than 10.44, per capita consumption plays a role in promoting GDP. For every 1 yuan increase in per capita consumption, GDP increases by 104 million yuan on average. When the aging dependency ratio is between 10.44 and 13.10, the promotion effect of per capita consumption on GDP begins to strengthen. When the aging dependency ratio is greater than 13.10, the promotion effect of per capita consumption on GDP begins to weaken. This shows that the impact of per capita consumption on GDP does have a promotion effect. After the first threshold value of 10.44 is exceeded, the promotion effect of per capita consumption on regional GDP becomes larger. After crossing the second threshold of 13.10, the promotion of per capita consumption to GDP slows down, which indicates that the more the aging phenomenon is not the better for national economic development, and it should be controlled within a certain proportion. If left unchecked, consumption per capita will contribute more and more slowly to GDP in the coming years, and consumption, which pulls one of the economic troika, will no longer be one of the driving forces. Hypothesis H1 is verified.

In addition, the results of control variables show that government public financial expenditure and regional permanent resident population have a significant role in promoting regional GDP, which is consistent with the national income theory. The impact of regional per capita income and per capita health care consumption on regional GDP is not significant, which is probably because health care consumption indicates that consumers are in illness, and people in illness have neither energy to work for compensation, nor mood and leisure to spend on other aspects; The per capita income is likely due to the large gap between the rich and the poor in the region, so the average of the total income has no significant impact on GDP. In addition, the impact of per capita education, culture and entertainment consumption on GDP is significantly negative.

Table 2. Threshold regression results

| variable | coefficient | t | P-value | Confidence interval | |
|------------------|-------------------------|--------|---------|---------------------|--------|
| Gov | 3.270*** (0.368) | 8.87 | 0.000 | 2.544 | 3.997 |
| Popu | 4.816*** (0.379) | 12.68 | 0.000 | 4.068 | 5.564 |
| perincome | 0.053 (0.238) | 0.22 | 0.822 | -0.416 | 0.524 |
| perhealth | -0.593 (1.611) | -0.37 | 0.713 | -3.767 | 2.580 |
| perentertainment | -5.379*** (1.655) | -3.25 | 0.001 | -8.641 | -2.118 |
| _cons | -24501*** (1781.389) | -13.75 | 0.000 | -28010 | -20993 |
| γ_1 | 10.44** | 19.55 | 0.040 | 9.72 | 23.55 |
| γ_2 | 13.10*** | 13.13 | 0.000 | 8.75 | 23.99 |
| γ_3 | 22.07 | 6.86 | 0.11 | 19.11 | 23.99 |
| zone 1 system | 1.038** (0.459) | 2.26 | 0.025 | 0.132 | 1.943 |
| zone 2 system | 1.329*** (0.444) | 2.99 | 0.003 | 0.453 | 2.205 |
| zone 3 system | 1.217*** (0.448) | 2.71 | 0.007 | 0.333 | 2.101 |
| F | 386.47 | | | | |
| R ² | 0.90 | | | | |

Note: ***, ** and * indicate that the series are significant at the levels of 1%, 5% and 10%, respectively



Fig. 1. LR test diagram of threshold number

5. Conclusions and recommendations

5.1. Conclusion

Through the empirical test of the impact of regional per capita consumption on GDP, this paper mainly finds the following conclusions:

First of all, per capita consumption plays a role in promoting regional GDP, and aging plays a threshold role in the impact. According to the results of the study, when the aging dependency ratio is between the threshold values of 10.44 and 13.10, per capita consumption has the largest pulling effect on GDP. This shows that the elderly in China have accumulated wealth for most of their lives and have a lot of leisure after retirement, so they use consumption to improve their quality of life.

Secondly, the regression results of the control variables show that although the physical fitness of the elderly is not as good as that of the young, the consumption per capita in terms of health does not have a significant impact on GDP. This is because the proportion of old people is small, and the proportion of young people dilates the cost of health care; At the same time, it also shows that regional fiscal revenue does not rely on medical treatment, and the problem of "excessive medical treatment" has been significantly improved. The impact of per capita education, culture and entertainment consumption on GDP is significantly negative, because the national "double reduction" policy has a certain effect on the education and training industry and the national "eight regulations" on the entertainment industry, and because with the aggravation of aging, the elderly are not willing to spend on education, culture and entertainment.

5.2 Suggestions

In the process of population aging, the elderly group, as an important part of society, has a significant impact on a country's economic activities and consumption. Therefore, on the basis of thoroughly implementing the national strategy of actively responding to the aging population, China should actively promote the consumption demand of the elderly.

First, we should create a good atmosphere of "everyone attaches importance to health and everyone pays attention to old-age care" in the whole society, actively respond to the national strategy of population aging, improve the old-age service system, and strengthen the construction of supporting projects and products for the elderly.

Second, we should actively promote the consumption of the elderly, guide the elderly to establish a correct concept of consumption, encourage the elderly to improve their own health awareness and risk awareness, and enhance the ability to resist risks. At the same time, we should strengthen the development of elderly care services to provide more high-quality elderly care services for the elderly.

Third, we should further strengthen the supervision of the consumer market of the elderly, especially the supervision of pension institutions, articles for the elderly and medical institutions, earnestly safeguard the legitimate rights and interests of the elderly, and crack down on all kinds of illegal acts that violate the consumer rights and interests of the elderly.

Fourth, we should actively improve the social security system, expand the coverage of social security, and improve the welfare level of the elderly group. We will continue to improve the social old-age service system, provide diversified old-age services for the elderly, enable more elderly people to be able to consume, and promote the growth of elderly consumption.

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