The Impact of Population Aging on China's GDP

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Abstract. The aging of population is a hot issue of social concern in recent years. It not only plagues developed countries but also plagues developing countries. In the context of a significant change in China's population structure, studying the relationship between population aging and GDP is also a pressing matter. Therefore, this paper focuses on the correlation between the population aging and China's GDP and uses the data of per capita GDP, the dependency ratio of the elderly in 31 provinces and cities in China. Stata is used to estimate the impact of population aging on GDP in China. The result shows that dependency ratio has a positive effect on GDP, but when take into account the proportion of the elderly population, the result has become different. Finally, this paper gives some policy suggestions based on the above research results.

Keywords: Population aging; GDP; dependency ratio

1 Introduction

China is the largest populous country in the world today. The issue of the relationship between population and GDP has always been the subject of competing studies both at home and abroad. From the early years of the founding of New China to the present, the population situation in China has undergone tremendous and fundamental changes: the surge in the population and the irrational structure of the population age. Since the 1970s, China has implemented two vital policies related to population and economic growth: the population-related family planning policy and the reform and opening-up policy in connection with economic growth. The family planning policy drastically reduced the number of newborns and the reform and opening up promoted the rapid economic growth in China. At the same time, people's living standards and medical conditions are improved and their life expectancies are gradually extended. These two policies brought about the problem of population aging along with the growth of the GDP. The significant change in the age structure of China's population and its impact on the economy was also highlighted. Aging leads to a decrease in the proportion of the working-age population and an increase in the dependency ratio on the elderly. Aging also has an impact on investment, consumption and savings. Besides, aging has increased the government's financial expenditure on the elderly and increased the financial burden. Now that the demographic dividend in China is about to end, China must be well prepared to meet the challenge of aging population. In this context, the aging of the population is bound to have far-reaching effects on the growth of GDP. If China wants to maintain or even increase the growth rate of its GDP, it must pay enough attention to the impact of population aging and deeply probe into the correlation between population aging and the growth of GDP.

2 Literature Review

China's economic growth has attracted worldwide attention over the past 30 years, its rapid economic growth has attracted significant interest from domestic and foreign economists and researchers. Scholars have offered various interpretations of China's miracle, from such perspectives as institutional reform (Chen, 1993; Qian, 2003; Woo, 1999; Liu and Hu, 2013). This paper interprets the impact of population aging on China's GDP.

Pitchford (1974) analysed the population which played an important role in economy. Lindh and Malmberg (1999) studied the population and economic growth of the OECD countries from 1950 to 1990, and found that the proportion of the elderly population increased gradually. The economic growth of the OECD countries has had a significant negative impact. Futagami and Nakajima(2002) believes that

personal savings behavior will change because people's life expectancy changes. Some scholars believe that China's 30 year economic growth miracle is attributed to favorable international environment, macroeconomic policies, social system, reform and opening strategy and other factors (Bloom et al., 2003). Bloom et al. (2006) investigate the determinants of economic growth in China and India using cross-country data during 1960–2000. The result shows that economic takeoffs in both countries have substantially benefited from a higher labor force per capita ratio induced by dramatic fertility declines, and rising health and life expectancy of the population. C. -B. An, S. -H. Jeon (2006) used the cross-country regression and panel data for OECD countries over the 1960–2000 periods, the non-parametric kernel estimation showed the inverted-U shape relationship between demographic change and economic growth; growth rates initially increase and then decrease with population aging. Holz (2008) examines China's future growth prospects and the potential drivers of future growth using two approaches and found that China's economic growth is likely to continue at current rates through 2015 before it gradually slows. Lu (2009) examines demographic effects on China's economic growth and regional disparity using provincial-level data in the production function during 1995–2007. The result shows a significant negative impact of the total dependency ratio on income per capita. Z. Wei, R. Hao (2010) examined the relationship between demographic change and economic growth in the case of China during the period 1989–2004 and found that China's rapid economic growth has been significantly attributable to changes in demographic structure. Hashimoto and Tabata (2010) constructs a two-sector overlapping generation model and found that population aging induces a shift in labor from the non-health care sector to the heath care sector and lowers the per capita income growth rate. Crespo et al. (2014) assessed empirically the role played by prospective ageing measures as a predictor of income growth in Europe and found that prospective ageing measures which move beyond chronological age and incorporate changes in life expectancy are able to explain better the recent long-run growth experience of European economies. Uddin et al. (2016) examines the relationship between the dependency ratio, savings rate and real GDP for Australia for the period 1971–2014,and found that changes in population age structure had a significant impact on real GDP per capita in Australia. Choi et al. (2015) developed a computable overlapping generations model in which the accumulation of human capital is endogenous, the simulation shows that the aging of the population will lead to the increase of labor supply and the increase of capital stock, and then affect the development of social productivity. Xiao Yiping and Yang Yanlin (2017) used Chinese 1987~2015 year census data, to study the changes of population age structure on economic growth, and found that the change of population age structure mainly by enhancing the use efficiency, production factors raise the level of human capital and increase industry to promote economic growth. According to the statistics of the world bank, China is the fastest country in the East Asia Pacific region. So it is of great significance to study the influence of the aging of the population on the GDP. Wongboonsin et al. (2017) examined 45 potential mediating variables between demographic structure and economic growth, the results suggest that demographic structure affects economic growth differently between developed and developing countries.

