Economics & Business Management
ISSN Print: 3079-5214
ISSN Online: 3079-5222
https://doi.org/10.63313/EBM.9003

Population Forecast for Anhui Province Based on Multiple Regression Analysis

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How to cite this paper: Han, J. (2025). Population Forecast for Anhui Province Based on Multiple Regression Analysis.Economics & Business Management, 1(1),25-33. ISSN Print: 3079-5214; ISSN Online: 3079-5222.
https://doi.org/10.63313/EBM.9003
Published:2025-03-06

Abstract

In recent years, population issues have become one of the focal points of global attention. With the development of global economic technology and changes in social environments, the continuous changes in aspects such as population structure, quantity, and quality have posed significant challenges to national governments and society. Many countries and regions, especially in terms of population aging, declining birth rates, and peak population issues, are facing major adjustments and development challenges in their population structures. Anhui Province, as one of China's major population provinces, is also encountering problems such as severe declining birth rates, deepening aging, and increased population mobility in its socio-economic development. Particularly, with the continuous development of the economy and the accelerated pace of urbanization, the population issues faced by Anhui Province are exhibiting new characteristics and trends, necessitating a series of effective policy measures to promote the optimization of population structure and the sustainable development of the economy and society. This paper aims to predict the population situation in Anhui Province over the next three years using a multiple regression analysis approach. Specifically, the article will first review the changes and trends in the population of Anhui Province. Then, by collecting a large amount of time series data, it will establish a model using multiple regression analysis to sort, summarize, and quantitatively analyze the various factors affecting population changes in Anhui Province. Additionally, the accuracy and predictive capability of the model will be evaluated, and based on actual conditions, predictions will be made regarding the trends and directions of population changes in Anhui Province over the next three years.

Keywords

Population; Multiple Regression; Anhui

1. Population Situation and Trends in Anhui Province

Anhui Province is one of the most populous provinces in the central region and is also a major agricultural province in the country. According to the data from the seventh national census in 2020, the total population of Anhui Province reached 61.027 million, making it the eighth most populous province in the country. From the perspective of total population, Anhui Province has a relatively large population

size, but due to unbalanced economic and social development, the population distribution pattern also shows corresponding characteristics and trends. The population of Anhui Province has been growing rapidly, but the growth rate has gradually slowed down. According to the results of the seventh census, the population of Anhui Province has exceeded 30.66 million since 1953, with a peak growth rate of 6‰. However, in 2021, the population growth rate in Anhui Province had dropped to 0.05‰, and the most recent census results showed that the population growth rate was only -0.93‰.

With social changes and development, the population structure in Anhui Province has also undergone significant changes. On one hand, the aging problem in Anhui Province has become increasingly prominent. Statistical data shows that the population aged 60 and above accounts for 15.8% of the total population in Anhui Province, and this proportion continues to rise. On the other hand, the issue of low birth rates is also quite serious in Anhui Province. According to official data, the birth rate in Anhui Province has dropped to 7.2‰, which is at a historical low. If effective measures are not taken to address this, it will have adverse effects on the future population quality and overall development of Anhui Province.

The population distribution in Anhui Province shows a clear urban-rural divide. Among the total population, 36.86 million people live in rural areas. However, the urban population is growing rapidly and at a high rate. According to the latest statistics, by the end of 2020, the urbanization rate had reached 58.3%. The ratio of urban to rural population is showing a significant trend of change, which is expected to continue expanding in the coming years. Therefore, the population issues faced by Anhui Province are not only reflected in quantity but also in population structure and spatial distribution patterns. To effectively address these issues, it is necessary to more scientifically and accurately predict the future population trends in Anhui Province, formulate scientific and reasonable population policies, actively promote urban-rural integration, and facilitate the rational adjustment and transformation of the population structure.

2. Analysis of the Factors Influencing the Growth of Permanent Population

Economic factors are one of the important influences on the growth of the permanent population. In modern society, the economy has become the core of national development and is closely related to population growth. The level of economic development and the number of people are influenced by many factors.

Economic factors can affect population mobility and the rate of urbanization.Taking developing countries as an example, economic growth can lead to an increase in people's income, while also accelerating urbanization. As the level of economic development improves, people are more inclined to move to cities to work in industry and services, thus forming a new urban citizenry. Therefore, economic factors are very important for the growth of the resident population, with urbanization rates

and population mobility being significant factors. Economic factors can also influence the formation of marriages and families, which directly affects population growth. In developing countries, as the economy steadily progresses, most families are able to achieve considerable income, and the living standards within households are secured. This enables most families to meet their reproductive needs, thereby promoting population growth. Economic factors can also affect people's educational levels, which indirectly influences population growth. When the economic conditions of a region are poor and the living environment is unfavorable, people generally lack educational opportunities, leading to a slower population growth rate in that area. Conversely, when a region's economic level improves, their educational levels will also increase accordingly, thus promoting population growth. Economic factors can also influence government population policies, such as family planning and pro-natalist policies. With the rapid acceleration of economic development, this has also driven the formulation of government population policies. For example, in recent years, many countries have adjusted their family planning policies, and this adjustment is closely linked to the development of economic levels.Therefore, using Stata software for multiple regression analysis, the following relationships were obtained, as shown in Table 1:

hpopulation=-8.325*year+0.017*gdp+ 158.366*natural+ 22238.000

hpopulation= 42.559*year+30.529*tertiary+156.897*natural-8.01e+04

Among them, hpopulation represents the total population of Anhui Province, tertiary represents the driving rate of the tertiary industry in Anhui Province, and natural represents the natural population growth rate of Anhui Province.

