Research on the Influence of Population Structure on Economic Growth: Based on the Provincial Panel Data Model

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Abstract

In recent years, the international environment and conditions of China's economic development have undergone profound and complex changes, but in the middle and long term, China's economy has been maintaining a stable medium-high speed development. It is remarkable that population changes bring about changes in economic development; especially the aging of the population has a particularly significant impact on economic growth. Therefore, based on the inter-provincial panel data of 31 provinces and municipalities from 2011 to 2019, this paper mainly studies the impact of population change on economic growth by establishing a solid fixed effect model. The results show that there is a long-term equilibrium relationship between population structure and economic growth, and population structure has a significant positive impact on economic development. In addition, there are regional differences in the positive and significant relationship between the two.

Keywords

Population Change, Economic Growth, Fixed Effects

1. Introduction

Since the reform and opening up, China's population structure has undergone a historic change, followed by a rapid economic progress. But the population and the aggravation of aging makes economic development lack of power. Based on this, You Shibing and Cai Yuanfei [1] (2017) constructed a panel vector autoregressive model using the provincial panel data from 2000 to 2013, which explained the problem that population aging is not conducive to economic development, and the authors point out that both direct and indirect effects of popu-

lation aging are detrimental to economic growth. Di Re A Ha [2] (2020) from the perspective of demography and family planning, China's political and economic system reform, elaborated the adverse effects of population aging on economic development and effective solutions. Research shows that population aging as one of the main factors affecting the process of socialist modernization construction, has a direct impact on economic development. Therefore, the relationship between the two should be comprehensively controlled, and the disadvantages should be turned into advantages to promote economic development. Chen Jiamin [3] (2020) analyzed the two-way adverse effects between population aging and economic growth in Guangdong Province based on the VECM model. He finds that population ageing depresses economic growth in the short run, but boosts it in the long run. Guo Han, Ren Baoping [4] (2014) studied demographic dividend and its change and the transformation of economic development mode through empirical analysis from the perspective of economics. The results show that the demographic dividend change has an impact on economic development through four dimensions: capital formation, labor supply, human capital accumulation and labor allocation efficiency. This paper uses Stata15 software [5] and Eviews10 software [6] to study the panel data of 31 provinces and autonomous regions, so as to get the influence degree of population change on economic growth.

2. Theoretical Basis

The general form of panel data entity fixed model is as follows:

$$y_{it} = \delta + \lambda_i + \sum_{k=2}^{k} \beta_k x_{kit} + \mu_{it} \tag{1}$$

The null hypothesis of the model is that under the null hypothesis, we can get the following this formula:

$$F = \frac{(RRSS - URSS)/(N-1)}{URSS/(NT - N - K + 1)} \sim F\left(N-1, N(T-1) - K + 1\right) \tag{2}$$

where, *RRSS* is the sum of regression residuals in the mixed model, and *URSS* is the sum of regression squares in the solid fixed effect model. *N* is the number of cross-sections, *K* is the number of explanatory variables, and *T* is the number of time points.

3. Empirical Analysis

3.1. Data Selection and Explanation

In this paper, elderly population dependency ratio and regional per capita GDP were selected as explanatory variables and explained variables, expressed by EDR and GDP respectively. Economic growth can be measured in terms of gross domestic product (GDP) and gross domestic product (GDP) per capita. Here we use GDP per capita. Before the establishment of the model, the natural logarithm transformation of each data can not only eliminate heteroscedasticity but also

make the data series more stable. First, the data are statistically described, as shown in Table 1.

3.2. Unit Root Test

Panel unit root test has its own methods. In this paper, LLC、IPS、ADF and PP-fisher are used to analyze the stability of the data to ensure the stability of the data and avoid the occurrence of false regression or false regression. The output results are show in Table 2. Table 2 shows that the two sequences after first-order difference reject the null hypothesis at the 5% level, so the data series is stable.

3.3. Co-Integration Test

$I(1)$ sequence of $\Delta \text{In} GDP$ and $\Delta \text{In} Q$ Complete the conditions of the Co-integration integration test, the following the two sequences with co-integration analysis, the results are shown in Table 3. It is not difficult to see from Table 3 that the P values of Perpdroni test, Kao test and joint distribution test mostly reject the null hypothesis. That is to say, at the 5% confidence level, these two data series have a co-integration relationship, that is, there is a long-term equilibrium relationship between population change and economic growth.

3.4. Model test

3.4.1. Likelihood Ratio Test

The null hypothesis of Likelihood Ratio (LR) test is that the model selection of fixed effect is redundant. As cab be seen from the test results in Table 4, at the 5% confidence level, the value of F statistic is 0, and the value of LR statistic also 0, which indicates that the model rejects the null hypothesis and further indicates

Table 1. Descriptive analysis of panel data.

