

Research on Labor Migration and Regional Economic Development from the Perspective of Population Aging

Song Xu

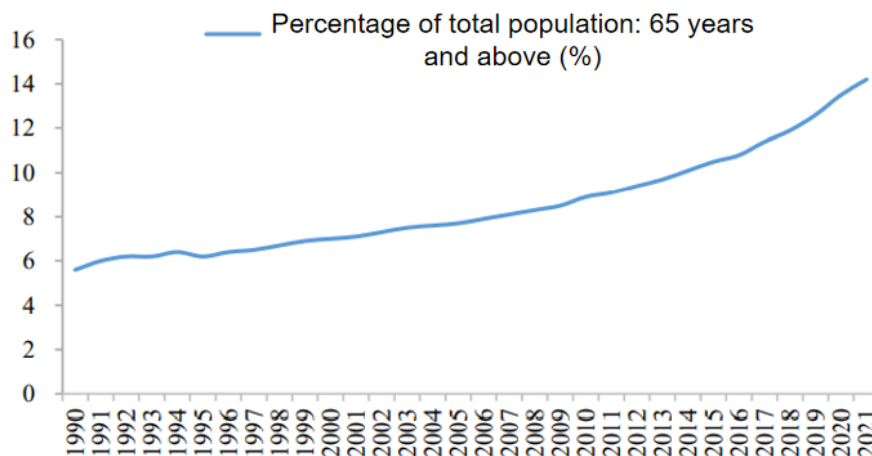
Faculty of Finance, City University of Macau, Macau, 999078, China

Abstract: This paper conducts a comprehensive literature review to explore the dynamics of labor migration and its impact on regional economic development in China with the deepening trend of population aging over the last two decades. Drawing international references in accounting for the population aging related issues, three key policy recommendations are hereby proposed, namely, enhancing the efficiency of the labor market operating mechanism, reinforcing regional labor mobility and collaboration, and fostering the advancement and transformation of the industrial structure. These policy recommendations are intended to more effectively tackle the challenges posed by an aging population and facilitate the harmonious development of labor migration in tandem with the regional economy in a Chinese context.

Keywords: population aging; labor migration; regional economy

1. Introduction

Population aging is one of the world's key challenges, according to the UN's projection, the proportion of the world's population aged 65 and over will rise from 9% to 16% by 2050, which means one in six people will be over 65.^[1] China has undergone a rapid demographic transition in the past few decades (as shown in figure 1). This change not only changes the supply and demand relationship of the labor market but also affects the labor force's migration pattern and the regional economy's development^[2]. Therefore, this paper explores the interaction between labor migration and regional economic development under population aging. Population aging has a significant impact on labor migration and regional economic development. The government and society need to take measures to address these challenges, including adjusting the industrial structure, optimizing the allocation of labor resources, and increasing investment in public services and infrastructure so as to promote the sustainable and healthy development of the regional economy.



(Data source: National Statistical Yearbook, The seventh national population census)

