The Shift in Population Aging and the Onset of High Savings in China

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Abstract: This paper examines the impact of aging on savings from two perspectives, namely life expectancy as well as dependency ratio, based on life cycle theory, using panel data for 28 Chinese provinces from 1989-2015 as a sample. 2SLS regressions conclude that rising life expectancy and rising per capita income promote higher savings rates. Thus, there is an evolutionary intrinsic correlation between China's demographic dividend and high saving, and the high saving in China is partly explained by the saving effect of the Chinese demographic dividend.

1. Introduction

In 2014, China's population aged 65 and above reached 10.1% of the total population, making it the only country in the world with an elderly population of over 100 million, and the number of elderly people will approach 300 million by 2025; life expectancy has now reached 76.4 years and may surpass that of the United States in 2027. Since population aging affects economic growth by influencing labor supply, consumption and savings, exploring the causes of China's high savings rate from a demographic perspective has become one of the hot topics of research. The process, pattern and relationship between population aging, saving and economic growth in China are unique in the world. How the relationship between population aging and high saving rate in China should be explained, despite several research attempts, leaves a large research space theoretically, methodologically and in terms of samples, so further research is needed both at the theoretical and empirical levels.

Unlike existing studies, this paper examines the relationship between population aging and saving rate from two perspectives of the two-way process of aging, i.e., life expectancy as well as dependency ratio, based on life cycle theory, and uses panel data of 28 provincial regions in China from 1989 to 2015 as a sample to examine the structural changes in life expectancy and the saving effects of juvenile dependency ratio and elderly dependency ratio, so as to provide empirical support for the relationship between aging and saving rate in China.

2. Literature Review

The main manifestations of population aging can be summarized in two ways: the aging of the age structure and the increase in life expectancy, both factors have an impact on the savings rate, but their mechanisms of action are not the same.

2.1 Age structure and savings rate

The emergence of life cycle theory compensates for the lack of micro-action mechanisms in Keynesian theory and becomes the starting point for studying the relationship between population age structure and saving rate. Its applicability has been verified by several empirical studies using cross-country data or single-country data as a sample, which mainly use the dependency ratio as a proxy variable for the population age structure to argue for the relationship between the population dependency ratio and the saving rate. For example, Leff (1969) uses cross-sectional data for 74 countries in 1964 for estimation and finds a negative relationship between the juvenile dependency ratio, the old-age dependency ratio and the national saving rate. Similarly using cross-country data, Loayza et al. (2000) find that the old-age dependency ratio has a negative effect on the national saving

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rate by examining cross-country data for a sample of 102 countries. Subsequent studies by Schultz (2005), Krueger and Ludwig (2007), Horioka (2010) and Curtis et al (2017) also support this finding. However, some studies have also found, no significant relationship between dependency ratio and saving. Cavallo E (2016) explores the relationship between population dependency ratio and saving rate using a panel dataset of 110 countries over the period 1963-2012 and concludes that there is no significant relationship between dependency ratio and saving rate in all regions except Asian countries. Therefore, at the empirical level, the relationship between population dependency ratio and saving rate remains to be examined.

2.2 Life expectancy and savings rate

In addition to the dependency ratio, another variable that measures the degree of aging, life expectancy, is an important factor in the savings rate. Deaton et al. (1994,1997,2000) a series of studies based on micro data find that the persistent increase in the savings rate is due to an increased proportion of savings at each age. Lee et al. (1998) simulated the saving rate in Taiwan from 1950 to 2050 and found that after controlling for two variables, interest rate and productivity growth rate, an increase in life expectancy and a decrease in fertility rate can increase the saving rate by about 10%. Bloom et al. (2003) add both health level and life expectancy to a life-cycle model, and by selecting cross-country data for 68 countries empirically conclude that increased longevity leads to higher saving rates at each age, and longer life expectancy promotes higher saving rates. Doshi (1994) using cross-country data, Hurd et al. (1998) using studies using household microdata, both reach the same conclusion.

