

Research on Influencing Factors of Natural Population Growth in China

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Abstract: The population of China has become an inevitable topic among current international competitions. It currently has the largest population compared to other countries. As of November 2020, China's population stood at 1.412 billion. But, meanwhile, China's population growth rate is only 0.59%, ranking 159th in the world. This kind of large population base and slow growth rate is worthy of our analysis. The economics factors may have a significant impact on the population growth. We will study the effect on influencing factors of population growth through quantitative analysis and as well predict the future population growth trend of China.

1. Introduction

Throughout history, China's population growth has been divided roughly four stages by the Chinese Government Statistics Bureau [1]. The first stage was from 1949 to 1957, when the population grew rapidly, the birth rate remained high, the death rate fell. The second stage was from 1957 to 1961, when the birth rate dropped sharply, the death rate rose sharply, and the population experienced negative growth. The third stage was from 1961 to 1970, when the population grew rapidly again, the birth rate rose sharply, and the death rate declined steadily. The fourth stage is from 1970 to the present, when the population has grown at a low speed, the birth rate and death rate have stabilized at a relatively low level, and the population has shown a slow growth trend. It can be seen from the four stages of China's demographic transition that, except for the special circumstances of famine from 1958 to 1961, the fluctuation of the birth rate is the direct factor leading to the demographic change. The changes in the birth rate are affected by economic development and social progress, as well as by the family planning policy. The birth rate remained high before the 1970s but dropped rapidly after the implementation of the family planning policy. The two small growth peaks after the 1980s were the lagging effects of the high birth rate in the 1960s.

In 2011, China gradually liberalized its family planning policy. However, the population growth of China did not grow as the policy relaxed. On the contrary, the annual change of population in China declined from 0.5% to 0.3% in 2020 [2].

In 2020, China conducted its seventh census. The census this time is a major basic national survey of China at the key node of the new journey of building a moderately prosperous society and building a modern socialist country. It has important and long-term significance for accurately grasping the new characteristics and new trends of population development. The results obtained can be roughly summed up as follows. The total population has shown an inertial growth, while the population growth rate has slowed down. So, we can tell from the result that the factors of population change are not limited to the policies or medical and health. There is also an essential factor that could affect population growth significantly, which is economics factor.

Take the example of Indonesia, which is currently the world's fourth most populous country after China, India and the United States. According to the statistics of the United Nations, the population of

Indonesia reached approximately 196 million in 1992 and maintained a growth rate of 1.7%. Indonesia's rapid population growth has its cultural and economic reasons [3].

Since the 1970s, the Suharto government had implemented the "Family Planning" and "Immigration Project". These two measures were aimed at reducing the birth rate of the population and solving the problem of excessive concentration of the Indonesian population on some major islands such as Java. Obviously, this government policy had achieved certain results. The birth rate in Indonesia had dropped from 56.1% in 1967 to 28.5% in 1994. At the same time, due to the continuous improvement of medical standards, the high infant mortality rate had changed, which made Indonesia's population growth still maintain a certain level.

Regardless of the negative effects of policies on population growth, the economy directly or indirectly promotes population growth. For example, the low education level of Indonesian women brought about by economic backwardness is an important reason for the high fertility rate in Indonesia. According to a 1994 survey report, the illiteracy rate among Indonesian women is about 21%, while that of women with a secondary education or above is only 24%. In this regard, the backward concept of "hoping to have more children" still exists among a considerable number of women. Indonesian women still believe that the ideal child is at least three, which leads to disadvantages in the implementation of contraceptive measures. Although many women know how to take contraceptive measures, only 55% of them are implemented. At the same time, the low level of culture also makes women have few opportunities to engage in high-level occupations. This not only means that women have more leisure time, but also lowers the cost for women to have children. It also allows a family to have more children in terms of time and money. We attribute it to the impact of resident consumption level on demographic changes.

We can also analyze the example of Japan, which has also had four stages of population change, like China. The four stages of population change can be attributed to four stages of economic status. Inoki [4] divided them into the recovery period of the national economy (1946~1955), the period of rapid growth (1956~1973), the period of low growth (1973~1990) and the period of stagnation (after 1990). The first stage was from 1946 to 1955. During the recovery period of the national economy, both the population growth rate and the economic growth rate showed a high trend. In 1946, the gross national product was only 65% of the pre-war level, and the industry and mining industry was only 28% of the pre-war level [5]. In 1955, the real GDP increased by 1.16 times, with an average annual real growth rate of 8.9%, industrial and mining production increased by 4.5 times, with an average annual growth rate of 18.2% [6]. Correspondingly, from 1946 to 1949, the birth rate was as high as 33% to 34.3%, and the number of births was between 2.68 and 2.7 million. From 1950 to 1955, the birth rate fell below 30%, the population growth rate was between 11.1% and 17.5%, and the number of births in 1955 had dropped to 1.78 million. It is still the fastest growing period after the war.