Figure 1: Growth trend of the proportion of people over 65 in China

2. Definition and current situation of population aging

2.1 Definition

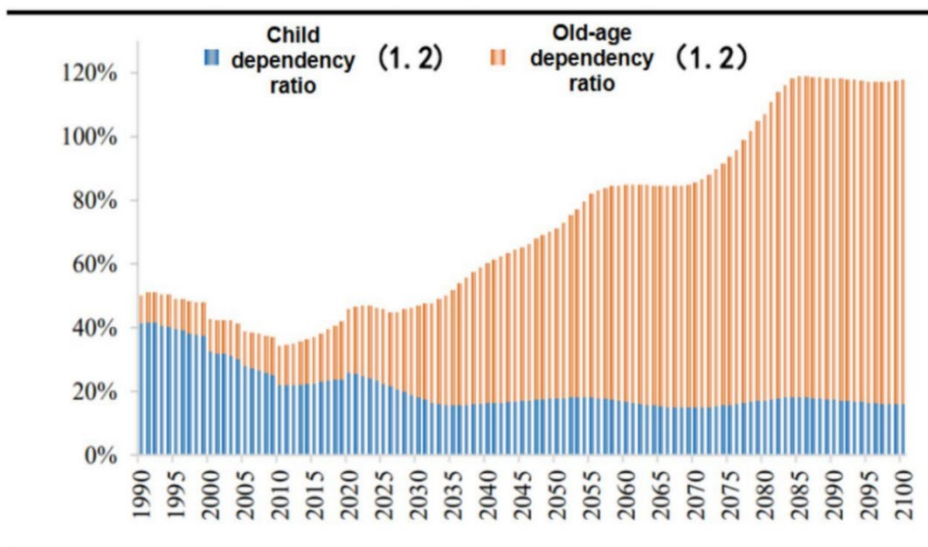
Population aging refers to the gradual increase in the proportion of elderly people (usually 65 years and older) in the total population in a country or region. This process is the result of a combination of factors, including declining fertility rates, longer lifespans, and advances in medical technology. At the macro level, population aging will lead to an increase in fiscal expenditures related to the elderly and a decrease in labor supply, and at the micro level, it usually means an overall decline in the physical function of the population^[3].

2.2 Current situation and characteristics of China's aging population

(1) The elderly population is growing rapidly

In recent years, the number of elderly people in China has rapidly grown. With the progress of medical technology and the improvement of living standards, life expectancy continues to extend, coupled with the impact of the family planning policy, the proportion of the elderly amongst the total population continues to rise. According to statistics, the number of elderly people aged 65 and above in China has reached hundreds of millions, and the number is still growing relatively quickly.^[4]

With the progress of medical technology and the improvement of people's living standards, the average life expectancy of the elderly population in China is also constantly increasing. As a result, the proportion of very old people (80 years old and above) continues to rise, and the aging trend is obvious. The elderly need more medical and nursing services, which puts higher demands on social security and medical services. As the proportion of the elderly population increases, China's old-age dependency ratio is also rising (see figure 2). This means that each workforce member needs to bear more of the burden of old-age care and medical services for the elderly population. This has brought pressure and challenges to the labor market and social security system, which requires the joint efforts of the government and all sectors of society to deal with.



(Data source: National Statistical Yearbook, The seventh national population census)

Figure 2: The elderly dependency ratio upward

(2) Aging comes ahead of schedule

Compared with some developed countries, China's population aging process shows the characteristics of early arrival. This is mainly due to China's transition from a high fertility rate to a low fertility rate in a relatively short period.^[5] Therefore, China's population aging process is more rapid than some developed countries.

(3) Significant regional differences

China's population aging shows obvious regional differences. The eastern coastal areas have a

relatively high population aging degree due to the developed economy and superior medical conditions.^[6] However, the central and western regions have a relatively low aging degree due to the relatively backward economy and limited medical resources. This regional disparity is likely to be further exacerbated in future development^[7].

According to the *World Population Prospects 2022*.^[8] Worldwide, persons aged 65 years or over outnumbered children under the age of five for the first time in 2018. In 2022, there were 771 million people aged 65 years or over globally, 3 times more than in 1980 (258 million). The older population is projected to reach 994 million by 2030 and 1.6 billion by 2050. Relative to proportions, in 2022 approximately 10 percent of people were aged 65 or over (see table 1). The proportion of older persons in the world is projected to reach nearly 12 percent in 2030 and 16 percent in 2050. Europe and Northern America had the largest proportion of older population in 2022, with almost 19 percent aged 65 or over, followed by Australia and New Zealand (16.6 percent). Both regions are continuing to age further. Projections indicate that by 2050 one in every four persons in Europe and Northern America could be aged 65 years or over.