As can be seen, there is still no consensus that life-cycle theory accurately describes the effect of demographic factors on the saving rate; even among those studies whose findings support life-cycle theory, there are still some additional increases in saving rates that cannot be explained by changes in the dependency ratio, a problem that is particularly evident in the literature examining the phenomenon of high saving in East Asian countries; moreover, these studies either do not combine life expectancy, population age structure and economic growth factors, or there are conflicting estimates of the saving effect of population age structure, so there is room for expansion of the existing studies as follows.

First, many studies have examined the effects of changes in dependency ratios or life expectancy only in isolation, leading to an incomplete examination of the savings effects of aging. In fact, in the aging process, a rise in the old-age dependency ratio generally coincides with an increase in life expectancy. The secondary demographic dividend theory suggests that an increase in life expectancy changes the level of savings of the working-age population and thus raises total savings, but an increase in life expectancy also implies a rise in the proportion of the total population that does not save at older ages and thus negatively affects the level of savings. Thus, estimating the saving effect of life expectancy without controlling for the dependency ratio can be endogenous and thus affect the estimation results, and vice versa.

Second, in terms of sample selection, the sample time span of existing studies is generally within 20 years, and the shorter time span can hardly reflect the complete process of population aging in China, so the sample period needs to be extended so that the saving effect of aging can be fully reflected.

3. Research design

In this paper, life expectancy, age structure and per capita income growth rate are selected as explanatory variables, where i denotes region, t denotes time, Sav denotes national saving rate, death denotes population mortality rate as a proxy for life expectancy, old denotes old age dependency ratio, youth denotes young child dependency ratio, gdp denotes per capita GDP growth rate as a proxy for per capita income growth rate, μ denotes individual effect, ε denotes random disturbance term. A series of control variables denoted by γ are added to the model, including: inflation rate, public finance expenditure ratio, urban-rural income ratio, industrial output ratio, per capita income level, and regional dummy variables, where per capita income level is used as a threshold variable to

examine whether the saving effect of population aging changes structurally with the change in income level. It has been shown that these variables are all closely and partially correlated with the saving rate, which can better summarize the economic and social characteristics of China's transition period and have some explanatory effect on the saving rate. Accordingly, this paper establishes a more complete empirical model as follows.

$$Sav_{it} = \alpha_1 death_{it} + \alpha_2 old_{it} + \alpha_3 youth_{it} + \alpha_4 gdp_{it} + \alpha_5 \gamma_{it} + \mu_i + \varepsilon_{it}$$

Due to the lack of data on life expectancy in China's sub-provincial statistics, this paper uses population mortality rate as a proxy variable for life expectancy. According to the theoretical explanation of the second demographic dividend and other major empirical studies, there is a negative relationship between expected mortality rate and savings rate, i.e., as the mortality rate decreases, the savings level increases, and the proxy variables for population age structure are old-age dependency ratio and juvenile dependency ratio, and the expected The coefficients on the child dependency ratio are negative, while the coefficient on the old-age dependency ratio is positive. The proxy variable for the growth rate of per capita income is the growth rate of GDP per capita, which is expected to have a positive sign. The coefficient of the public expenditure ratio is expected to be negative; in terms of income inequality, the higher the income inequality between rural and urban areas, the higher the total saving rate in the economy, and the sign of the coefficient is expected to be negative; in terms of the coefficient of the share of industrial output, from the perspective of factor income distribution In terms of the coefficient on the share of industrial output, there are differences in the propensity to save across factors, and changes in the industrial structure often imply changes in the distribution of factor income, which has an impact on the savings rate. Relative to other industrial sectors, the industrial sector is capital intensive and has a lower share of labor income; therefore, the higher the share of industry in the economy, the higher the saving rate, and according to other literature, the sign of the coefficient is expected to be negative.

Due to excessive missing data of some key variables in Tibet and Xinjiang, these 2 provinces were excluded; meanwhile, the data of Sichuan and Chongqing were combined and calculated, and the panel data of 28 provincial units and 1989-2015 were finally used in the study after deducting Hong Kong, Macao and Taiwan. All data were obtained from the China Statistical Yearbook, the Compilation of Statistical Information on the Six Decades of New China, and the statistical yearbooks of each province. The basic statistical characteristics of each variable are shown in Table 1.

