

The Influence of China's Aging on Scientific and Technological Innovation

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Abstract: Since 2000, China's growing aging population, aging is not only on behalf of the staff labor reduce because of a decline in the physical quality of the staff led to enterprise's labor costs rise, also on behalf of the demand for pension increase, it is a big spending for governments, for the whole society, pension costs are also on the increase. Technological innovation means that there is a constant flow of new ideas, and there is a huge demand for capital, and if the government is already spending a lot of money on pensions, it is very difficult to subsidize companies to innovate new technologies because the government's spending may be more than their total income. So far, aging will inhibit the development and innovation of science and technology to a certain extent, and it will also affect negatively the economic and social development of our country. This paper will be divided into two parts, respectively the theoretical analysis part and the empirical part. The theoretical analysis part will combine the previous existing literature and the recent years of our technological development to analyze whether aging really suppresses the technological innovation. The empirical part will collect the data of population over 65 years old from EPS database from 2000 to 2022. Based on the theoretical hypothesis, the existing model will be used to analyze whether the aging degree will have an impact on scientific and technological innovation. The significance of this paper is that if population aging and scientific technology innovation can be included in the same framework, the interaction between them can be further developed.

Keywords: Aging population, Technological innovation, GMM method.

1. Introduction

Since the reform and opening-up in China in 1978, China's economic development has presented a rapid trend. The sound economic development not only represents the steady advancement of China's social undertakings, but also the quality of people's lives has been gradually improved. However, as China gradually enters the international market, there are new challenges to China's economic and social development. With the passage of time, China's economic development speed is gradually declining. If we want to be competitive in the international market, it is essential for the development and innovation of science and technology and ensure the quality. However, since 2000, China has gradually entered the aging society. Data show that by 2022, the aging population of China has reached 13.4%. It is expected that in 2022, China will enter the deep aging society and the aging ratio will be increasingly serious. Aging accounts for 22%. After 2060, the aging ratio will account for one third of the total population, which means that there may be one elderly person in every three people in China[1]. In China and around the world, there has always been a relatively close relationship between population age structure and economic development. For China, demographic dividend often affects economic development. However, after the reform and opening up, especially after 2013, with the deepening of population aging, demographic dividend is also gradually disappearing, leading to the decline of effective labor force and labor resources. So there is less supply in the labor market, which leads to a gradual increase in labor costs, and for the firm, a rise in costs means that total profits are going down and if their total revenues are constant, they might not invest that income in technological innovation. In other words, population aging may affect scientific and technological

innovation by affecting the increase of labor input and pension costs. Compared with developed countries, China is not only still in the developing stage, but the aging trend is showing a rapid growth, which is a major challenge to scientific and technological innovation[2].

2. Experiment and Reasons

When the aging trend becomes more severe and leads to higher labor costs, it may have a negative impact on scientific and technological innovation. If scientists can identify the ways in which population aging impedes scientific and technological innovation early, and even if some scholars predict that China will enter a super-aging society in the future, we can develop countermeasures based on these experimental results, then aging will not be one of the major causes of scientific and technological innovation in the future society.

3. Empirical Analysis and Discussion

3.1. Hypothesis

Because China has only discovered in recent years that population aging may threaten technological innovation, but at the beginning it was found that population entering negative growth did not affect technological entrepreneurship very significantly. Therefore, this paper hypothesizes that there is not a linear relationship between population aging and technological innovation, i.e., it is when the population aging exceeds a value that it really affects technological innovation, thus affecting the economy of the society and the subsequent technological development.

3.2. Theoretical Mechanisms

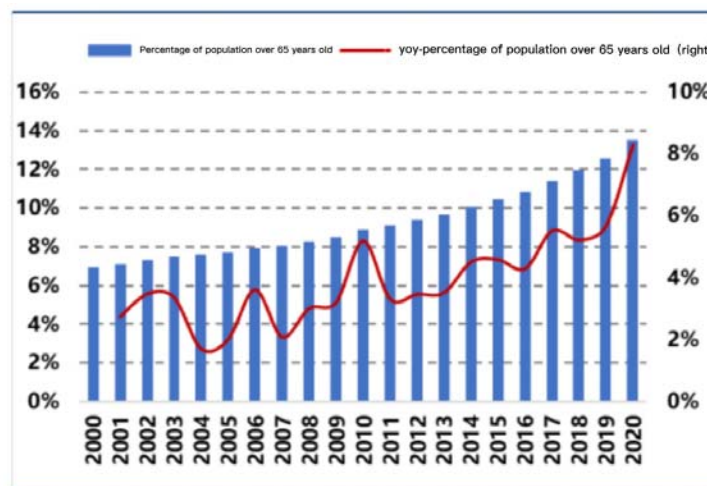
First of all, as far as individuals are concerned, although the

