A Study of the Impact of Resident Income on Population Growth in China

——Application Analysis based on Regression Modeling

Zhangming Wu[1,a], Zhaokun Lin[2,*]

[1]Shanghai Normal University, Shanghai, 200233, China
[2]School of Shandong experimental high school, Jinan, 250000 China

[a]Jammy@wedo365.com, *3160645107@qq.com

Abstract. Exploring the crucial effect of residents' income on population growth in the context of the gradual disappearance of China's "demographic dividend" and the aging of the population. In this paper, we use a univariate linear regression model to explore the impact of residents' income on population growth based on Chinese panel data from 2005 to 2023, and further adopt the robustness test and heterogeneity analysis method. This paper draws the following conclusions:(1)China's total population is basically growing, but after 2022, the growth trend basically disappears.(2) After 1992, the population of the countryside began to show a sharp decline, while the population of towns and cities underwent a significant increase.(3) The total population at the end of the year shows a positive correlation with disposable income per capita, with the rate of growth of the total population at the end of the year approaching zero after a very high level of disposable income per capita.(4) For population growth, the current income of Chinese residents has a positive impact on it in general.(5) China's residents' income has the greatest impact on the increase in population growth in the eastern region, followed by the western region, with a smaller impact on the central region and a negative impact on the northeastern region.(6) The boost of disposable income per capita for all residents to the year-end resident population is largest in 2008-2019, slightly smaller before the outbreak of the subprime mortgage crisis, and less pronounced after the outbreak of the new Crown pneumonia epidemic.(7) For the urban population, the higher the income of the inhabitants, the larger the population, while for the rural population, the higher the disposable income per inhabitant, the smaller the population.(8) Urban incomes contribute more to population growth than rural incomes.

Keywords: population income, population growth, regression model, heterogeneity analysis, China.

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1 Introduction

Population aging and population decline have become a major problem affecting social stability and economic development, and it is projected that by 2050, 10% of China's population will be over the age of 60. At the same time, the income of the population is also crucial, and the income of the population has a direct impact on the standard of living and well-being of the population. In this context, the study of the relationship between residents' income and population growth is extremely helpful for the government to give appropriate policies through the conclusions. Therefore, this paper will utilize China's inter-provincial panel data from 2005-2023 to empirically analyze the relationship between residents' income and population growth by using univariate linear regression, robustness test, and heterogeneity analysis, in order to provide a Chinese case study and a Chinese strategy for residents' income and population growth.

2 Literature Review

The research most relevant to this paper focuses on exploring the relationship between income and population. Song Jiaying & Gao Chuansheng [1] pointed out that population aging has widened the income gap, and there is regional heterogeneity and spatial heterogeneity in population aging. Song Jiaying et al [2] showed that economic growth can play a moderating role in the process of population aging affecting the residents' income gap. Li Jinlu [3] found that residents' income, demographics and economic growth are positively correlated with real estate prices. Xiong Fen [4] found that residents' income has a positive impact on house prices first, and then a negative impact; population growth has a positive impact on the rise of house prices.

Another aspect of the literature related to this paper is that it only explores income. Jiang Ting & Liu Yan [5] pointed out that the construction of network infrastructure can increase farmers' income, and the effect of increasing income is increasing year by year. Luo Hohua & Liu Huiting [6] found that the use of digital finance contributes to the diversity of household income. Yang Bing & Zhu Ziyan [7] concluded that the construction of digital villages is effective in raising the incomes of rural and urban residents, and that there is regional heterogeneity. Guan Yanfang & Zhang Ziwen [8] pointed out that optimizing the income structure of rural residents can improve the resilience of farmers' income. Yang Shengli et al. [9] concluded that the increase in the level of equalization of public services can effectively reduce the income gap between urban and rural residents. Xian Chengyi et al [10] found that digital finance can optimize the income distribution of residents. Niu Bi Jade [11] study concluded that education can contribute to population aging and raise the burden of population dependency by lowering fertility and increasing longevity, as well as lowering labor force participation rates by delaying graduation.

In addition, literature that focuses solely on population is also relevant to this paper. Wen Chen [12] constructed a framework for assessing the cultural quality of the population and economic development, and obtained results on the evaluation of the

cultural quality of the population and the level of economic development. Hongli Dai [13] pointed out that improving the digital literacy and skill level of the whole population has become an important part of helping to improve the overall quality of the population. Huang Zuyu & Wang Guixin [14] pointed out that population migration is still the dominant factor driving the development of urbanization in China.

