

The Impact of Natural Population Growth Rate and per Capita GDP on Life Expectancy in China

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Keywords: Life Expectancy, Natural Population Growth Rate, Capital GDP.

Abstract: With the development of modern society, the quality of people's lives has become better and people pay more attention to life quality. Food and clothing are no longer the most concerning issue for people, while how to live longer and healthier has become a heated discussion. The main factors that impact life expectancy is one of the key research topics today. After searching for relevant information, the research finds two variables that may affect life expectancy. So the research topic of the article is the relationship between the population growth rate, per capita GDP, and life expectancy. The research method of this article is as follows. First, the data of natural growth rate, per capita GDP, and life expectancy in China from CEL data. Then, adopting a suitable model of the variables and doing the tests to check the degree of fit. Finally, performing regression analysis on data and getting the result to conclude. The research finds that the natural population growth hurts life expectancy and the per capita GDP has a positive impact on life expectancy in China. The article also provides an in-depth analysis of the reasons for this result. To increase life expectancy, people need to solve the problem of retirement and strengthen infrastructure construction to help solve the health problem with the help of the government and the family.

1 INTRODUCTION

In recent years, China's national strength is steadily increasing and people have lived a happy life. With the rapid development of the Chinese economy, pursuing health and longevity has become the most beautiful vision in the heart of the people of the whole country (Guo 2022). To realize this vision, scientists are searching main factors that may affect life expectancy. According to Wang Xiaolei, the GDP has a critical impact on life expectancy (Wang GAFLT). With the growth of the economy, people can learn more about ways to stay healthy, and medical security can become more comprehensive which is beneficial for people's longevity. So per capita GDP is the main factor that can not be ignored. In recent years, the natural growth rate in China has been low making the population structure tend toward aging (Li GAFHBU).

At the same time, with the increase in the elderly population, retirement has become a major societal issue in recent years (Wu CSHE). The age structure causes young people can not take good care of the

elderly because they also have the pressure to take care of the children. Meanwhile, the lack of caregivers in nursing homes can also lead to issues with elderly care. Based on these facts, the research uses the natural growth rate as an independent variable to find the relationship between it and life expectancy in China. However, the deep reasons why these two variables affect life expectancy need further discussion. The research is based on the data from CEI data to analyze the impact of natural growth rate and per capita GDP in China and attempt to place hot issues under the test of objective data. The research will summarize the data from 2014 to 2021. Using natural growth rate and per capita GDP as the independent variables and using life expectancy as a dependent variable. Then applying the data to calculate the regression model and used the result to analyse the fitting degree. Finally deriving the relationship between the three variables and using relevant data to analyze the deep reasons.

2 METHOD

2.1 Data Description

This study mainly explores the relationship between life expectancy, natural population growth rate, and per capita GDP in China from 2014 to 2021. The data set is sourced from CEI data. The database provides a reliable function for our study because it is controlled by the government of China. Employing sample data aims to find the relationship between life expectancy and two explanatory factors and whether the natural population growth rate and per capita GDP in China influence life expectancy.

2.2 Data Analyze

To find the relationship, a regression model is used:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + u_i \quad (1)$$

Here, X_1 and X_2 serve as the independent variable, Y serve as the dependent variable, β_1 , and β_2 denote the regression coefficient and u_i serves as the error term. Y is life expectancy in China, X_1 is the natural population growth rate in China, and X_2 is the per capita GDP in China.

Input data into the computer and use Excel to get the regression.

Table 1: Regression coefficients.

	Coefficients	Standard error
Intercept	74.9515232	1.03475241
X Variable 1	-0.1247191	0.06489231
X Variable 2	0.04078889	0.01256032

Table 2: Regression statistics.

Regression Statistics	
Multiple R	0.98670885
R Square	0.97359436
Adjusted R Square	0.96303211
Standard error	0.14837689

As shown in Table 1, the regression is

$$Y = 74.95 - 0.12X_1 + 0.04X_2 \quad (2)$$

The same as

$$\text{Life expectancy} = 7495 - 0.12 * \text{Natural population growth rate} + 0.04 * \text{Per capita GDP} \quad (3)$$

According to Table 2, the R Square is 0.97, the Adjusted R square is 0.96 the standard error is 0.15. It indicates that the linear correlation between variables is very close, and the fitting validity of the regression equation is high.

Table 3: Hypothesis test.

	t Stat	P-value
Intercept	72.4342578291421	9.49942522182486E-09
X Variable 1	-1.92193942921116	0.112648212569879
X Variable 2	3.24744069216676	0.0227604296678813

Then, doing the hypothesis test. There is a close relationship between natural growth rate and life expectancy. So proposing verifiable hypotheses. The null hypothesis (H_0) is $\beta_1 = 0$, and the alternative hypothesis (H_1) is $\beta_1 \neq 0$. Table 3 shows that the t-statistics are high while corresponding p-values are small. So rejecting H_0 and get the conclusion that there is high confidence that there

is a strong correlation between the natural population growth rate and life expectancy in China. Then doing the hypothesis test of β_2 , it can also have the same result. As a result, the regression model concludes that the three variables in the regression model are significant and two factors of natural growth rate and per capita GDP have a significant linear influence on life expectancy.

At the same time, using Excel to get VIF to exclude the problem of multicollinearity. The VIF between X1 and X2 is 0.52 which is less than 5. It means that the complex collinearity between X1

and X2 is relatively light. So there is no multicollinearity problem between natural growth rate and per capita GDP in China. The equation fitting effect is good.

