

Assessing the Economic Impact of Population Aging in China: A Review

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Abstract: *China currently has the largest population aging worldwide and one of the world's fastest aging speeds. In addition, China's economy is transforming from high speed to low speed. This study examines the current literature on how demographic transitions to an older population affect labor markets, economic growth, public financing and growth of Artificial Intelligence. The analysis explores into several crucial areas, including the anticipated shrinkage of the labor force as the working-age population declines, the rising financial pressure of healthcare and pension systems, and the broader implications for productivity and economic dynamism. It also investigates how demographic shifts are impacting possibly transforming the development and adoption of artificial intelligence (AI) in China. This study attempts to provide an in-depth examination of the various economic implications of an aging population by combining and evaluating a diverse set of research findings. It outlines significant areas of worry and opportunity, giving a more detailed picture of how demographic shifts are transforming China's economic environment. Furthermore, the report provides policy suggestions to meet the issues brought by population aging and discusses future options.*

Keywords: Population Aging; China's Economic Growth; Capital Expenditure; Artificial Intelligence.

1. Introduction

Numerous socio-economic issues are confronting nations worldwide as a result of the growing trend of population aging. A demographic phenomenon known as "population aging" is defined by a rising median age in the population as a result of increased life expectancy and declining birth rates. By international criteria, a country or territory is classified as an aging society if up to 7% of its population is 65 years of age or older; a society is classified as significantly aging if its percentage of people over 65 is greater than 14%; and a society is classified as seriously aging if its percentage is greater than 21%.

The National Bureau of Statistics of China (2024) estimates that 90 million people in China were 65 years of age or older in 2001, accounting for 7.1% of the country's total population. With more than 200 million people over 65, or 14.2% of the country's total population, by the end of 2021, China has officially entered an aging society. This suggests that in just 21 years, China has transitioned into a much older culture (Figure.1). China has now entered a severely

aging society, as predicted by the United Nations Medium Fertility Variant Projections' "World Population Prospects 2022" which states that by 2034, the country's elderly population (those 65 and over) will number over 300 million, accounting for more than 21% of the total population. After stabilizing for a while, it subsequently increased rapidly to 34.7% in 2057 and then to 42.2% in 2085.

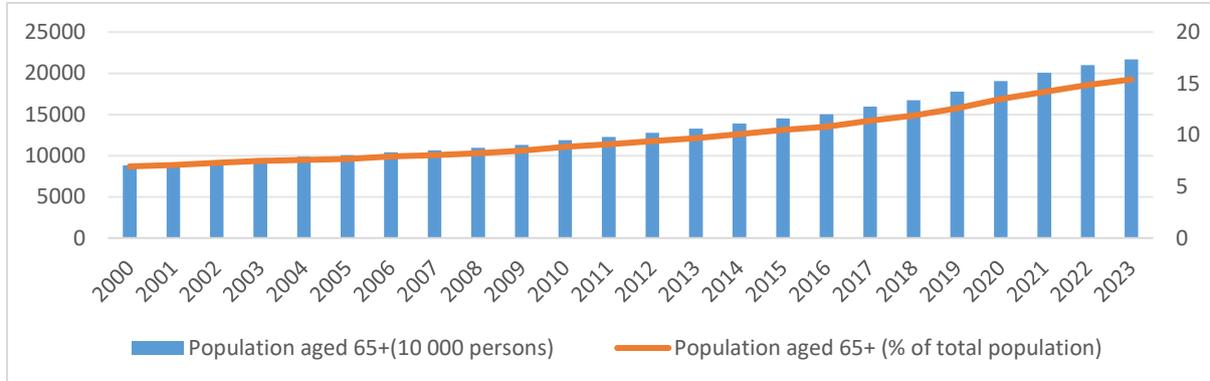


Figure1: The Number and Proportion of The Population Aged 65+ in China (2000 – 2022)
 Data source: National Bureau of Statistics of China (2024)

China currently has the largest population aging worldwide and one of the world's fastest aging speeds. Furthermore, China is grappling with a significant socio-economic challenge often referred to as 'getting old before getting rich'. China started the aging process in 2001, with a GDP per capita of US\$2,359 (measured in US dollars at constant prices in 2015); by 2021, when profound aging began in China, the GDP per capita had increased to US\$11,200. In 1994, 1994, and 2018, respectively, the USA, Japan, and South Korea all became societies with a significant aging population. Their relative per capita GDPs were \$55,700, \$29,500, and \$31,000 at that time (Fig.3). Consequently, growing serious issues including a drastically diminished labor supply, pension security, health care, and social services will arise as the population ages. Thus, the aim of the paper was to comprehensively review the effects of China's aging population on the country's economy and offer relevant recommendations.