The second stage was from 1956 to 1973, a period of rapid national economic growth, when the population growth rate was first low and then high. Since 1955, the Japanese economy has entered a period of rapid growth for nearly 20 years. From 1956 to 1968, the average annual real growth rate of GNP was 10.1%. From 1969 to 1973, although the growth momentum slowed down, it was still as high as 9.4%. The consumption level of urban and rural households has been greatly improved. The Engel coefficient of urban residents has dropped to 30%, and that of rural residents has dropped to 26% [6]. And, during the period from 1971 to 1973, the population growth rate and growth amount were close to the highest post-war levels, and the annual increase in the number was between 1.04 and 2.45 million.

The third stage was from 1973 to 1990, when the economic growth rate slowed down significantly but the population growth rate continued to decline. In 1987, the GDP reached US\$2.3856 billion, equivalent to 53% of that of the United States, and the per capita GDP was US\$19,642, surpassing the United States for the first time in history. In the international competitiveness rankings, it has ranked first for eight consecutive years.

The latest stage is from 1990 to present. Since the fourth quarter of 1997, the Japanese economy has fallen into the worst recession since the war. The unemployment rate exceeded 4% in 1998 and

was close to 5% in 2000. The nominal GDP growth rate has declined for four consecutive years. During this period, the absolute and relative amounts of population growth showed a downward trend. The total population increased from 114.15 million in 1977 to 123.54 million in 1990, an increase of 9.39 million in 13 years. From 1990 to 2000, the total population increased by only 3.38 million. Among them, from 1994 to 2000, the total population increased by only 1.65 million, with an average annual increase of 276,000, with an average annual growth rate between 1.58 ‰ and 2.54 ‰ [7].

We can tell that every economic change in Japan is accompanied by a change in population, especially for the last stage. With the worst recession, Japan also met its lowest population growth. Since Japan's population is not affected by national policies, we can see the direct impact of economic parameters on population better. So, we can also attribute it to the negative impact of national income and GDP per capita on demographic changes.

Back to China, we find that in many cases it is similar. China in the first stage can be said to be Indonesia with insufficient education, because the rapid population growth was caused by people's unconsciousness. The effects of natural disasters in the second stage on population changes will not appear in our essay for this time. After the disaster, the rapid population growth is like Japan in the period of rapid economic development. Along with the rapid economic development, the population has also grown rapidly, but it is not like the explosive growth of the first stage, but a gradually decreasing growth rate. Due to the increase in GDP per capita, the increase in national income, and the changes in the Consumer Price Index, there are corresponding reactions in the population. In our essay, we will use quantitative analysis to figure out the significance of these three effects on the population and determine whether their impact on the population is positively correlated or negatively.

2. Literature Review

2.1 Population Size

The world experienced an unprecedented increase in its population size. As Gu [8] said, during the 20th century alone, the population in the world has grown from 1.65 billion to 6 billion. In 1970, there were roughly half as many people in the world as there are now. For several centuries, China has been the world's most populous country.

While from an ecological point of view, the increase in population size could be considered a success, only a thriving ecosystem can generate and sustain a large species. Many development practitioners are concerned about environmental, socio-political, and economic challenges associated with the large and rapid population expansions of our time. Thus, before that, a natural question to ask is as follows: what has caused the demographic growth in a country, like China?

The factors affecting natural population growth include both policy factors such as the implementation of the family planning policy and non-policy factors such as economic factors, cultural factors, and medical and health factors. Traditional fertility research focuses on the influence of these factors on fertility. For example, the fertility influencing factor model proposed by Bongaarts and Potter [9] is such a classic fertility model. It is used to study how the marriage rate, contraceptive rate, induced abortion rate, and infertility rate inhibit human natural fertility and achieve the actual fertility rate.

2.2 Economic Factors

On the other hand, economic factors, which are non-policy factors, play a major role in natural population growth in that it determines the population's value-added conditions and living conditions, and affects the population's natural growth rate by changing the population's birth rate and death rate. Therefore, we explore empirically three answers to the above question in this study, namely, that the population growth was caused by growth in countries' national income, GDP per capita and household price consumption index.

