Extended Abstract

Owing to strict implementation of one-child policy since late 1970s, the pattern and pace of aging are significantly different from that of other countries. China is now facing the aged but not affluent era, which is also characterized by great regional disparity among the provinces, municipalities, and autonomous regions. In 2000 China's population structure reached the UN's benchmark line of aging, having 856 dollars per capita income, while most industrial countries and regions entered the aged era with much higher income per capita (Zhang, 2005). These evidences indicate a complex challenge to China and its economic development.

Despite the impact of aging on economic growth in different regions of China, this important issue has been ignored in most of the previous studies inside and outside of China. Therefore, this study investigates this issue and find out the correlation and causation of the impact of population aging on economic growth in different regions of China. The findings of this study may help policy makers to formulize the policies according to the needs of population of different regions in China.

Methodology

Sources of Data

In this paper the panel data has been used that spans from 1990 to 2009 for all the 31 provinces, municipalities, and autonomous regions in China. The GDP per capita, elderly dependency ratio, population, the enrollment of higher education, the enrollment of secondary education, and the enrollment of primary education from 1990 to 1995 have been taken from the Comprehensive Statistical Data and Materials on 50 Years of New China (CNBS). In order to calculate the saving rate in urban and rural areas, we used the disposable income per capita and living expenditure per capita in cities, rural net income per capita, and rural living expenditure per capita; corresponding data from 1990 to 1995 have also been taken from the Comprehensive Statistical Data and Materials on 50 Years of New China (CNBS). The data for later years have been drawn from China Statistical Yearbooks of various issues.

Models

Ordinary least squares regressions have been used to investigate the effect of elderly dependency ratio on the economic growth of 31 provinces, municipalities and autonomous

regions in China. The panel data comprised of 4 sub-periods, 1990-1995, 1995-2000, 2000-2005 and 2005-2009, which were the periods when the aging process in China started and accelerated.

According to the Solow Growth Model and its extension, the growth model estimated in this paper is:

$$grGDPit = \beta_0 + \beta_1 lnGDPit + \beta_2 grPOPit + \beta_3 lnSKit + \beta_4 lnSHit + \beta_5 lnEDRit + \varepsilon it$$

where the dependent variable grGDPit is the 5-year GDP per capita growth rate during each sub-period. In this equation, *i* stands for the region and *t* stands for the time period. The independent variables are the determinants of economic growth according to the Solow and the extended models: lnGDPit is the GDP per capita in real term for each initial year of every sub-period; grPOPit is the growth of the population during each sub-period; lnSKit is the 5-year average physical saving rate of each period, which is the variable that represents the accumulation of physical capital in the economy; lnSHit is the variable that represents the accumulation of human capital in the economy of each period; and lnEDRit is the elderly dependency ratio of each period.

Results & Discussion

Above mentioned regression results do not suggest a clear relationship between population aging and economic growth in China, which is not consistent with some previous literature because the aging process and the elderly have often been regarded as a burden to society and contributing less than the younger people to economic growth. However, there can be some plausible explanation for why population aging in China has a vague effect on economic growth. One unanticipated result that came from the above regressions is the significantly negative relationship between the enrollment rate of secondary education which serves as the main proxy of the human capital accumulation and the economic growth of China. It is reasonable to expect that the higher enrollment in secondary schools will contribute to the local economic growth and this is the case in most developing countries (Tsai, Hung & Harriott, 2010). However, this positive relationship could not be found in the analysis.

Table 1 Results of the Six Main Regressions

Growth of GDP per capita	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	Regression 6
lnGDP	-0.432237 (0.000) ***	-0.3992296 (0.000) ***	-0.4438041 (0.000) ***	-0.4183297 (0.000) ***	-0.4340462 (0.000) ***	-0.4128869 (0.000) ***
DIFF_POP	-0.0605481 (0.016) **	-0.0629332 (0.015) **	-0.0511417 (0.035) **	-0.0535283 (0.031) **	-0.0544296 (0.035) **	-0.0550983 (0.036) **
lnsku	0.1037365 (0.298)		0.0711409 (0.457)		0 .0768872 (0.430)	
lnskr		-0.0035844 (0.959)		-0.0142913 (0.829)		-0.0123336 (0.855)
lnshs			-0.2617964 (0.004) ***	-0.2678921 (0.004) ***	-0.2646783 (0.004) ***	-0.2696424 (0.004) ***
lnEDR					-0.0885597 (0.699)	-0.0464497 (0.841)
Adjusted R-square (overall)	0.4470	0.4553	0.4342	0.4339	0.4245	0.4294

Standard errors are in parentheses. * indicates significance at 0.10 level. ** indicates significance at 0.05 level. *** indicates significance at 0.01level.

A possible explanation for this discrepancy could be that because secondary education in China is part of the compulsory education system and secondary schools have been fully established during the last three decades, there is nearly no room for increasing the rate of the secondary enrollment. Hence, the marginal return of the secondary education could be negative to the economic growth (Tsai, Hung & Harriott, 2010). Furthermore, since the secondary-school-going age overlaps the working age, the increase in the secondary education enrollment may even reduce the exiting work force. From this point of view, the negative relationship between secondary education enrollment and the growth rate of GDP per capita can be to some extend explainable.[1]

[1] Another possible reason for this negative relationship may go to the calculation of the secondary education enrollment. Due to the lack of data, we used the ratio of secondary education enrollment over the total population of each region, instead of the most commonly used ratio of enrollment.

According to the Solow Growth Model, it is theoretically reasonable to expect a significantly positive relation between the saving rate and the economic growth. However, the results show that there is no statistically significant relationship between economic growth and either urban or rural saving rate in China.

Conclusion

This is an empirical study of the impact of population aging on the economic growth in different regions of China under the framework of the Solow Growth Model and its extension. The findings show that population aging has no clear effect on the growth rate of GDP per capita among regions in China, which can be explained by the unique development of China during the last three decades. One unanticipated result is the statistically significant negative relationship between the secondary education enrollment rate and economic growth which could be explained by the unique development pattern of China. When it comes to the effect of physical capital accumulation on economic growth, unlike the Solow Growth Model, results show that there is no statistically significant relationship between economic growth with either urban or rural saving rate in China.