Table 1.Influencing factors of the growth of permanent residents

	(1) hpopulation	(2) hpopulation
year	-8.325	42.559**
	(46.020)	(7.476)
gdp	0.017	
	(0.021)	
natural	158.366**	156.897**
	(15.939)	(11.300)
tertiary		30.529*
		(13.145)
_cons	22238.000	-8.01e+04**
	(92141.066)	(15168.573)
N	18	17
F	59.388	70.222
R2	0.927	0.942
Adj. R2	0.91	0.93

* Significant at the 0.05 level; ** Significant at the 0.01 level

In summary, economic factors are crucial for the growth of the resident population. The improvement of economic levels can increase people's income and quality of life,

encourage marriage and family formation, and enhance education levels, all of which can promote the growth of the resident population. Of course, while economic factors are one of the important influences on resident population growth, they are not the only factors. A comprehensive consideration of various perspectives and factors is necessary to develop a reasonable population growth plan and policy.

3. Forecasting Plan Setting

This article calculates the natural population growth rate of Anhui Province from 2022 to 2025 based on historical data published by the Anhui Provincial Bureau of Statistics, with specific data shown in Table 2. Therefore, when predicting future population, the total fertility rate indicators for 2022-2025 will use the existing calculated results.

Table 2. The natural population growth rate of Anhui Province from 2022 to 2025

Year	2022	2023	2024	2025
Natural population growth rate	-0.93	-0.84	-0.79	-0.73

3.1. Program Setting

Calculate the average value and trend of the three industrial driving rates and the natural population growth rate in Anhui Province over the years. Based on historical data, establish a relationship model between the three industrial driving rates, the natural population growth rate, and population changes, using methods such as regression analysis for modeling. Utilize the established relationship model to predict future three industrial driving rates and natural population growth rates, and subsequently infer future population changes in Anhui Province. Compare and analyze the predicted results with actual situations, continuously refining and adjusting the prediction model to improve accuracy.

3.2. Birth Sex Ratio

The birth sex ratio in Anhui Province refers to the ratio of male to female infants born in the province. Generally, under normal circumstances, the ratio of male to female infants should be close to 1:1. However, in reality, due to certain influencing factors, the birth sex ratio may deviate. According to data released by the Anhui Provincial Bureau of Statistics, the birth sex ratio in Anhui Province in 2021 was 111.07. This figure is higher than the normal range set by the World Health Organization (WHO) (100-106) and also exceeds the normal range established by the National Health and Family Planning Commission (104-107).

Observing the trend in the sex ratio of newborns in Anhui Province, it can be seen that in recent years, the sex ratio of newborns has shown an upward trend, with the highest peak occurring in 2012, reaching 121.76. After that, it continued to decline

until 2016, when it slightly rebounded. This trend indicates that although the sex ratio of newborns in Anhui Province has decreased, it still leans towards males overall, especially in rural areas. There are many reasons for the skewed sex ratio of newborns in Anhui Province, mainly including the following aspects:

(1)Social and cultural factors. In traditional rural culture, sons are considered an important means of continuing the family line, so families prefer to have boys.

(2)Economic factors. Some families believe that having sons can increase household income and provide support for their retirement, thus they are more inclined to give birth to boys.

(3)Birth policies. Although China's two-child policy has been implemented, there are still differences in birth regulations and family assistance policies, which may affect family reproductive decisions.

(4)Technological conditions. Modern technology allows for early knowledge of the fetus's sex, providing some families with the opportunity to make choices. However, the misuse of technology leading to sex selection is an important reason for the imbalance in the sex ratio of newborns.

In summary, the deviation in the sex ratio of newborns in Anhui Province still needs to be taken seriously. A series of measures should be implemented to strengthen the enforcement and supervision of laws and regulations, improve the quality and awareness of family fertility concepts, and enhance publicity and education to promote the idea of gender equality among children, in order to achieve a balance in the male-to-female ratio as soon as possible.

3.3.Average Life Expectancy

In 2020, the average actual life expectancy of the deceased population in Anhui Province was 74.05 years, with males having a life expectancy of 71.98 years and females 76.84 years. Approximately 10% of the male population died before the age of 52.1, while about 10% of the female population died before the age of 57.6. The median life expectancy for deceased males in Anhui Province was 76.2 years, and for females, it was 81.3 years, both of which are significantly higher than the actual average life expectancy and are close to the expected life expectancy.