To date, few studies have explored the impact of unconfined income on fertility. Lee [10] reviewed the evidence of the wage-fertility relationship in pre-industrial economies, and argued that in these economies, compared with developed countries, wage changes are unlikely to be confused with

institutional and technological progress. He reported on the positive income elasticity of fertility rates in most countries. Black et al. [11] analyzed a homogeneous sample of American women in the mid-1970s and found that the fertility rate was positively correlated with the husband's income. These findings are consistent with the fact that children are "normal goods". Our calculations of the positive impact of national income growth on fertility support this view.

In terms of consumer price index, the Xu Anqi Research Institute [12] of the Shanghai Academy of Social Sciences calculated the cost of raising children to 30 years old in Xuhui District of Shanghai at 490,000 yuan based on 2003 prices. As soon as the news was released, it caused widespread concern in the society. Although there is a lot of controversy over this data, it is an indisputable fact that the cost of raising children in China has increased exponentially. With the development of society, the cost of childbirth, parenting, and education has become a large expenditure. For the quality of life and learning environment of the child, parents will choose high-quality products and schools. Therefore, these costs are growing rapidly, occupying families. Significant ratio of expenditures. Considering the cost of raising children, many families are forced to have late pregnancy. Even with the implementation of the second-child policy, many families will choose to raise one child only. The increasing cost of support has led to the relaxation of the childbirth policy and failed to take effect, which is one of the main reasons for the continuing decline in the birth rate in China. Therefore, in our article, the consumer price index is used as the second factor affecting China's population growth.

GDP per capita has a great impact on population, and even GDP can be used to measure population. Ivan [13] connects GDP and population and concluded that the population recovery method based on GDP potentially is of a higher accuracy than routine censuses. Markus and Hannes [14] used the instrumental variable (IV) method to construct a country-specific oil price shock variable as the change in the log of the international oil price weighted with countries' sample average net-export shares of oil in GDP. It is found that countries' GDP per capita growth, as instrumented by the oil price variable, has significant positive effects on countries' population growth. Quantitatively, the estimated effects are sizeable. Dawei [15] also used regression analysis and grey forecasting to analyze the correlation of China's population influencing factors and concluded that population is highly correlated with several influencing factors such as GDP and grain output.

2.3 Analyze

In our article, we established a multiple linear regression model to specifically analyze the three factors that lead to China's population growth, national income, per capita GDP, and consumer price index, and then analyze the national population growth law and predict China's future population growth trend.

3. Quantitative Analysis

To study the impact of natural population growth in China comprehensively, to analyze the national population growth pattern and to predict the future population growth trend in China, we establish a multiple linear regression model. In the model, the response variable is the national population growth. Explanatory variables include national income (x_1) and GDP per capita (x_2) which reflect the overall economic growth and consumer price index (x_3) which reflects resident consumption level. We select the time series data from 1990 to 2020 in China to analyze, the data comes from "National Bureau of Statistics of China".

First, we can use EViews to draw a scatter plot to initially observe the relationship between variables. The scatter chart is showed below:

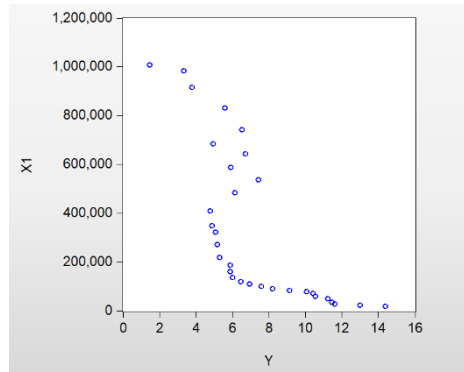


Fig. 1. Scatter plot between explanatory variable (x_1) and the response variable

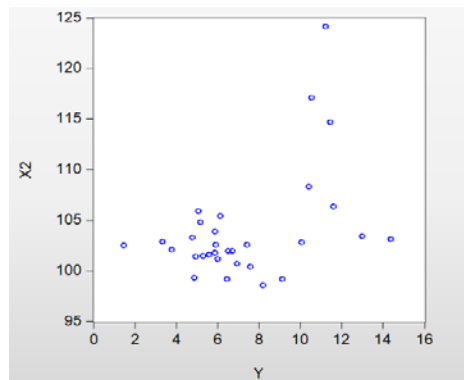


Fig. 2. Scatter plot between explanatory variable (x_2) and the response variable

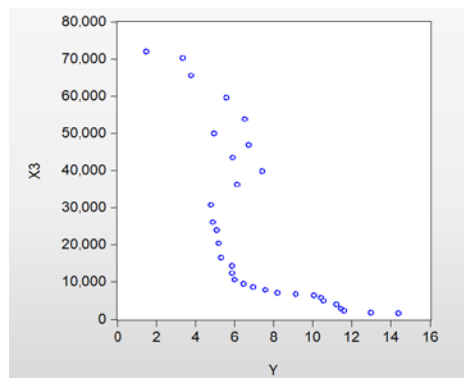


Fig. 3. Scatter plot between explanatory variable (x_3) and the response variable ...