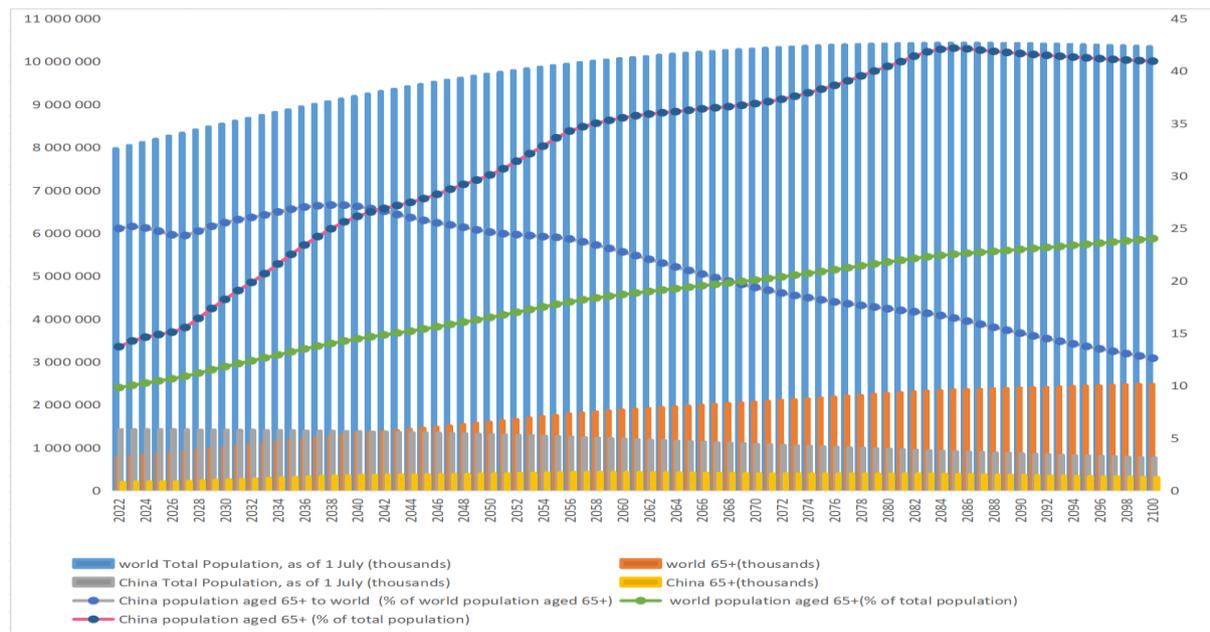


Figure 2: Medium Fertility Variant Projections (2022-2100)
 Data source: The United Nations (2023)