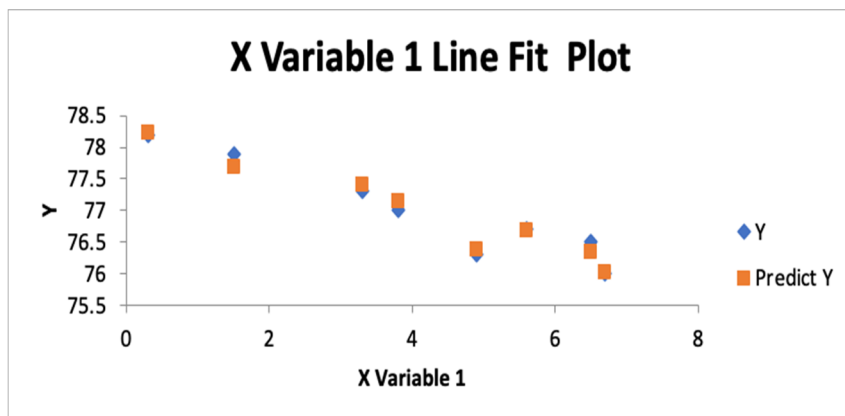


Figure 1: The changes of Y and predict Y with the change of X1 (Picture credit: Original)

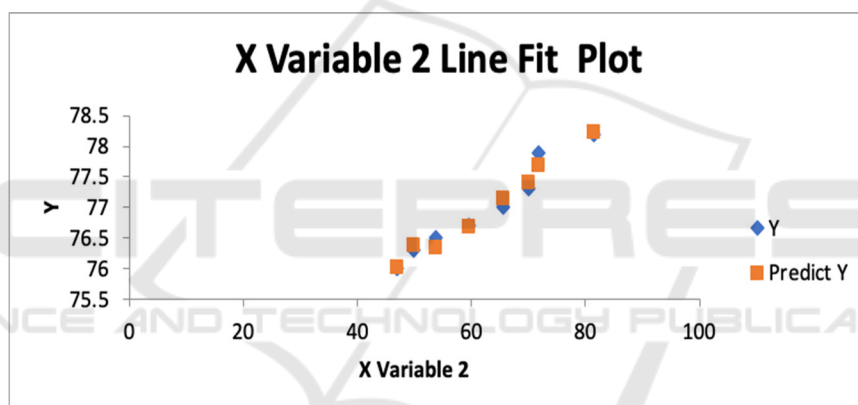


Figure 2: The changes of Y and predict Y with the change of X2 (Picture credit: Original)

Figure 1 and Figure 2 show that the changes of the dependent variable Y with the changes of the independent variables X1 and X2. The Figure 1 and Figure 2 made by the computer show the predicted Y is almost identical to the actual Y. It means that the model fits very well and the results are faithful. So the research can draw a conclusion according to the regression model.

3 RESULT AND DISCUSSION

This research investigate two factors that may affect life expectancy in China, including natural growth rate and per capita GDP. Using the two explanatory variables of natural growth rate and per capita GDP to research the relationship with the dependent variable of life expectancy.

The impact of natural population growth on life expectancy. The tables above show that there is a negative correlation between natural population growth rate and life expectancy. It means that if the natural population growth rate is higher, then the life expectancy is lower. The natural growth rate is an important factor affecting population structure. To reduce the degree of population ageing, the Chinese government is gradually lifting birth restrictions (Guo et al 2019).

With the higher natural growth rate, the age structure tends to be younger. However, the main part supporting the elderly is still the family, so as the pace of age changes, middle-aged people need to spend more time with children (Gao 2002). As a result, the time spent taking care of the elderly will be reduced and many middle-aged people no longer choose to live with the elderly which means that old people will receive less care. Meanwhile, more children mean more household

expenses, so many middle-aged people have to migrate. Once there are any health issues with the elderly, they will not be able to arrive the first time. Therefore, the natural population growth rate harms life expectancy.

The impact of per capita GDP on life expectancy. The tables above show a positive correlation between per capita GDP and life expectancy. It means that if the per capita GDP is higher, the life expectancy is higher. The per capita GDP is an important indicator for measuring a country's economic level. With a higher level of economic development, the pension benefits are better (Yang and Chang 2021). It means that more elder people can be taken good care of and more difficult and miscellaneous problems can be solved. Meanwhile, the high economic level means that pregnant women can have better care and babies can have a higher survival rate (Zhu and Liang). At the same time, a more complete social system can improve the overall quality of people which can increase life expectancy (Wang and Zhu 2014). People can arrange their daily lives more scientifically and have a healthier diet.

From another perspective, the per capita GDP is high means that there is more investment in medical security (Wang 2021). And the medical security system can save more lives. For example, pregnant women can determine the health status of their fetus through tests and advanced medical technology can ensure the safety of pregnant women and children's lives. At the same time, more people can afford medical examinations which can assist patients in knowing their condition in advance and receiving treatment. Meanwhile, people also have enough money to receive treatment. These can effectively reduce the mortality rate and thus increase the life expectancy.

4 CONCLUSION

The research finds a negative correlation between the natural growth rate and life expectancy in China and the per capita GDP has a positive effect on life expectancy in China.

The research evaluates the objective factors that affect life expectancy in China based on data analysis. To extend life expectancy, the research suggests people improve the pension system to avoid that the elderly can not be taken good care of due to the pressure of taking care of children. At the same time, with the rapid growth of the economy, medical security is getting better and

many complicated diseases can be treated. Though the government can take action to take care of the elderly with the improvement of the economy, the family is still the main part of supporting the elderly.

So the article also suggests people spend more time with the elderly which is not only aimed at caring about their physical health, but also good for their mental health. This research is aimed at finding the main factors that affect life expectancy. The research can help scientists find ways to achieve the vision of pursuing health and longevity. There are still some missing variables in the study. In future research, further refinement can be made in the operationalization of the aforementioned variables to facilitate in-depth research on this topic. With the development of economic and the help of the government and the family, people can live longer and healthier in the future.

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