Based on the current research situation both at home and abroad, we find that the research on population age structure and current account, real effective exchange rate and current account have been continuously pushed forward. At present, China is facing the challenge of the rapid reduction of labor force. Therefore, it is of great practical significance to study the impact of aging in China on GDP.

3   Research Process

3.1   Overview of Population Aging

In the article "The relationship between changes in the age structure of Asian population and socio-economic development", Kuroda (1993) proposed that the population should be divided into three groups according to the age of the population. The population aged 65 and over can be classified as the elderly group which is called the aging population. Internationally, countries or regions whose aging population account for more than 7% of the total population are entering an aging population. China's population aging is worsening. This is mainly reflected in the increase of the proportion of the population aged 65 and over. By 2014, this proportion has reached 10.1%, which shows that China has entered an aging society, as shown in Figure 1.
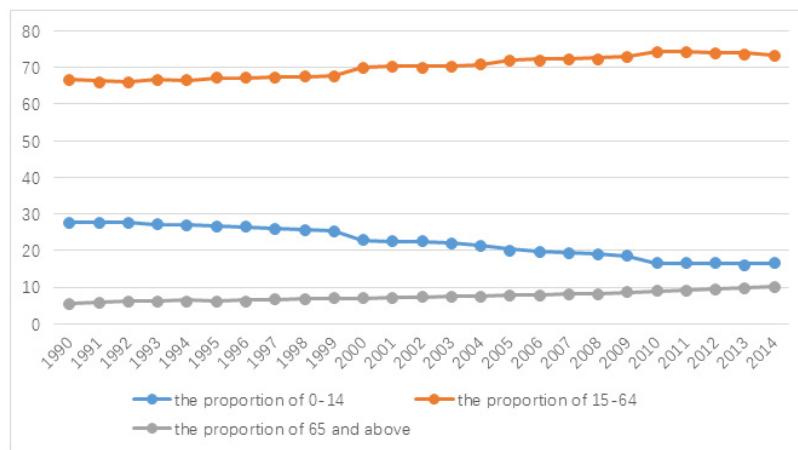
Source: 1990-2014 China Statistical Yearbook

Figure 1. Proportion of population in all age groups

3.2   Estimate Model

In this paper, the panel data of 31 provinces and cities in China from year 2000 to 2010 are used to estimate the relationship between population aging and GDP in China and to summarize the impact of population aging on the GDP. The model is as follows:

$$PGDP = \alpha ODR + \beta OTR + \gamma X + \varepsilon$$

In this model, PGDP represents per capita GDP, which is an indicator of GDP; ODR represents the elderly dependency ratio, and OTR represents the proportion of elderly population in the total population. Both ODR and OTR are the indicators of population aging; X is the control variable, This paper selects the urban-rural income ratio (URP) as the control variable; ε is a random disturbance item.

3.3   Data Sources and Descriptive Statistics

Table 1. Descriptive statistics of variables

Variables	Obs	Mean	SD	Min	Max
LNPGDP	341	9.551330823	0.693150085	7.922623574	11.23946183
LNODR	341	2.451885341	0.204258594	1.937301775	3.085572978
LNOTR	341	2.1123359	0.227475338	1.446237397	2.795760059

Source: 2000-2010 China Statistical Yearbook

Based on the above research methods and related models, this paper estimates the annual sample data of 31 provinces and cities in China from year 2000 to 2010. The data are from China Statistical Yearbook and China Demographic Yearbook. The per capita gross domestic product (PGDP) is the explained variable, and the dependency ratio of the elderly (ODR) and the proportion of the elderly population in the total population (OTR) are explanatory variables. In order to reduce the endogeneity of variables and the variation range of data, all the relevant variables are taken as natural logarithms. Taking the logarithm, the data can be linearized and data information loss can be less. The urban-rural income ratio (URP) is chosen as the control variable. It is obtained through dividing per capita disposable income of urban households by per capita net income of rural households.