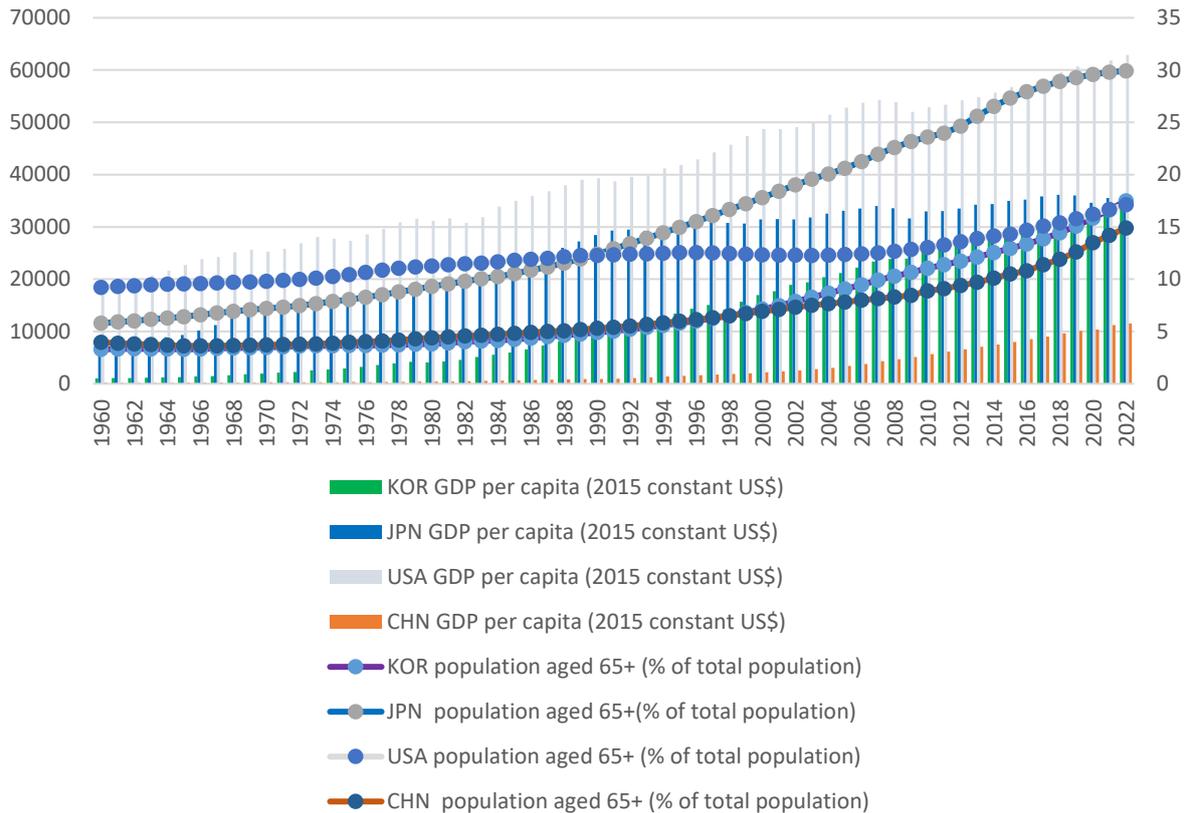


Figure3: GDP Per Capita And the Proportion of The Population Aged 65+ In the United States, South Korea, Japan, And China (1960-2022)
Data source: The World Bank (2024)

2. Method

The paper comprehensively reviews relevant literatures to critically discuss the impact of population aging on economy in China. Apart from that, this paper refer data comes from the "China Statistical Yearbook", "China Labor Statistics Yearbook", the National Bureau of Statistics, the International Federation of Robotics (IFR), the United Nations, and the World Bank to analyse the trend in aging population and AI in China. Based on the review conducted, this paper categorizes the impact into five key themes, which will be discussed in the following section.

3. Finding: Review on The Impact of Aging Population in China's Economy

The results highlighted the emergence of five major themes. Theme one discussed the economic growth and population aging in China. The second theme explored its impact on capital expenditure. The third theme was the nexus between population aging and human capital; the fourth, its consequences for labor productivity. The fifth theme explored the nexus between population aging and the development of artificial intelligence (AI) in China. Altogether, these factors have taken a heavy toll on China's economy

3.1 Economic Growth

Population aging has multifaceted impacts on the economy, influencing the economic growth rate, labor markets, productivity, and capital expenditure. Globally, the slowing growth of the working-age population and rapid aging will reduce the demographic tailwinds that previously

boosted economic growth, with significant slowdowns expected in high-income countries and China (Baxter et al., 2017). For instance, a 10% increase in the population aged 60+ led to a 5.5% decrease in per capita GDP, primarily due to slower employment and labor productivity growth in the US (Maestas et al., 2023). Additionally, population aging exacerbates income and consumption inequality (Chen et al., 2018), and increased pension contributions also place fiscal pressures on firms and governments (Zhang & Zhao, 2022), inhibiting household consumption in China (Zhang et al., 2023). Economic growth is adversely impacted by the old-age dependence ratio due to population aging, which lowers the working-age population, labor participation, and savings rates. This shows the importance of human capital accumulation, policy reforms and technological advancements, such as achieving higher employment rates, raising the retirement age, and increasing automation, can mitigate some negative effects. (Huang et al., 2019; Park et al., 2022).