Then, based on experience and preliminary analysis of the data, we consider that x_1 , x_2 and x_3 show a linear relationship. So, we establish a multiple regression model as follow:

$$y_i = C + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \varepsilon_i$$

Using the model to assess, the corresponding regression results can be obtained as follows:

Table 1. Multiple Linear Regression Results (EViews Output)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.515075	7.007877	-0.073499	0.9420
X1	0.000137	5.62E-05	2.436204	0.0217
X2	0.113283	0.064510	1.756072	0.0904
X3	-0.002015	0.000791	-2.547331	0.0169
R-squared	0.672504	Mean dependent var	7.280000	
Adjusted R-squared	0.636115	S.D. dependent var	3.018166	
S.E. of regression	1.820644	Akaike info criterion	4.156172	
Sum squared resid	89.49811	Schwarz criterion	4.341203	
Log likelihood	-60.42066	Hannan-Quinn criter.	4.216487	
F-statistic	18.48123	Durbin-Watson stat	0.332333	
Prob(F-statistic)	0.000001			

Dependent Variable: Y

Method: Least Squares

Date: 08/10/21 Time: 22:46

Sample: 1990 2020

Included observations: 31

According to the assessed result, the multiple regression model takes the form as:

$$\hat{y} = -0.515075 + 0.000137x_1 + 0.113283x_2 - 0.002015x_3$$

Finally, model tests are carried out, including economic significance tests and statistical tests. Model assessment results show that when all the other variables in the model are held fixed, the natural population growth rate will increase by 0.000137% for every 100 million yuan increase in national income that year. When all the other variables in the model are held fixed, the natural population growth rate will increase by 0.113283% for every 1 unit increase in the consumer price index that year. When all the other variables in the model are held fixed, the natural population growth will decrease by 0.002015% for every 1 yuan increase in the GDP per capita increases that year. The result is consistent with theoretical analysis and empirical judgment. From the statistical test point of view, the first is the goodness of fit, the value of R^2 is 0.672504, it shows that the regression line fits the observations well. The second is the test of F , the value of F is 18.48123, much larger than the critical value, which means the regression equation is significant. National income, GDP per capita, and consumer price index do affect the natural population growth rate. The final one is the test of t , when $\alpha=0.05$, $t_{\frac{\alpha}{2}}(27) = 2.052$. For national income, since $t = 2.436204 > 2.052$, the null hypothesis is rejected with 95% confidence, which means national income has a significant impact on the natural population growth rate. For consumer price index, since $t = 1.756072 < 2.052$, the null hypothesis is accepted with 95% confidence, which means consumer price index does not have a significant impact on the natural population growth rate. For GDP per capita, since $t = -2.547331 < -2.052$, the null hypothesis is rejected with 95% confidence, which means GDP per capita has a significant impact on the natural population growth rate.

4. Conclusion

To sum up, this research aimed to analyze the influence on population growth, which stems from countries' national income, GDP per capita and household price consumption index, in most countries

We first studied the trend of the impact of these three factors on population growth. Both of national income and GDP per capita are positively correlated with population growth. The above uses the influence of men's income on family fertility, which directly affect population. And the change of oil price is taken as an example to illustrate that GDP growth promotes population growth. However, household price consumption index is negatively correlated, since for most families, the cost of

childbirth, parenting, and education has become a large expenditure, which are growing rapidly, occupying families. Significant ratio of expenditures. We also established a multiple linear regression model to specifically analyze the three factors that mainly contributes to the population growth. Moreover, GDP per capita has the greatest influence on the population growth. This is also the reason why China relaxed its family planning policy in 2011, but the annual population change rate did decrease.

The main measures and objectives adopted to control the effect of population growth is to improve the quality of population, make population growth adapt to social and economic development, and coordinate with resources and the environment. In order for the population to change steadily within a controllable range, the government needs to constantly adjust the birth policy and demographic structure changes to meet the needs of the country amid the changes of the above three factors.

Although our country is at a key node in the new journey of building a well-off society in an all-round way and building a modern socialist country, we can know from the slow annual population growth rate that people's national income is not ideal, and GDP per capita has not risen significantly and is accompanied by rising consumption level. Of course, this does not mean that the annual population growth rate is only linked to economic development, and there are other social, environmental, and cultural impacts. The annual population growth rate is a complicated matter. The most important thing is to pursue economic development while not neglecting the indirect impact of social foundation, environmental, cultural, and other factors on human activities, and seeking sustainable development between human cities.

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