Table 1 Basic statistical characteristics of the variables

Variables	Sample size	Mean	Standard deviation	Min.	Max.
Sav	756	0.4426	0.1052	0.0853	0.6590
death	756	0.0620	0.0076	0.0421	0.0850
old	756	0.1111	0.0263	0.0438	0.2189
youth	756	0.3107	0.1067	0.0654	0.5689
gdp	756	0.0981	0.0381	-0.037	0.3900
finance	756	0.1600	0.0804	0.0492	0.6269
industry	756	0.3835	0.0835	0.1134	0.6215
Urban-rural	756	2.7263	0.6422	1.2411	4.7586
Inflation rate	756	0.0680	0.0705	-0.0320	0.2840
income	756	1.5611	1.7580	0.0685	9.4124

4. Analysis of results

4.1 Empirical results

Table 2 presents the results of the estimation of model. Among them, FE is the estimation result of the fixed effects model and RE is the estimation result of the random effects model, and as a

comparison, the estimation result of the ordinary least squares (OLS) method is also presented in this paper. It can be seen that the independent variables all show significant at different levels, the magnitude of the coefficients does not change much under different estimation methods, and the signs of the coefficients are as expected. The coefficient of the population mortality rate, a proxy variable for life expectancy, is significantly negatively correlated under OLS estimation, indicating that the increase in life expectancy raises the saving rate of the population, while it is not significant under other estimations; the coefficient of the juvenile dependency ratio is significantly negative in all models, while the coefficients of the old-age dependency ratio and the growth rate of per capita income are significantly positive in all models.

Table 2 Simple estimates of savings rate

Variables	OLS	FE	RE
death	-1.033*** (-2.57)	0.625 (1.29)	0.416 (0.89)
old	0.503*** (3.71)	0.594*** (4.50)	0.578*** (4.44)
youth	-0.526*** (-15.37)	-0.465*** (-13.36)	-0.469*** (-13.71)
gdp	0.535*** (7.17)	0.385*** (6.75)	0.393*** (6.86)
R^2	0.4814		
Hausman			0.1227
Observations	756	756	756

*** $p \leq 0.001$ ** $p \leq 0.01$, * $p \leq 0.05$, + $p \leq 0.10$.

4.2 Discussion

Combining the estimation results shown in the previous paper, the conclusions drawn in this paper are as follows: there is a significant negative relationship between mortality rate and and saving rate, and a significant positive relationship between per capita income growth rate and saving rate; there is a significant negative relationship between juvenile dependency ratio and saving rate, and the higher the per capita income level, the weaker the negative relationship between juvenile dependency ratio and saving rate; when the per capita income level is low, there is a negative relationship between old age dependency ratio and saving rate, but as the per capita income level rises, the relationship between old age dependency ratio and saving rate changes to positive and gradually increases.

There is a positive correlation between life expectancy and savings rate, which is consistent with the findings of a series of previous studies proving the existence of a second demographic dividend in China. Holding the retirement age constant, the increase in life expectancy implies a longer post-retirement period and a greater demand for consumption in retirement, so people have to save more for retirement and precautionary savings when they are not retired, thus causing an increase in the savings rate. Thus, the increase in life expectancy positively affects the total saving rate by changing the saving behavior of the working-age population.

In the future, with the rising burden of old-age dependency in China, the continuous decline of the labor force ratio may lead to a shortage of labor supply and thus a labor supply dilemma, and this first demographic dividend brought about by the numerical advantage of the labor force starts to gradually disappear, while the high savings level brought about by it does not tend to decline significantly because the demographic transformation brought about by aging is still able to However, the second demographic dividend is not formed spontaneously, especially in the context of increasing aging, and it needs to be complemented by national policies in order to truly produce the dividend effect of boosting the economy; at the same time, from the perspective of the second demographic dividend theory, with the increasing elderly dependency ratio and In this context, China should make efficient use of the new savings brought by aging, and transform them into consumption and investment in a reasonable way, and maintain a moderate level of savings to promote sustainable economic growth.

Therefore, it is urgent to delay the disappearance of the first demographic dividend and fully exploit the effect of the second demographic dividend.

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