Based on the reviews, the population aging claimed to negatively impact China’s economic growth. According to the World Bank (2024), since 2010, the economic growth of China has declined year by year, with the GDP growth rate falling from 10.6% in 2010 to 6% in 2019. During the COVID-19 pandemic, the growth rate of GDP is only 2.2% in 2020, 8.4% in 2021, and 3.0% in 2022. Moreover, according to the National Bureau of Statistics (2024), the GDP growth rate was 5.2% in 2023, which is lower than in 2019. This indicates that China's economic growth rate continues to decline. However, population aging, and the old-age dependency ratio are increasing year by year. China’s old-age dependency ratio rose from 11.9% in 2010 to 19.9% in 2022 as presented in Figure 4

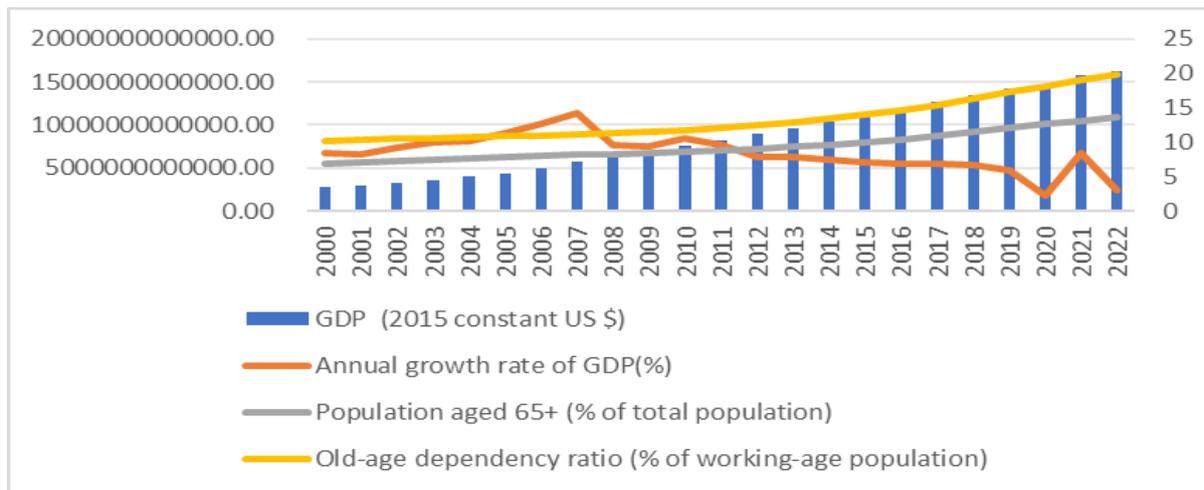


Figure 4: Annual Growth Rate of GDP and Old-Age Dependency Ratio In China (2000-2022)
Data source: The World Bank (2024)

3.2 Capital expenditure

Population aging significantly impacts capital expenditure through various mechanisms, such as fiscal policy, savings rates, and social security programs, thus affecting economic growth. Population aging affects international capital flows, leading to lower savings rates and investment, has a significant impact on the growth of health expenditures, with moderate increases in acute care and significant increases in long-term care costs, driven by the interaction between medical technology and aging, due to elderly individuals being more liable to physical discomfort or serious sickness (Gai & Zhang, 2018). Rapid population aging demands changes to social security programs, such as healthcare and pensions (Cai et al., 2018), which presents a significant risk to fiscal sustainability, particularly in developed

regions where healthcare and social security expenditures are major factors (Liu & Zhao, 2023).

Additionally, the savings rate and capital expenditure are negatively impacted by population aging in China (Dai et al., 2021). As populations age, governments typically raise capital and labor income tax rates as well as the public debt-to-GDP ratio in order to manage the fiscal load, as demonstrated in the US and Japan (Uchida & Ono, 2023). Furthermore, as the proportion of retirees rises, the tax landscape changes, resulting in reduced income taxes (Luo, 2024). According to the World Bank (2024), gross capital formation of GDP in China declined from 46.40% in 2013 to 43.29% in 2022, and while there was a slight increase in 2018, there was an overall downward trend, suggesting that capital expenditure was negatively affected by population aging.