4   Empirical Results and Analysis

Table 2 shows the basic results obtained from the above model. Among them, (1) (2) are the regression

results of the explained variable and two explanatory variables respectively. It can be seen that the coefficient is significantly positive when the two explanatory variables are respectively included in the model. That is, there is a positive impact between the per capita GDP and the old dependency ratio or the proportion of the elderly in the total population, which is contrary to the perception that aging will affect economic development. However, when both explanatory variables are included in the model, as shown in (3), the dependency ratio of the elderly has a negative effect on the growth of GDP per capita, that is, the increase of the dependency ratio of the elderly lead to the decrease of per capita GDP. While the proportion of the elderly population still exerts a positive effect on GDP per capita. It is probably because the growth rate of per capita GDP is far greater than the growth rate of the elderly in the total population. In result (4), the influence is still significant after adding the control variable of urban-rural income ratio (URP). Time fixed effect is included in (5), in which the regression result is similar to (4), and the coefficient is significant at 1% level. And (6) add the individual and time fixed effect at the same time.

Table 2. Estimation results

	(1) LNPGDP	(2) LNPGDP	(3) LNPGDP	(4) LNPGDP	(5) LNPGDP	(6) LNPGDP
LNODR	1.508***		-5.142***	-5.173***	-5.255***	-0.203
	(0.165)		(0.389)	(0.399)	(0.446)	(0.159)
LNOTR		1.870***	6.268***	6.311***	6.268***	0.460**
		(0.131)	(0.349)	(0.368)	(0.452)	(0.180)
URP				0.012	0.011	0.071***
				(0.033)	(0.031)	(0.020)
Year fixed effect					Yes	Yes
Firm fixed effect						Yes
_cons	5.854***	5.602***	8.918***	8.865***	9.464***	8.300***
	(0.406)	(0.278)	(0.338)	(0.367)	(0.310)	(0.131)
N	341	341	341	341	341	341
R^2	0.197	0.377	0.589	0.589	0.754	0.980

Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: 2000-2010 China Statistical Yearbook
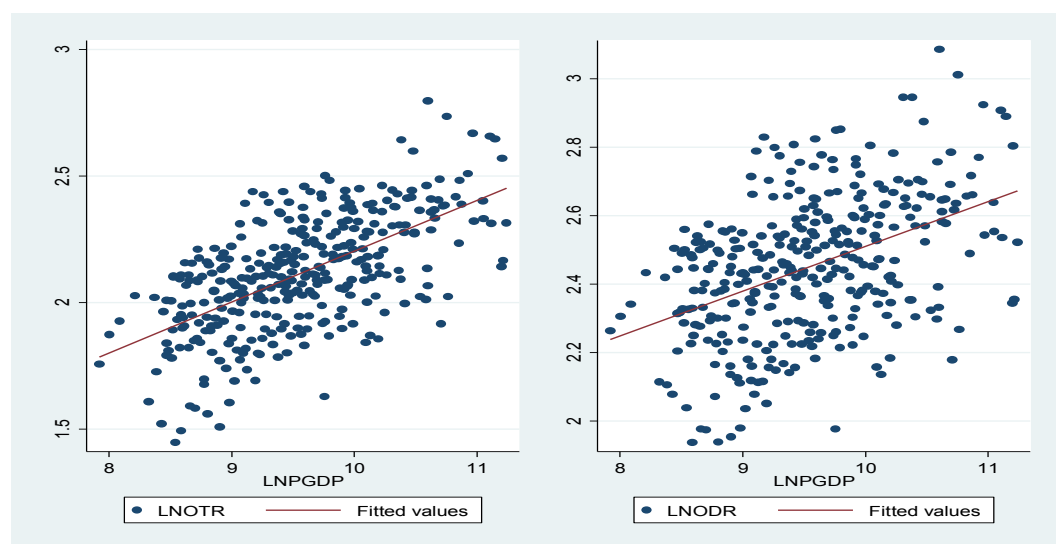
Source: 2000-2010 China Statistical Yearbook

Figure 2. LNPGDP and LNODR, LNOTR relationship

5   Conclusion

As the problem of population aging is highlighted in today's society, the study of the relationship between population aging and GDP is of paramount importance. This paper uses panel data from year 2000 to 2010 to analyze the relationship between population aging and GDP. The conclusion is that the dependency ratio of the elderly has a positive correlation with the GDP. But when the percentage of elderly population is included, it shows a negative correlation. This article shows that there is a deepening trend in population aging, and it is very important to study and solve the relationship between aging and economic growth. Simple economic policies along are not enough to bring about substantial economic growth. We also need to combine relevant and appropriate population policy. Faced with this phenomenon, the government should first raise awareness of the issue of aging and reform the system of pension insurance so that an old-age pension insurance system composed of government, society and families can be built as soon as possible. Secondly, developing the aging industries and human resources of the aged can have a better use of the large number of lower-aged ones so as to reduce the negative impact on the GDP.

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