aging of the population makes individuals' functions seriously aged, their learning ability decreases, and their learning of foreword knowledge is insufficient, at the same time, the elderly population has accumulated rich practical work management experience and labor production management skills through "learning by doing" in practice, and some research results show that the existing work experience and cutting-edge In practice, older people can share their mature experience with young people to reduce the mistakes made by young people in the process of technological innovation to a greater extent, and promote technological innovation activities; they can also use their work experience accumulated in practice to discover more effective foreword work strategies, which can complement the foreword knowledge of young people and enhance their innovative work efficiency; therefore, older groups with high-quality practical experience in technology can effectively mitigate the reduction of innovation capacity due to the aging population. [7] But another experimental data show that in China, the aging of population will increase the burden of pension, both the government and the family will increase the expenditure on pension, thus crowding out scientific research and education funds, government funds can not be used for

technological innovation, so it is not conducive to technological innovation. The research shows that when the aging degree of population deepens by 1%, technological innovation will decrease by 0.409%[3].

3.3. Experiment process

This paper unfolds the theoretical hypothesis that the rising proportion of elderly people in china does have a negative impact on technological progress, innovation and thus on the country's economic development. In contrast to the original literature, which used data from the earlier years, which may lead to conclusions that apply only to the aging structure of that era. The data for this paper are obtained from the proportion of the aging population collected in the EPS database from 2002 to 2022, and then use the systematic GMM method, which means that the sample statistic is used to estimate the true value of the total, a simple example is using the sample mean to make an estimate of the expectation. It does not know the true value of the aggregate so using the sample statistic to estimate it. That is, the sample statistic = the estimate of the true value, to test the impact of aging on the level and structure of scientific and technological innovation.



Source: National Bureau of Statistics, HuaChuang Securities

Figure 1. Figure for China's aging population data from EPS database

4. Conclusion and Insights

4.1. Conclusion

In the model, it is obvious that there is a direct hump-shaped relationship between population aging and scientific and technological innovation, which also indicates that when population aging is relatively moderate, population aging can promote the development of science and technology, and scientific and technological innovation reaches the peak when the population aging is 8.8%. But when an aging population exceeds a certain amount of time, would have a negative effect to our country science and technology innovation, can be seen in the model, more than 65 years old and the elderly population in China than in 2010 more than the peak stage, has reached to 13.5% in 2020, it shows that China's population aging has been and will continue to have a negative impact on the science and technology innovation. In areas with a high degree of aging, the downward trend of incremental innovation is relatively mild, while the

downward trend of fundamental innovation is significantly more obvious. Moreover, by looking at the peaks of both, we can find that the fundamental innovation level peaks at 7.1% of the elderly population, while the progressive innovation level peaks at 10.7% of the elderly population. In other words, when the proportion of the elderly population is in the range of 7.1% to 10.7%, population aging can still promote incremental innovation, but it has begun to inhibit fundamental innovation. The reason is that disruptive technological breakthroughs or new product research and development are mostly done by young people with active thinking and knowledge frontiers, so the inhibitory effect of aging on basic innovation appears earlier; Progressive innovation, represented by utility model patents and design patents, relies more on the accumulation of individual work experience [4]; therefore, the decline of progressive innovation occurs in societies with a higher degree of aging. This finding confirms Schneider's conclusion based on microscopic individual data. When he used data on employees of German companies in 2004, he found that the

ability of individual employees to create new products (radical innovation) peaked when they were about 40 years old, while the ability to improve existing products

(incremental innovation) remained stable between 30 and 50 years old and began to decline after that age. [5][6]

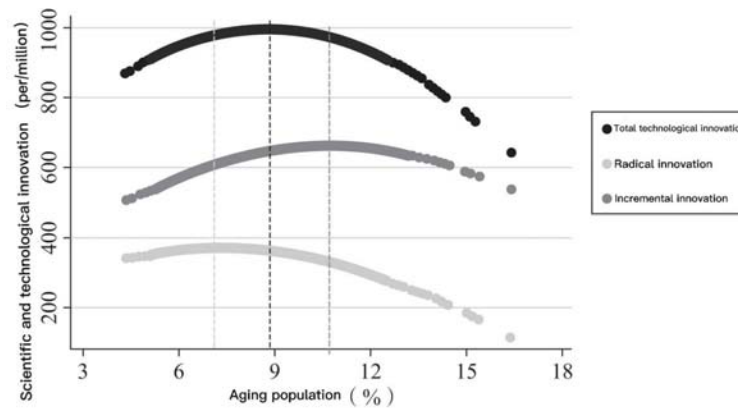


Figure 2. Figure for 3 types of innovation's model

4.2. Insights

This paper is based on the revelation of the results: first, the state should give full play to the positive effect of population aging on technological innovation, and the coordinated optimization effect made by various economic actors on population aging to strengthen the positive effect of population aging on technological innovation; second, the government should strengthen investment in education, implement the strategy of strengthening the country with talents, and strengthen investment in scientific research, which in turn promotes technological innovation.[7]

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