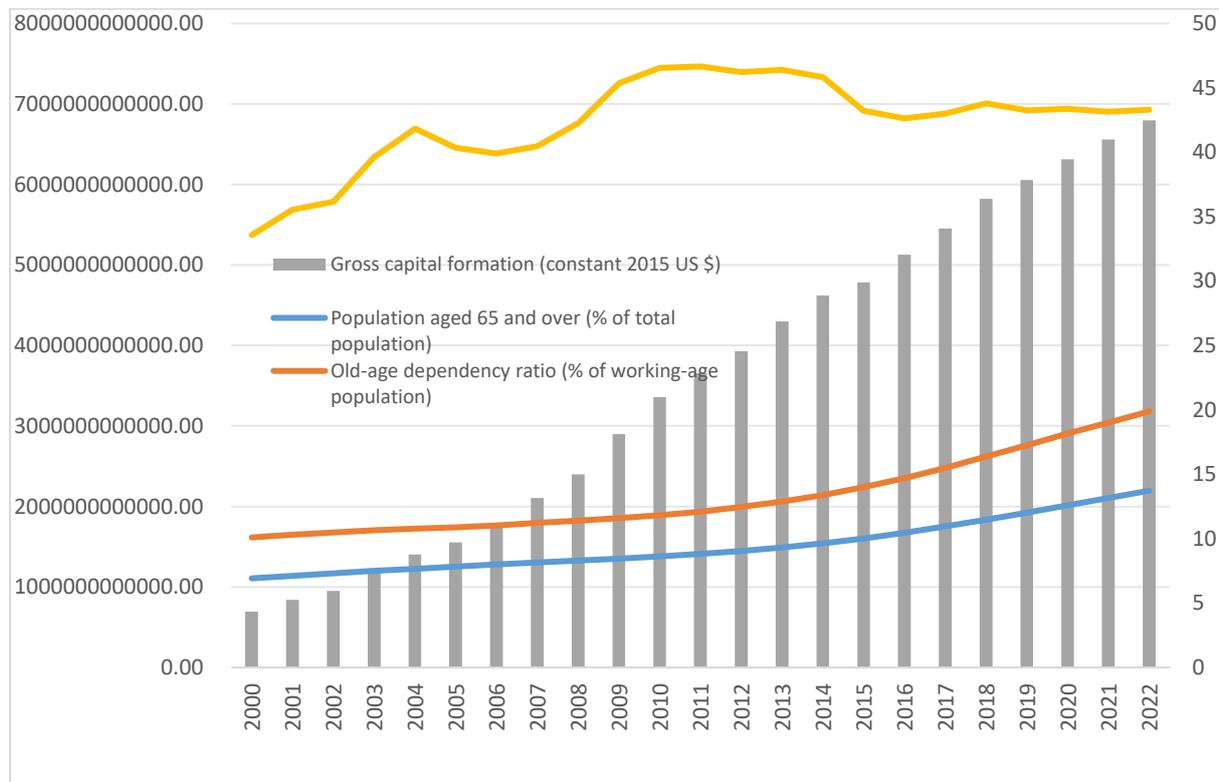


Figure 5: Gross Capital Formation of GDP in China (2000-2022)
 Data source: The World Bank (2024)

3.3 Human Capital

Population aging and human capital have a significant connection, with significant implications for economic growth and productivity. Research shows that population aging will require increased human capital formation, coupled with improved health and education, which can boost human capital investment, affect labor force composition, and thus enhance productivity (Prenzel & Iammarino, 2021). The human capital of the elderly, shaped by their earlier education and work experience, emphasizes the need for policies that support lifelong learning and preventative health measures to maintain productivity among older adults (Amornkitvikai et al., 2022), which positively affects productivity growth and is crucial for mitigating the economic impact of aging populations (Huang et al., 2019). Improving human capital through education has a greater impact on economic growth than changes in age structure (Lutz et al., 2019). In China, delaying retirement and enhancing human capital by prompting policies to

increase investment in education and skills can significantly contribute to sustainable economic growth (Liu et al., 2022; Zhang et al., 2023).

According to the National Bureau of Statistics of China (2024), the growth rate of years of schooling fell from 7.29% in 2011 to 0.1% in 2022. There were fluctuations, but the overall trend was downward, suggesting that human capital was negatively affected by population aging. However, the trend of the proportion of college and higher level to the population aged 6+ has been rising (Fig.6), which shows that investment in higher level education is increasing. And investing in higher level education can develop high-quality talent; thus, it is possible to capitalize on the advantages that elderly people have in terms of human capital by reinvesting their wealth of labor experience and expertise into the production sector. This would increase productivity and better support economic development.