Table 3. Parameter values of life expectancy by sex in Anhui Province (unit: year)

Year	Male	Female
2015	73.85	79.04
2020	74.75	79.94
2025	75.25	80.44

4. Population Forecast Results and Analysis

By the end of 2022, the permanent resident population of the province was 61.27 million, an increase of 140,000 from 2021, representing a growth of 0.23%. Compared to the 61.03 million recorded in the seventh national population census of

Anhui Province in 2020, there was a total increase of 240,000, with an average annual increase of 120,000 and an average annual growth rate of 0.2%. Based on the parameters set above, software was run to predict the population of Anhui Province. According to the statistical data forecast, under this scenario, the permanent resident population of Anhui Province is expected to reach 61.70 million by 2025. In terms of the aging rate of the permanent resident population, there are 12.16 million people aged 60 and above, accounting for 19.85% of the total population, of which 9.68 million are aged 65 and above, accounting for 15.80% of the total population.

During the "14th Five-Year Plan" period, the trend of worsening aging issues in Anhui Province will be difficult to reverse; however, attracting a large influx of young people has a significant effect on alleviating population aging. Additionally, since the scenario is set for a complete relaxation of fertility policies and a noticeable increase in fertility willingness, population growth is more pronounced.

5. Conclusion and Recommendations

With the development of technology and improvements in medical standards, the issue of population aging in the country is becoming increasingly prominent. At the same time, due to various reasons, the birth rate in our country is also declining year by year. This situation will bring many adverse effects on the country's development; therefore, relevant departments need to take a series of measures to improve this situation. Here are some suggestions:

5.1.Establish a comprehensive social security system.

Elderly people play an important role in society, and their passing can bring significant pressure to families and society. Therefore, establishing a comprehensive social security system is an important way to alleviate the pressure on the elderly. The government can make the lives of the elderly more secure and comfortable by increasing pensions, subsidizing health insurance, and providing free public transportation, among other measures. At the same time, for young people, it is also necessary to establish various social insurance systems and housing security policies to address the difficulties they face in family and social life.

5.2. Increasing the Birth Rate

The birth rate in our country has been at a low level, which has a significant negative impact on population development. In response to this issue, we suggest that the government implement a series of measures, such as expanding the applicability of the two-child policy, improving family support policies, and providing more comprehensive maternal and child health services. Additionally, there should be increased policy support for small and medium-sized enterprises regarding maternity leave and childbirth, allowing more young people to feel secure in having children.

5.3. Promoting the Influx of Labor

Although our country has a large population, the issues of labor shortages are becoming increasingly prominent against the backdrop of an aging population and low birth rates. Therefore, the government can actively attract high-quality labor, especially skilled talent, to seek greater development opportunities in our country. At the same time, strengthening education and training efforts to improve the overall education level of the population will enhance the comprehensive quality of society. This will help expand the labor market and meet the economic and social needs of the country.

5.4. Advocating a Healthy Lifestyle

Advocating a healthy lifestyle is an important way to alleviate the issues of aging. By implementing health education, providing convenient health screenings, and encouraging regular exercise, we can enhance the public's health awareness and self-care abilities, thereby protecting people's physical health. At the same time, maintaining a healthy lifestyle can slow down the physiological aging process, contributing to increased lifespan and quality of life. In summary, the issues of population aging and low birth rates have become challenges that society as a whole must face. It requires collaboration among the government, businesses, and individuals to take effective measures to address these issues. The suggestions mentioned above are just preliminary discussions; in the future, we need to conduct further in-depth research and adopt more practical measures to continuously inject vitality into the healthy development of our society.

Policy factors are one of the most important influences on population growth, specifically including national-level population policies, urban-level urbanization policies, and social security policies. These policies affect people's decisions regarding childbirth, migration, and education, thereby having a significant impact on the growth of population size. National-level population policies are one of the most direct and important factors influencing population growth. When population growth is too rapid, the government implements family planning policies to limit the fertility rate of couples in order to control population growth. Under family planning policies, the growth rate of the population size is significantly reduced, thus alleviating the population burden on the country. Additionally, urbanization policies are also one of the most significant policy factors affecting population growth. During the urbanization process, people continuously migrate from rural areas to cities. The implementation of urbanization policies elevates cities from simple living and public facilities to more complex demands such as employment, education, and income, thereby attracting more people to move to cities and promoting the growth of urban population size.

In addition, social security policies also have a significant impact on population growth. After reaching old age, people need pensions, health insurance, and other social welfare to supplement their income, which causes the elderly population, under the combination of social status and family planning policies, to gradually lose

the foundation for caring for their descendants. As a result, the number of children people have after giving birth also decreases. In summary, policy factors are one of the most direct and important influences on population growth. National population policies, urbanization policies, and social security policies will all have a continuous and significant impact on the growth of the population, either directly or indirectly. As these policies continue to improve and optimize, the growth of the population will also maintain a more reasonable and stable state.

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