Based on the above existing studies, there are four possible contributions of this paper as follows. First, in the research methodology, this paper will conduct four types of heterogeneity analysis, namely regional heterogeneity analysis, temporal heterogeneity analysis, demographic heterogeneity analysis, and social heterogeneity analysis. Secondly, in terms of subject matter, the article is current. The goal of this article is to explore solutions to the serious problem of population aging and declining population growth in the context of a major reality of China's decelerating population growth. Third, in terms of research data, this paper adopts data from the National Bureau of Statistics of China from 2005-2023, which is comprehensive, newer and close to the reality, helping to reflect the overall problems in China in the past 20 years, and even more helpful in drawing more accurate and time-sensitive economic conclusions. Fourth, in the context of China's aging population and declining population growth rate, it is particularly important to study the relationship between residents' income and population size, which is conducive to arriving at more policies that can solve the problem.

3 Characterizing Facts

Figure 1 shows the trend of China's population in China from 1953-2023. Figure 1 shows that, firstly, China's total population is basically growing, but the growth trend disappears after 2022, which may be mainly due to the significant aging of the population. Second, the total female population was lower than that of males during the sample period. Thirdly, the rural population was on an upward trend until 1992, but began to show a sharp decline after 1992, mainly due to the accelerated process of urbanization in China. Fourth, as a result of China's accelerated urbanization, the total urban population has also grown significantly since 1992, and in 2010, for the first time, the total urban population exceeded the total rural population.

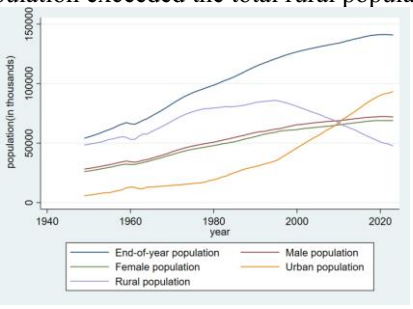

Fig. 1. Population Trends in China.

4 Research Design

4.1 Variable Selection

The explanatory variable in this paper is population growth, using year-end resident population as a proxy variable. This paper uses per capita disposable income of all residents as the core explanatory variable to measure the income level of residents in China. In this paper, we will use consumption expenditure per capita of all residents to conduct robustness tests. In addition, this paper will use urban population and rural population for population heterogeneity analysis and urban per capita disposable income and rural per capita disposable income for income heterogeneity analysis.

4.2 Data Sources

The empirical part of this paper selects 31 provinces, cities or autonomous regions in China as the object of empirical analysis, and the observation period is from 2005 to 2023, and the sample data taken are from the National Bureau of Statistics of China. The descriptive statistics of this paper are shown in Table 1.

Table 1. Descriptive statistical analysis.

Variable	Obs	Mean	Std.Dev.	Min	Max
Year-end resident population (10,000 persons)	589	4400	2847	280	12706
Per capita disposable income of the population as a whole (yuan)	589	20993	13726	3625	84834
Per capita disposable income of rural residents (yuan)	589	11474	7261	1971	42988
Per capita disposable income of urban residents (yuan)	589	28434	14965	8013	89477
Rural population (10,000 persons)	558	1969	1400	203	6505
Urban population (10,000 persons)	558	2424	1706	58	9466

4.3 Modeling

The research model in this paper is a one-way linear regression as follows:

$$Y = \alpha X + \beta + \varepsilon \text{（1）} \tag{1}$$

Where Y is the explanatory variable population growth, X is the core explanatory variable residents' income, and ε is the random error term.

5 Empirical Analysis

5.1 Correlation Analysis

Figure 2 depicts the relationship between the level of income of the population and population growth. As can be seen from Figure 2, the total population at the end of the year increased with the growth of disposable income per capita, indicating a positive correlation between the two. In addition, the year-end population has a very high rate of increase until disposable income per capita rises to a certain level. After a relatively high level of disposable income per capita is reached, the rate of growth of the total population at the end of the year decreases considerably. Even after a very high level of disposable income per capita, the total population growth rate at the end of the year is close to 0. Of course, the relationship between the level of income of the population and the population growth needs to be determined by this study through regression analysis.