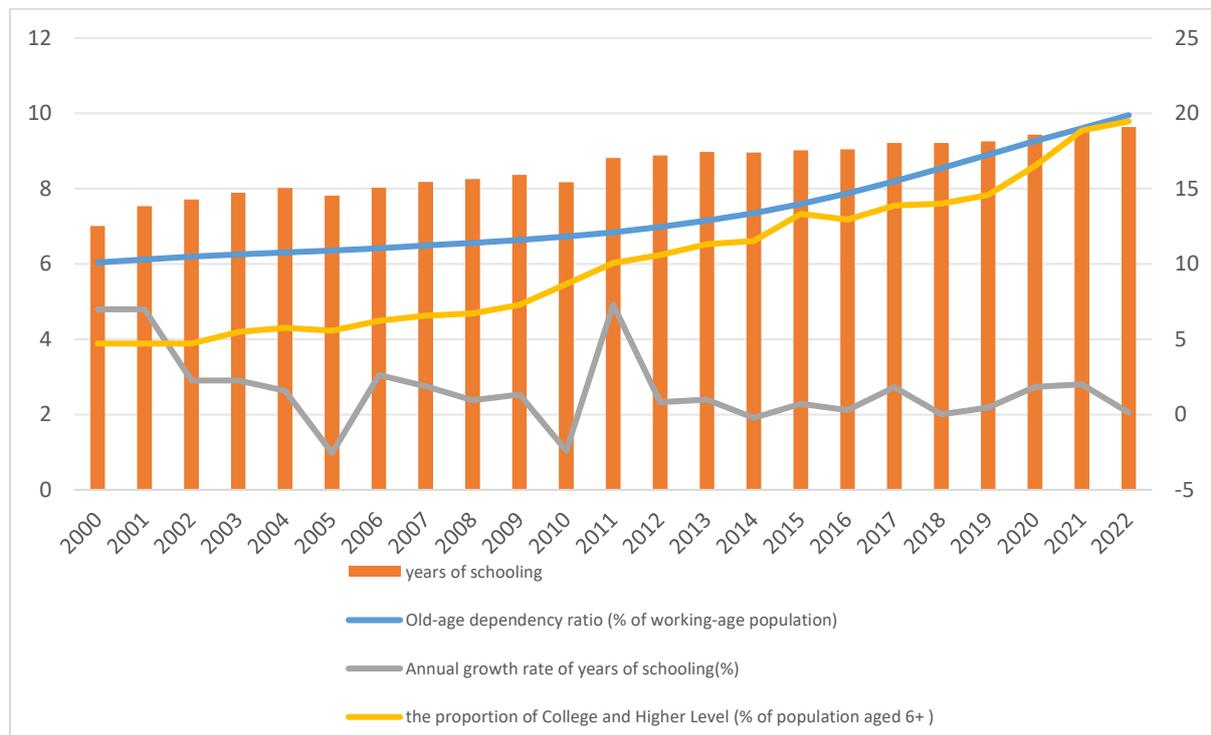


Figure 6: Annual Growth Rate of Years of Schooling and Proportion of Junior College Students And Above To Aged 6+ in China (2000 – 2022)
Data source: National Bureau of Statistics of China (2024)

3.4 Labor productivity

Population aging negatively impacts labor productivity, as older age groups contribute less to growth (Park et al., 2020). It can lower labor participation and potentially lower labor productivity in the long term due to interactions between labor, capital, and energy resources. (Wei et al., 2017). Study shows that labor productivity tends to decline when the percentage of elderly workers rises. According to Calvo-Sotomayor et al. (2019), for example, a 1% increase in the workforce aged 55–64 has been associated to a decline in yearly productivity growth in Europe of between -0.106% and -0.479%. Similarly, two-thirds of the decline in GDP per capita growth in the USA can be attributed to slower labor productivity growth brought on by population aging (Maestas et al., 2023).