*Table 1: Percentage of population aged 65 years or over for the world
(2022, 2030 and 2050)^[8]*

<i>Region</i>	<i>2022</i>	<i>2030</i>	<i>2050</i>
World	9.7	11.7	16.4
Sub-Saharan Africa	3.0	3.3	4.7
Northern Africa and Western Asia	5.5	7.0	12.5
Central and Southern Asia	6.4	8.1	13.4
Eastern and South-Eastern Asia	12.7	16.3	25.7
Latin America and the Caribbean	9.1	11.5	18.8
Australia/New Zealand	16.6	19.4	23.7
Oceania*	3.9	5.1	8.2
Europe and Northern America	18.7	22.0	26.9
Least developed countries	3.6	4.1	6.1
Landlocked developing countries (LLDC)	3.6	4.1	5.8
Small island developing States (SIDS)	8.9	11.3	16.0

(4) Current policy responses

Policy reform is of great practical significance to solve the problem of an aging population. During the 14th Five-Year Plan, China is pushing forward the reform of its fertility policy to realize independent family reproduction as soon as possible. At the same time, it is also necessary to promote the construction of a supporting public service system, reduce the cost of raising children, form a child-friendly social environment, and improve the willingness of families to give birth and the ability to raise children. According to Xie Yongqing's research, under the background of population aging, the reduction of the labor participation rate affects the individual income tax base, and the rise in labor costs affects the corporate income tax base. In the future, China should enrich tax preferential methods, expand the coverage of tax preferential policies, and implement further tax preferential policies^[9]

3. The relationship between labor migration and regional economic development

According to existing research conclusions, the research on the impact of population aging on the economy can be summarized as follows.

3.1 Labor redistribution and resource optimization

Based on the panel data of provinces, autonomous regions and municipalities from 2005 to 2020, scholar Li Cheng found that by building an econometric model, he empirically studied the relationship between population aging, labor flow and industrial structure upgrading, and drew the following conclusions: (1) Population aging has a significant role in promoting the development of the advanced industrial structure, but it will hinder the rational development of the industrial structure. (2) The effect of labor flow on the upgrading of industrial structure is affected by the degree of aging, which shows a

nonlinear relationship.^[10]

Labor migration promotes the reallocation of human resources in geographical space. When labor moves from one region to another, they bring with them their skills, knowledge, and experience, and these resources are redistributed and utilized in the new region. This reallocation helps to optimize resource allocation and improve overall economic efficiency.^[11]

3.2 Promoting regional economic growth

Labor mobility and migration bring additional labor resources to the destination, which helps to promote local economic development and growth. The new labor force can provide local enterprises with more productivity and innovation capabilities, thus promoting industrial upgrading and economic development.^[12] In addition, labor migration is often accompanied by economic restructuring and transformation. When the labor force is transferred from traditional to emerging industries, they promote upgrading and transforming the industrial structure. This transformation will help to drive the regional economy towards a more efficient and innovative direction. The elderly who leave the labor force continue to contribute through taxes and other forms of income redistribution, helping to maintain public sector expenditures. In addition, the assets accumulated by many elderly people (real estate, financial assets, deposits) contribute to welfare/economic growth, and help to maintain the expenditure pattern, in which a large amount of expenditure comes from income sources, rather than from the transfer of social security and pension plans.^[13]

3.3 Increase market demand and supply

In January 2024, the Chinese government issued the latest policy "Opinions of The General Office of the State Council on Developing a Silver Economy to Improve the well-being of the Elderly", which is China's first "silver economy".^[14] The consumption demand of the elderly has become one of the driving forces of the economy. The migration of labor will increase the market supply and demand of the destination. On the one hand, the new labor force will create more consumer demand and promote the prosperity of the local market. On the other hand, their skills and knowledge can also improve production efficiency and supply quality to meet more market demands.