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
GDP	279	23,132.21	19,690.16	611.5	107,986.9
EDR	279	13.8319	3.410124	6.7	23.8

Table 2. Unit root test of panel data.

Variables	LLC	IPS	ADF	PP-Fisher
LNGDP	−8.6656	0.77555	70.0251	124.816
	(0.0000)**	(0.7810)**	(0.2263)**	(0.0000)**
ΔLNGDP	−23.585	−6.01438	146.28	93.7781
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0057)**
LNEDR	−1.36388	3.89141	30.8036	45.0248
	(0.0863)**	(1.0000)**	(0.9997)**	(0.9484)**
ΔLNEDR	−24.5886	−9.84071	220.689	235.832
	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**

Note: Δ indicates first-order difference; **represents a significance level of 5%.

Table 3. Co-integration test (test results and test results).

Statistical methods	Statistic	Statistics
Perpdroni	Panel v-Statistic	2.073606 (0.0191)**
	Panel rho-Statistic	−0.588827 (0.2780)**
	Panel PP-Statistic	−4.933536 (0.0000)**
	Panel ADF-Statistic	−4.473958 (0.0000)**
	Group rho-Statistic	1.883452 (0.9702)**
	Group PP-Statistic	−6.469837 (0.0000)**
	Group ADF-Statistic	−7.932487 (0.0000)**
Kao	ADF	−3.521499 (0.0002)**
Hypothesized No. of CE(s)	Fisher Stat.*from tracetest)	Fisher Stat.* (from max-eigentest)
None	448.2(0.0000)	422.5 (0.0000)**
At most 1	136.1(0.0000)	136.1 (0.0000)**

Table 4. Likelihood ratio (LR) test of panel data.

Effects Test	Statistic	d.f.	Prob.
Cross-section F	30.857748	(30,209)	0.0000
Period F	239.243284	(8209)	0.0000

that the model is appropriate to select the fixed-effect model.

3.4.2. Model Selection

Before the model is determined, the mixed model regression is first carried out to get the value of RRSS, and then the formula (2) in the theoretical basis is calculated to determine the final appropriate model for estimation. According to the calculation, we obtain the follow results:

$$F = \frac{(197.804 - 3.036)/248}{3.036/30} = 7.7609$$

the value of RRSS is 197.804 and that of URSS is 3.036. And at the 5% confidence level, it's clear, so it's OK to choose the solid fixed effect model here. The regression results are shown in Table 5.

4. Conclusions and Suggestions

This paper uses stationary test, co-integration test and fixed effect regression estimation of panel data to study the impact of population change on economic growth. It's found that there is a long-term equilibrium relationship between the dependency ratio of the elderly population and economic growth GDP in 31 provinces and autonomous regions of China, and the influence of population changes in the top 18 provinces and autonomous regions on economic growth shows a positive correlation trend, especially in the top six cities, such as Heilongjiang, Liaoning and...., Zhejiang particularly significant. Moreover, it is not

Table 5. Regression results of the model.

Impact of EDR on GDP	Regional rankings	Impact of EDR on GDP	Regional rankings	Impact of EDR on GDP	Regional rankings
3.613766	Heilongjiang 1	0.912237	Henan 13	−2.035799	Hainan 25
3.449027	Liaoning 2	0.796196	Fujian 14	−2.199992	Qinghai 26
3.396326	Shandong 3	0.665445	Tianjin 15	−2.577146	Yunnan 27
3.385346	Shanghai 4	0.417151	Gansu 16	−3.336375	Guizhou 28
3.14807	Hebei 5	0.356245	Ningxia 17	−3.897913	Xizang 29
3.055012	Zhejiang 6	0.324927	Anhui 18	−5.02428	Chongqing 30
2.811836	Jilin 7	−0.13057	Shanxi 19	−11.66585	Guangxi 31
2.452173	Beijing 8	−0.412568	Hubei 20		
2.022946	Shanxi 9	−0.725591	Xinjiang 21		
1.758254	Neimenggu 10	−0.829784	Sichuan 22		
1.310668	Guangdong 11	−0.908233	Hunan 23		
1.05112	Jiangsu 12	−1.182642	Jiangxi 24		

difficult to see that the economic growth of Gansu, Ningxia and Anhui is less affected by population. Secondly, provinces and autonomous regions ranked from 19 to 31 show a negative correlation, among which Guangxi Province was particularly significant.

Therefore, in view of the above situation, several relevant suggestions are put forward:

1) Encourage fertility. In response to the Partly Central Committee's family planning policy, encourage people to have a second child, and fundamentally increase the number of labor force population.

2) Formulate scientific industrial adjustment policies to cater to the change of population structure. According to the population characteristics of our country, the government should formulate some targeted industrial adjustment strategies, so as to promote economic development.

3) Increase investment in human resources to provide a human base for high-quality economic development.

4) In view of the regional differences in the impact of population structure on economic growth, some regions can appropriately delay retirement.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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