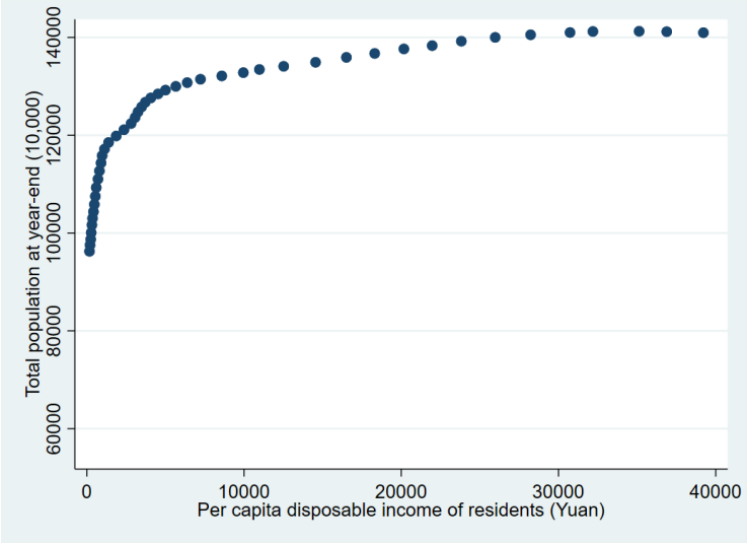

Fig. 2. Correlation between Population Growth and Income in China.

5.2 Benchmark Regression

Table 2 Model (1) reports the main regression results of disposable income per capita for all residents affecting the year-end resident population. Specifically, the estimated coefficient of the core explanatory variable of the model is 0.0598, which is significantly positive at the 1% significance level. The regression results preliminarily suggest that, for population growth, the impact of current Chinese residents' income is positive in general.

Table 2. Benchmark regression, robustness test and regional heterogeneity analysis.

	(1) Y	(2) Y	(3) Y	(4) Y	(5) Y	(6) Y
X	0.0598***	0.0637***	0.1299***	0.0198***	0.0581***	-0.0821***
	(16.9905)	(16.4148)	(22.8476)	(10.3006)	(15.3366)	(-7.5483)
_cons	7.5288***	7.5103***	6.9591***	8.4584***	7.1511***	8.9289***
	(47.3323)	(46.8860)	(23.5163)	(54.6267)	(24.9333)	(53.0924)
N	589	589	190	114	228	57
R2	0.3410	0.3256	0.7442	0.4962	0.5221	0.6145

z statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The same as below.

5.3 Robustness Tests

In order to test the stability and reliability of the benchmark regression estimates, this paper will replace the measure of residents' income. This paper will use the consumption expenditure per capita of all residents to replace the core explanatory variable disposable income per capita of all residents for robustness analysis. The empirical results of model (2) in Table 2 show that the impact of per capita consumption expenditure of all Chinese residents on the year-end resident population is still significantly positive, and the conclusion of the benchmark model is robust.

5.4 Heterogeneity Analysis

5.4.1 Regional Heterogeneity Analysis.

Hubei Province, Hunan Province, a total of 7 provinces; the western region includes Xinjiang Uygur Autonomous Region, Tibet Autonomous Region, Gansu Province, Qinghai Province, Sichuan Province, Yunnan Province, Guangxi Zhuang Autonomous Region, Ningxia Hui Autonomous Region, Guizhou Province, Chongqing Municipality, Shaanxi Province, a total of 11 provinces. The Northeast region includes three provinces, Heilongjiang, Jilin, and Liaoning]., in order to unveil the regional characteristics of population growth influenced by residents' income. Table 2 Models (3), (4), (5), and (6) report the regression results of per capita disposable income of all residents affecting the year-end resident population in Eastern, Central, Western, and Northeastern China, respectively, with estimated coefficients of the explanatory variables of 0.1299, 0.0189, 0.0581, and -0.0821, respectively, with the regression results in Eastern, Central, and Western regions being significantly positive at the 1% level. The regression results for the Eastern, Central, and Western regions are significantly positive at the 1% level of significance, but the regression results for the Northeast region are significantly negative at the 1% level of significance. The regression results show that for China, the income of Chinese residents has the greatest impact on the increase of population growth in the eastern region, followed by the western region, with a smaller impact on the central region and a negative impact on the northeastern region. (The eastern region includes a total of 10 provinces, includ-

ing Beijing, Hebei, Tianjin, Shandong, Shanghai, Jiangsu, Zhejiang, Guangdong, Hainan, and Fujian; the central region includes a total of 7 provinces, including the Inner Mongolia Autonomous Region, Shanxi, Henan, Anhui, Jiangxi, Hubei, and Hunan; and the western region includes a total of 11 provinces, including the Xinjiang Uygur Autonomous Region, Tibet Autonomous Region, Gansu, Qinghai, Sichuan, Yunan Province The western region includes 11 provinces including Xinjiang Uygur Autonomous Region, Tibet Autonomous Region, Gansu, Qinghai, Sichuan, Yunnan, Guangxi Zhuang Autonomous Region, Ningxia Hui Autonomous Region, Guizhou, Chongqing and Shaanxi. The Northeast Region includes three provinces: Heilongjiang, Jilin and Liaoning.)