3.4 Promoting urbanization

Labor migration is also an important driver of urbanization. With the flow of labor from the countryside to the city, the size of the urban population continues to expand, and the level of urbanization continues to improve. This will help promote the construction of urban infrastructure and the improvement of the public service system and further promote the development of the regional economy. At the same time, labor migration also helps to narrow the development gap between regions. When labor forces migrate from economically developed areas to relatively backward areas, they bring advanced production technology and management experience, which helps promote economic development and industrial upgrading in these areas.

Matias Busso used Brazilian data to assess the empirical validity at high urbanization levels of the Harris-Todaro model of rural migration. Matias Busso's research found that in order to transfer the labor force from the agricultural sector to the secondary and tertiary industries with higher productivity, the flow of rural labor force to the city not only did not lead to the contraction of agricultural production but also promoted the transformation of traditional agriculture and the development of modern agriculture. As a result, farmers' incomes have continued to rise and rural poverty has been greatly alleviated, supporting urban development and sustained macroeconomic growth.^[15]

4. The impact of population aging on labor migration and regional economic development

Economist Robert J. Barro has argued that aging will affect the labor supply. Effective labor supply $L=NR(1-U)$ is determined by the number of working-age population N , labor participation rate R , and unemployment rate U . Aging means that the labor force population will become retired population due to the increase of age, withdraw from production activities, and reduce the labor force N . Aging has "exit effect" and "crowding out effect", which makes the elderly population withdraw from the labor market or retire voluntarily, and the young labor force has to increase the time to take care of the elderly population and reduce the labor participation rate.^[16]

In the decades after the reform and opening up, China has experienced the process from massive population growth to negative growth, and from high economic growth to medium and low economic growth, which provides sufficient data for analyzing the impact of population aging on labor migration and regional economic development. According to the research data of the China Population and Development Research Center^[17], from the perspective of the population aging process, the proportion of people aged 65 and above in China reached 7% in 2000, entering the aging society. It reached 14.2% in 2021, entering a moderately aged society, and is expected to enter a severely aged society around 2035. From the perspective of economic growth, 1980 to 2010 was a period of rapid development in China, with an average annual GDP growth rate of 10.1%. Since then, China's economic growth has begun to decline, with the average annual GDP growth rate falling to 6.8% between 2010 and 2020 (as shown in figure 3).

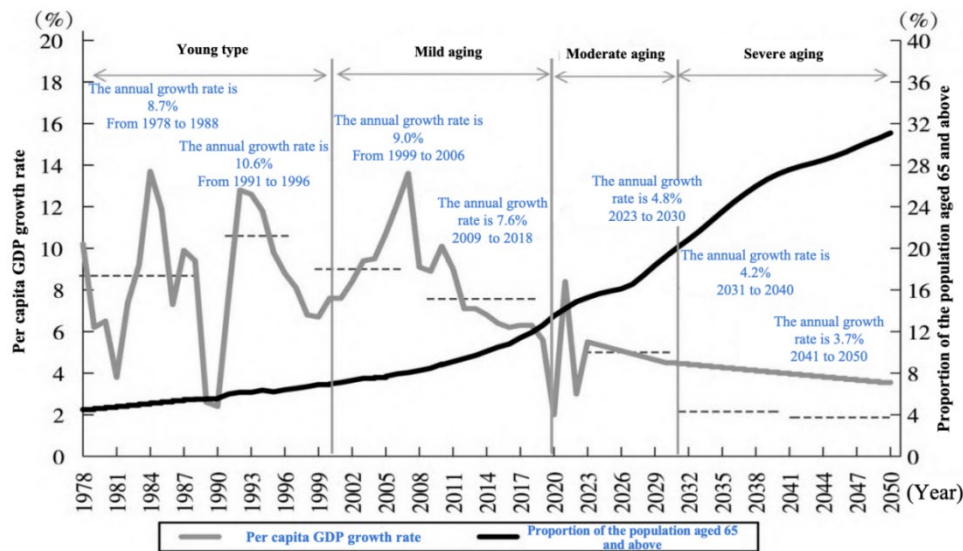


Figure 3: China's aging population and economic growth trends

The effects of population aging on labor migration and regional economic development are as follows:

4.1 Decreased labor supply and raised costs

With the development of an aging population, the supply of labor will gradually decrease. This is because the proportion of the elderly population has increased while the proportion of the young population has declined, resulting in an overall labor shortage. This may prompt companies to seek more efficient production methods, or to import labor from other regions to make up for the shortage of local labor. In addition, with the increase in the elderly population, the social demand for pensions, medical care, and other services will also increase. This can lead to higher labor costs for enterprises, as they need to provide more benefits and security for employees in addition to normal wage expenses. This can have a negative impact on the profitability and competitiveness of the business.

4.2 Changes in labor migration trends

The flow of labor force is a typical phenomenon of population migration. Previous studies have shown that labor force, as an important factor of production, plays a very important positive role in stimulating market vitality and increasing per capita income.^[18] But at the same time, due to the differences in economic development between regions, China's labor flow has the characteristics of regional agglomeration. Large-scale migration of labor from central and western China to the eastern coastal areas; Rural labor force to urban agglomeration; The labor force in the less developed areas is gathering to the regional economic center. For the places where the labor force is relocated, the outflow of labor force is conducive to improving the economic income and production efficiency of the emigrated workers and has a positive effect on increasing the per capita income, but it will also aggravate the aging process of the population in the emigrated places and reduce the pension supply. For the places where the labor force flows in, the influx of labor force will alleviate the aging trend of the local population and inject new vitality into urban development.

On the one hand, the aging of the population may prompt the adjustment of the industrial structure.

Due to insufficient labor supply and rising costs, some labor-intensive industries may face difficulties, while technology-intensive and service industries may get more developmental opportunities. This industrial restructuring will help promote the regional economy to develop more efficiently and innovatively. On the other hand, population aging may also affect the migration trend of the labor force. Due to the shortage of local labor supply, more foreign labor force may be attracted to move in; however, due to the increase in the elderly population, there may be a surplus of labor force in some regions, leading some of the labor force to choose to migrate to other regions in search of better employment opportunities.^[19]

4.3 Uneven regional economic development

Nicole Maestas has found that an aging population will slow economic growth in the United States. The study used changes in the predetermined components of population aging by state to estimate the impact of aging on per capita GDP growth from 1980 to 2010. According to the data, every 10% increase in the proportion of people over 60 years old will reduce GDP per capita by 5.5%. A third of the decline was due to slower job growth; Two-thirds of this is due to a slowdown in labor productivity growth, and a consequent decline in labor compensation and wages.^[19]

Population aging has many impacts on labor migration and regional economic development, the most significant of which is that it may lead to unbalanced regional economic development. First, from the labor migration perspective, an aging population may lead to a decrease in labor supply, especially in rural areas. Due to the increasing proportion of elderly people, the labor force in rural areas may decrease, which may lead to the migration of rural labor to cities or other areas. Such migration will likely exacerbate the urban-rural gap and uneven development between regions. Secondly, from the perspective of regional economic development, population aging may also hurt regional economic development. Due to the increase in the elderly population, the labor force in some regions may shrink, which may lead to lower productivity and economic growth rates in these regions. At the same time, due to the increasing consumer demand and medical needs of the elderly population, the pressure on public services and social welfare in some regions may increase, which may also have a negative impact on the development of local economies. In addition, an aging population may also lead to an "aging trap" in some regions, where economic growth may be hampered or even negatively affected due to the increasing proportion of elderly people. This situation may further aggravate regional economic imbalance.