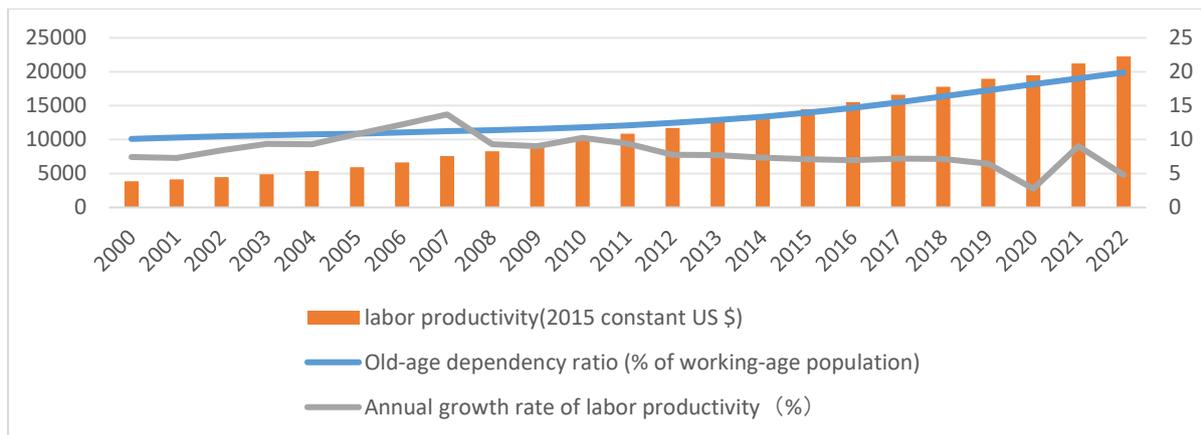


Figure 7: Annual Growth Rate of Labor Productivity In China (2000-2022)
Data source: The World Bank (2024)

China's sustained high-speed economic growth in the last twenty years has largely depended on a sufficient labor supply, which has benefited from population dividends (Cai, 2020). The gradual deepening of population aging has a negative impact on labor productivity, as confirmed in China. Since 2010, the labor productivity of China has declined year by year, with the growth rate of labor productivity falling from 10.2% in 2010 to 6.4% in 2019. Affected by the COVID-19 pandemic, the growth rate of labor productivity in 2020 was only 2.8%, and was 9.0% in 2021; however, 4.9% in 2022, which is lower than in 2019 (Fig.7). This indicates that the growth rate of labor productivity in China continues to decline.

3.5 Artificial Intelligence (AI)

There may be a lack of labor in many industries, which raises labor costs and hampers economic growth as the population aging process is speeding up. By automating procedures and tasks, AI may play a role in labor productivity, human capital accumulation, industrial upgrading and transformation, and technological innovation efficiency. Labor may be replaced by technology; both also have strong complementarities that boost productivity and increase demand for labor. For instance, Damioli et al. (2021) found that AI patent applications positively impact labor productivity, particularly in SMEs and services industries. Wang & Wang (2020) showed that aging has forced enterprises to replace labor with AI and promote intelligent old-age industries to motivate the industrial structure upgrading and transformation (Wu et al., 2022), thus AI might lessen the potential negative impact of population aging on China's economy (Yu & Cong, 2023).

AI as a productivity and economic growth engine is bringing out a global earthquake of technical advancement (Denning & Lewis, 2017). China launched the "Made in China 2025" program, which encourages focusing on intelligent manufacturing and strongly developing artificial intelligence in a variety of industries, to fully utilize the new opportunity for economic development.

The largest industrial intelligent robot market in the world, according to the International Federation of Robotics (2022), has been in China since 2013. China's total installed base of industrial intelligent robots surpassed all other markets combined around the globe by 2021, reaching 2,618.95 million units, and 51.8% of global installations as in Figure 8. Since 2010, China's installation of industrially intelligent robots has significantly risen. Even though the number decreased in 2018 and 2019, it is still the nation with the most installations worldwide. In particular, according to Fig.9, the installation volume in 2021 grew by 51% over the previous year. This indicates that China is at the forefront of artificial intelligence construction,

suggesting that China may utilize AI to mitigate the adverse effects of population aging and economic growth.