5.4.2 Temporal Heterogeneity Analysis.

In this paper, based on the feasibility of the data, we will use the outbreak of the subprime mortgage crisis in 2008 and the outbreak of the New Crown Pneumonia epidemic in 2019 as the time nodes, and divide the sample period into three time periods to launch the analysis of temporal heterogeneity. Table 3 Models (1), (2), and (3) report the regression results of the impact of residents' income on year-end resident population for 2005-2008, 2008-2019, and 2019-2023, respectively, with estimated coefficients of the explanatory variables of 0.0623, 0.0660, and -0.0002, respectively. In particular, the regression results of the period before the outbreak of the subprime crisis and the period before the outbreak of the New Crown Pneumonia outbreak are both are significantly positive at the 1% significance level, while the regression results after the outbreak of the New Crown Pneumonia epidemic are not significant. The regression results suggest that the effect of disposable income per capita of all residents on the increase in year-end resident population is largest in 2008-2019, slightly smaller before the outbreak of the subprime crisis, and insignificant after the outbreak of the New Crown Pneumonia epidemic.

Table 3. Analysis of temporal heterogeneity.

	(1) Y	(2) Y	(3) Y
X	0.0623***	0.0660***	-0.0002
	(5.1795)	(13.4125)	(-0.0210)
_cons	7.5004***	7.4729***	8.1466***
	(39.0108)	(46.1350)	(47.3889)
N	93	341	155
R2	0.3024	0.3674	0.0234

5.4.3 Population Heterogeneity Analysis.

This paper analyzes the heterogeneity of China's population into urban and rural populations based on the social environment, and Table 4 reports the effects of per capita disposable income of all residents on the urban and rural populations, respectively, with estimated coefficients of the explanatory variables of 0.3069 and -0.2003, respectively. The effect of per capita disposable income on the urban population is

significantly positive at the 1 percent level of significance, while the effect on the rural population is significantly negative at the 1 percent level of significance. The regression results indicate that for the urban population, the higher the per capita income, the larger the population, while for the rural population, the higher the per capita disposable income, the smaller the population.

5.4.4 Income Heterogeneity Analysis.

In this paper, the per capita disposable income of all Chinese residents is categorized into per capita disposable income of urban residents and per capita disposable income of rural residents based on the social environment. Table 4 Models (3) and (4) report the effects of urban and rural incomes on the year-end resident population, respectively, and the estimated coefficients of the explanatory variables are 0.0683 and 0.0569, which are both significantly positive at the 1 percent significance level. The regression results suggest that urban incomes contribute more to population growth than rural incomes.

Table 4. Population and Income Heterogeneity Analysis.

	(1)	(2)	(3)	(4)
	Y	Y	Y	Y
x	0.3069***	-0.2003***	0.0683***	0.0569***
	(65.8865)	(-37.4025)	(17.4216)	(16.8783)
_cons	4.5041***	9.1718***	7.4210***	7.5908***
	(27.5820)	(51.2383)	(46.0777)	(48.3367)
N	558	558	589	589
R2	0.8921	0.7266	0.3523	0.3382

6 Summary

Based on the above empirical results, the following conclusions are drawn from this study: (1) China's total population is basically growing, but the growth trend disappears after 2022. (2) The rural population began to show a sharp decline after 1992, mainly due to the accelerated process of urbanization in China, with the total population of cities and towns increasing significantly after 1992. (3) The total population at the end of the year grows with the growth of per capita disposable income, i.e., there is a positive correlation between the two, and the growth rate of the total population at the end of the year decreases significantly after the per capita disposable income has reached a relatively high level. (4) For population growth, the current Chinese population's income has a positive effect on it in general. (5) Based on different regional perspectives, China's residents' income has the greatest impact on the enhancement of population growth in the eastern region, followed by the western region, with a smaller impact on the central region and a negative impact on the northeastern region. (6) Based on different times, the boost of disposable income per capita for all residents to the year-end resident population is largest in 2008-2019, slightly smaller before the

outbreak of the subprime mortgage crisis, and less pronounced after the outbreak of the new Crown pneumonia epidemic. (7) Based on the different types of population, for the urban population, the higher the per capita disposable income, the higher the population, while for the rural population, the higher the per capita disposable income, the lower the population. (8) Based on different types of incomes, urban incomes contribute more to population growth than rural incomes.

Although this paper only examines the relationship between residents' income and population growth, there may also be factors that can influence the size of China's population that are not considered in this study. Therefore, follow-up studies could also explore the influence from education. In terms of research methodology, although this paper only uses one-dimensional sub-linear regression, subsequent studies can try to use non-linear regression. In terms of research data, although this study only uses data from the National Bureau of Statistics of China, subsequent studies can use data from Asia, Europe and even the whole world.

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