4.4 Increased demand for public services and infrastructure

Another important impact of an aging population on labor migration and regional economic development is the increased demand for public services and infrastructure. First, as the proportion of the elderly population increases, the demand for public services such as medical care, old-age care and rehabilitation will increase significantly. Especially in rural areas, this increase in demand will be more pronounced due to the relative scarcity of medical and elderly care resources. This requires the government and society to increase investment in public services and improve service quality to meet the needs of the elderly population. Second, infrastructure needs will increase accordingly. For example, in order to facilitate the elderly to travel, it is necessary to improve the transportation facilities; (a) The need to increase medical facilities in order to provide convenient medical services; In order to enrich the spiritual life of the elderly, it is necessary to increase cultural and sports facilities^[20]. All these require the government and society to make a lot of investment in infrastructure construction. However, this increase in investment may exacerbate the uneven development of regional economies. Because some areas may be due to financial resources, geographical location and other reasons, it is difficult to provide adequate public services and infrastructure. This may lead to the migration of the elderly population to other areas, further aggravating the imbalance in regional economic development.

5. Suggestions on labor migration and regional economic development under the perspective of population aging

An aging population is seen as one of the most dangerous economic dilemmas of the coming decades. How to maintain a certain economic growth rate under the condition of population aging, while constantly improving the quality of economic development, has increasingly become a major global issue. This paper puts forward the following suggestions:

5.1 Strengthen labor market monitoring and regulation to promote orderly labor migration

OECD countries are aging earlier. In terms of supplementing the labor force, they mainly introduce immigrants and build a fertility support system to boost the fertility level to supplement the existing and future labor force. There should also be a focus on improving the multi-pillar pension system, establishing a mechanism linking pensions with aging, and reducing the intergenerational burden of pension payment.^[21]

The aging of the population has a remarkable effect on the migration of the labor force and the development of the regional economy. In this context, strengthening the monitoring and regulation of the labour market and promoting the orderly migration of labor is a crucial proposal. The first step is to strengthen labor market monitoring. This can be achieved through the establishment and improvement of the data statistics and monitoring system of the labor market, real-time collection and analysis of the supply and demand of the labor market, wage level, employment structure and other data, based on the collected data, trend analysis and predictions, as well as the timely detection of possible problems and risks in the labor market, to provide a scientific basis for policy formulation. The second is the strategy of regulating the labor market. Through the formulation and implementation of relevant policies to guide the orderly migration of labor forces and optimize the allocation of labor resources. For example, policies to encourage labor mobility could be introduced in areas with aging populations. Another option is establishing a sound labor market information service system to provide workers and enterprises with timely and accurate employment information to help them better plan their careers and choices. Finally, it promotes orderly migration of the labor force. By improving transportation, housing, and other infrastructure, the cost and threshold of labor migration are reduced, and the convenience of labor migration is provided. Moreover, according to the needs of the migrant labor force, it provides relevant vocational skills training and education, improves their employment competitiveness and adaptability, promotes cooperation between different regions, realizes the sharing and optimal allocation of labor resources, and promotes the coordinated development of the regional economy.

5.2 Promote industrial upgrading, transformation and upgrading, and improve the quality and skills of the labor force

In 2018, the European Commission again interpreted the concept of the silver economy as the sum of all economic activities that meet the needs of people aged 50 and over, including the products and services they purchase directly and the further economic activity that results from their consumption. According to a 2018 study conducted by the European Commission on the silver economy (people aged 50 and over), the contribution of the EU silver economy to the GDP in 2025 will reach 6.4 trillion euros and 88 million jobs, equivalent to 32% of the EU GDP and 38% of EU employment; The total cost of ageing in the EU in 2070 will be 26.7% of the EU GDP. The silver economy plays an important role in creating jobs and boosting economic growth.^[22]

The influence of population aging on labor migration and regional economic development cannot be ignored. From the perspective of an aging population, promoting industrial upgrading, transformation and upgrading, and improving the quality and skills of the labor force are important ways to cope with current challenges and promote sustainable development.