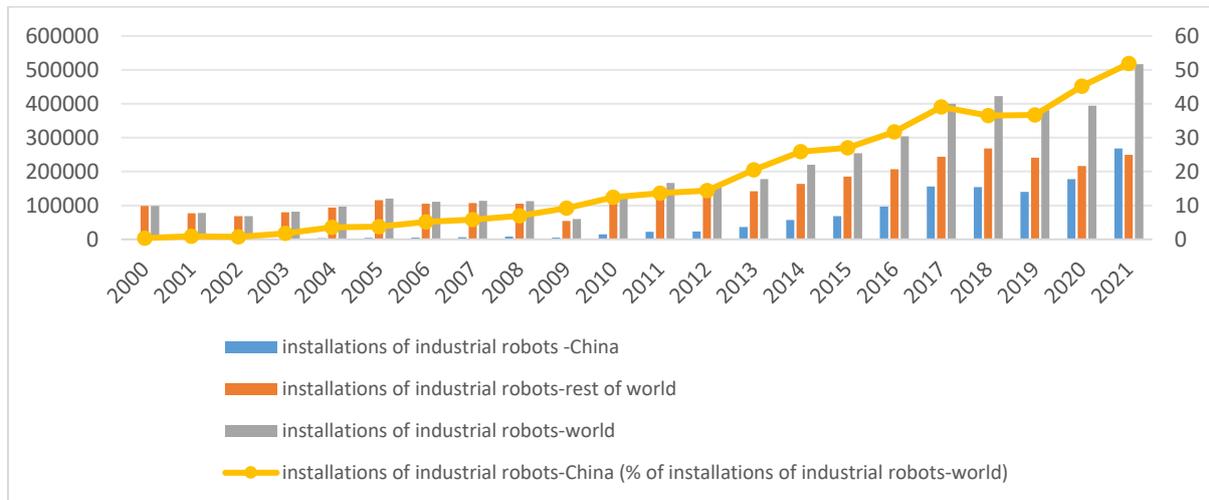


Figure 8: Installations of Industrial Robots-China VS World (2000-2021)
Data source: International Federation of Robotics (2022)

4. Conclusion

The study presented above draws the following conclusions in this paper: (1) China's economic growth is negatively impacted by population aging. (2) China's capital expenditure is negatively impacted by population aging. (3) In China, aging populations have a favorable effect on high education but a negative impact on human capital. (4) China's labor productivity is slowed by an aging population. (5) AI can successfully lessen the negative consequences of China's aging population.

In the view of these findings, this paper presents the following considerations. First, implement effective strategies to slow down the aging of the population. The Chinese government implemented the most comprehensive "three-child" policy to encourage births as the proportion of the old population increases and the number of persons between the ages of 20 and 29 decreases. However, the findings are not encouraging, according to China's National Bureau of Statistics (2024). For the last two years, China's natural population growth rate has been falling; in 2022 and 2023, it was -0.6% and -1.48%, respectively. Furthermore, complementary birth support policy systems that reduce workplace pressure and childcare costs, such as shared family responsibilities, extended maternity leave, expanded childcare services, increased maternity cost subsidies, and additional financial support for families with multiple children, can encourage childbirth by alleviating economic pressure on residents (Tian & Fang, 2023).

Secondly, explore the elderly's potential for consumption and grow the elderly industry. China's aging population offers both opportunities and problems for economic growth, especially in the sectors that provide care for the elderly and those that are linked. Spending on social security and healthcare is predicted to increase as the number of senior people rises, endangering the country's financial stability. However, this demographic shift also opens significant business opportunities. The development of the "silver economy" can be a driving force for economic growth if properly harnessed, such as through investment in healthcare facilities and aged care services that cater to the elderly population. Based on the unique requirements of the elderly, create age-friendly housing options, healthcare solutions, assistive technologies, leisure activities, and other products and services that are specifically geared

toward the elderly (Guido *et al.*, 2022).

Thirdly, to increase the capital investment in human power to realize the substitution of quality for quantity of labour. Government and industry need to establish an education and training system fit for all age groups, vigorously develop vocational education and lifelong education, strive to cultivate innovative talents, accelerate the accumulation of human capital, improve the quality of labor, and accelerate the transformation from a large country of people to a large country of population (Yuan *et al.*, 2017). Fourthly, to adopt appropriate policies to extend the retirement age to adjust the level of labor activity supply. Implementing voluntary delayed retirement policies can enhance labor supply, alleviate pension burdens, leverage elderly human capital, boost productivity, foster economic growth, and promote economic development (Wu *et al.*, 2022). Five, to accelerate the advancement of AI development. The government should actively invest in worker and staff training for digital technologies to keep up with the growing trend of digital technologies like AI, in addition to making significant investments in fundamental research and development in this area. It can not only boost the supply of top-tier human capital that intelligent manufacturing requires, thereby preventing the unemployment issue brought on by the new technology's potential for creating employment replacement (Guo & Hu, 2022).

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