On the one hand, it is necessary to promote industrial upgrading, and transformation, where you take the initiative to adjust the industrial structure in response to the aging population and changes in labor supply and develop in the direction of high technology, high added value, low energy consumption, and low emissions. It is also important to increase support for innovative enterprises and scientific research institutions; promote the research and development and application of new technologies, new processes, and new products; lead industrial upgrading; promote the integration and collaboration between different industries; form close cooperation between the upstream and downstream of the industrial chain, and improve the overall competitiveness. At the same time, it is also necessary to, increase investment in education and training, especially in areas with serious aging, and improve the overall quality and skills of the labor force. We will promote the concept of vocational education and lifelong learning to provide diverse learning paths and opportunities for the workforce to adapt to the needs of industrial upgrading. Establishing a perfect skill certification and evaluation system to objectively evaluate the skill level of the labor force and provide references for enterprises is also an important step in the right direction.

On the other hand, it promotes the combination of labor migration and industrial upgrading, and guides labor to migrate to regions with faster industrial development and more employment opportunities through regional balanced development strategies. It would be beneficial to strengthen the construction

of the labor market information service system, provide timely and accurate employment information, and help the labor force better match job opportunities. Finally, policy support and incentive mechanisms are needed. Enterprises engaged in industrial upgrading and labor training are given tax incentives to reduce their costs and improve their enthusiasm, and employment subsidies are given to enterprises that absorb labor in industrial upgrading to encourage them to increase employment.

5.3 Develop the human resources of the aging group

A study by Maestas found that a 10% increase in the share of people aged 60 and over in the United States would lead to a 5.5% decline in the economy, two-thirds of which would be due to a decline in productivity and one-third to a slowdown in the growth of the labor force.^[23] There is an inverted U-shaped relationship between age and labor productivity. With the increase of age, labor productivity tends to decline after reaching its peak. Human capital is the endogenous driving force of economic growth. Population aging mainly affects human capital through labor supply and labor productivity, and then affects economic growth. The rich human resources of the elderly groups in our country enhance the possibility of the development of the aging human resources. The elderly are not marginalized groups, but participants in economic construction and the fruits of sharing. In the important window period of deepening population aging and harvesting longevity dividends, the population opportunities contained in the population age structure are breaking through the traditional set of resource-based and gradually presenting new advantages of capital-based. Encouraging the elderly to choose their own employment, vigorously safeguard intergenerational fairness in the labor market, severely crack down on ageism, respect the needs and rights of the elderly to participate in the labor market, and give full play to the subjective initiative of the elderly in choosing employment will help to promote the positive interaction between labor migration and regional development, and attract the orderly migration of labor by improving the employment environment, housing conditions, and public services in the migration destinations.^[24]

6. Conclusion

This paper discusses the relationship between labor migration and regional economic development under the background of an aging population. It is found that population aging has an important impact on labor migration and regional economic development, and optimizing labor migration is an important way to promote regional economic development. To deal with the problem of labor migration and regional economic development from the perspective of population aging, the government, enterprises and society must make joint efforts and take comprehensive measures to promote the healthy development of labor market and the sustained growth of economy. Future research could further focus on the long-term interaction between an aging population, labor migration, and regional economic development, and explore how to better address these challenges through policy adjustments and innovations in market mechanisms. In regions with a low degree of aging, there is usually a net inflow of labor population. As the labor population becomes increasingly saturated, it is necessary to adjust the industrial structure, provide more job opportunities, prevent the occurrence of unstable factors, and formulate corresponding policies to properly solve practical problems such as the enrollment of children of immigrants and the purchase of real estate, so as to promote regional economic development.

References

- [1] Yang Y, Zheng R, Zhao L. Population aging, health investment and economic growth: Based on a cross-country panel data analysis[J]. *International Journal of Environmental Research and Public Health*, 2021, 18(4): 1801.
- [2] Zhou Jun. Analysis on the impact of population aging on county economy [J]. *Business Manager*, 2019,33(13):15. (in Chinese)
- [3] Cao Jiaoyan. Research on dilemma and Countermeasures of social integration of rural and urban elderly floating population [D]. *Chongqing Technology and Business University*, 2023.
- [4] He Mingjie. A comparative study on the process and prospect of population aging in China and the world [J]. *Scientific Research on Aging*, 2023, 11(12): 36-51.
- [5] Fang Wen. The impact of population aging on the future service of China's economy: A comparative study based on the experience of China and Japan[J]. *Journal of Southwest Jiaotong University (Social Science Edition)*, 2022, 23(2): 24-34. DOI: 10.3969/j.issn.1009-4474.2022.02.003.

- [6] Wu Linguo, Wu Rongwei. *Multi-scale regional difference and dynamic evolution of population aging in China* [J]. *Resources Development & Market*, 2023, 39(3): 328-336.
- [7] Miyake Y. *Labor or Capital Income Tax for Growth in an Aging Society* [J]. *Applied Economics and Finance*, 2020, 7(5): 54-65.
- [8] Information on: https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf
- [9] Xie Yongqing, Li Xiangju. *International experience and inspiration of tax policy to cope with population aging in China* [J]. *Population and Economy*, 2023, (05): 88-97.
- [10] Li Cheng. *The impact of population aging and labor flow on industrial structure upgrading* [J]. *Heilongjiang Science*, 2023, 14(05): 1-5+10.
- [11] Gong Feng, Deng Longzhen. *Population aging, cross-district population flow and county economic growth* [J]. *Journal of Zhongnan University of Economics and Law*, 2022(1): 147-160. (in Chinese) DOI: 10.3969/j.issn.1003-5230.2022.01.013.
- [12] Maestas N, Mullen K J, Powell D. *The effect of population aging on economic growth, the labor force, and productivity* [J]. *American Economic Journal: Macroeconomics*, 2023, 15(2): 306-332.
- [13] Cristea M, Noja G G, Stefea P, et al. *The impact of population aging and public health support on EU labor markets* [J]. *International journal of environmental research and public health*, 2020, 17(4): 1439.
- [14] https://www.gov.cn/zhengce/zhengceku/202401/content_6926088.htm
- [15] Busso M, Chauvin J P, Herrera N. *Rural-urban migration at high urbanization levels* [J]. *Regional Science and Urban Economics*, 2021, 91: 103658.
- [16] Barro R J. *Human capital and growth* [J]. *American economic review*, 2001, 91(2): 12-17.
- [17] Zhang Li, Wang Qinchi. *An aging population, economic growth and development* [J]. *High quality reference in economic research*, 2024, (03) : 73-88.
- [18] Lei Ting, Guo Juan, Xiang Chuan. *The influence of Labor market integration on aging population agglomeration: Based on the test of moderating effect and mediating effect* [J]. *East China economic management*, 2023, 5 (12) : 69-77. The DOI: 10.19629/j.carolcarrollnki.34-1014/f.230106009.
- [19] Maestas N, Mullen K J, Powell D. *The effect of population aging on economic growth, the labor force, and productivity* [J]. *American Economic Journal: Macroeconomics*, 2023, 15(2): 306-332.
- [20] Linda George, Kenneth Ferraro. *Handbook of aging and the social sciences* [M]. *Academic Press*, 2021.
- [21] Yang X, Li N, Mu H, et al. *Study on the long-term and short-term effects of globalization and population aging on ecological footprint in OECD countries* [J]. *Ecological Complexity*, 2021, 47: 100946.
- [22] Leśna-Wierszółowicz E. *Silver economy as a response to demographic changes* [J]. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 2018 (529): 162-169.
- [23] Maestas N, Mullen K J, Powell D. *The Effect of Population Aging on Economic Growth, the Labor Force and Productivity* [R]. *NBER Working Papers*, 2016
- [24] Rudnicka E, Napierała P, Podfigurna A, et al. *The World Health Organization (WHO) approach to healthy ageing* [J]. *Maturitas*, 2020, 139: 6-11.