

Research on Population Distribution and Coordinated Development of Regional Economy in Chengdu City

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Abstract: *The relationship between population and economy plays an important part in the regional sustainable development. The study on whether the population distribution in Chengdu City is coordinated with the development of regional economy is of great significance in promoting the economic development in Chengdu City and the western development with "Chengdu -Chongqing" as the center. This paper conducts a study on the population distribution and development of regional economy in Chengdu City in different circles. By adopting the statistical method of multiple stepwise regression, it carries out the quantitative analysis on the correlation between population distribution and economic development. The matching of the population distribution and the development of regional economy measured by the coefficient of geographic association helps to identify the problems lying in the distribution of urban population and the development of regional economy in Chengdu City and puts forward the corresponding policy suggestions.*

Keywords: *population distribution; regional economy; Chengdu City*

1. Introduction

The relationship between population and economy plays an important part in the regional sustainable development, and has drawn great attention in the fields of demography, economy and geography. The relationship between population and economic development can be summarized as two aspects: the relationship between the population growth and economic development, and the relationship between population distribution and the development of regional economy. And this paper focuses on studying the latter one. The population distribution has its own laws, which is not only affected by the natural environment, but also by the economic society. When the population distribution is almost consistent with the scale, location and direction of productivity, it is beneficial for the production and life nearby, as well as promoting the local economic development; Otherwise, it will have an impact on the local economic development^[1]. Therefore, the study on whether the population distribution is coordinated with the development of regional economy is of great significance for formulating the regional population policies, and adjusting the layout of regional population and productivity. Located in the center of Western Sichuan Plain, Chengdu City is the capital of Sichuan Province and the largest city in western China. In 1999, the State Council announced Chengdu to be the central city of the Southwest region. As the Go-West Campaign continues, Chengdu City has gradually developed into a center of science and technology, commerce, finance, transportation and communication in the southwest region. In June 2007, it was announced that Chengdu and Chongqing served as the national integrated urban-rural pilot zones, and the flow of production factors between urban and rural areas accelerated, which resulted in the further adjustments in the distribution of urban and rural populations and regional populations. Therefore, the study on whether the population distribution in Chengdu City is coordinated with the development of regional economy is of great significance in promoting the economic development in Chengdu City and the development of the west with Chengdu City as the center.

2. Current Population Distribution in Chengdu City

According to the relevant data released by the 6th China Population Census, the annual resident population of Chengdu City reached 14.04 million, and the resident population of the main urban area reached 5.295 million, with an increase of 1.825 million compared to 2000, which accounted for 6.5

percentage of the city's population. In the context of the Go-West Campaign, Chengdu, as a key town in the southwest, has continuously enhanced its shooting power and gathering power, and its central city status has become more prominent. With the deepening of the reform of the registered residence system, Chengdu City has become more and more attractive to the floating population, and more and more people are flowing into the urban area of Chengdu City; On the other hand, the development of Chengdu itself has also triggered a demand for labor and talents at all levels, objectively promoting population migration. Therefore, the population mechanical change rate in Chengdu City has greatly exceeded the natural population growth rate since 1998. Especially after 2000, Chengdu took the opportunity of the Western Development Strategy to vigorously develop, and the growth rate of mechanical changes has maintained an upward trend, with the highest rate of 19.2 ‰ in 2005 and only slightly decreasing in 2007(See Figure 1). From 1998 to 2003, the average annual migration rate in Chengdu City was 23.13 ‰, with migration rates above 30 ‰ from 2004 to 2006, while the average annual migration rate was only 13.4 ‰. Another significant phenomenon is the continuous increase in population density in the central urban area of Chengdu City. Among the three major circles in Chengdu City, the population density in the main urban area is 10,103 people/square kilometer, far exceeding the other two circles.

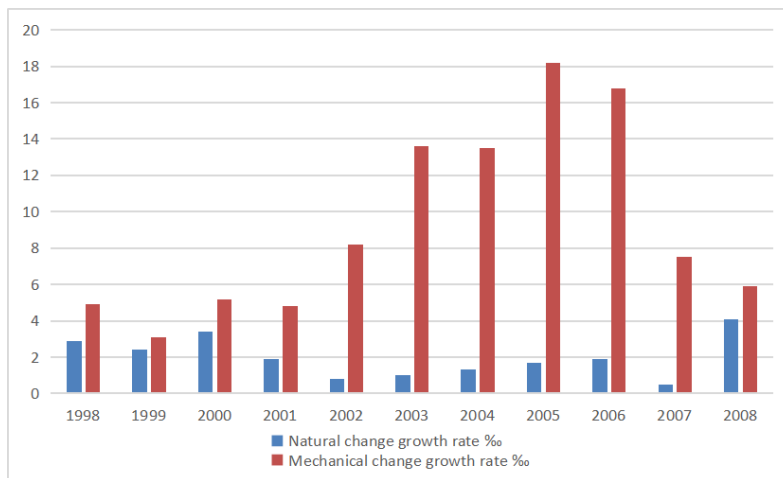


Figure 1: Population Changes in Chengdu City in Recent Years

The population distribution which refers to the spatial distribution of the population in an area over a period of time, is the spatial manifestation of the population process. Due to the many attributes contained in population, the population distribution can be divided broadly or narrowly. The broad population distribution includes the distribution of different attributes of the population, such as the distribution of population quantity, the distribution of variables such as birth rate and mortality rate, the distribution of natural attributes such as gender and age, the distribution of social and economic attributes such as population education and current occupational structure; The narrow population distribution generally refers to the distribution of population quantity^[2]. This paper studies the narrow population distribution. When examining the regional differences in population distribution, it usually adopts the indicators of population density, agricultural population density, comparative density, and nutrient density. On the basis of the current situation and data collection in Chengdu City, the population density index is applied to studying the population distribution in Chengdu City. Now, 19 districts (counties or cities) in Chengdu City are taken as objects to study the population distribution in Chengdu City from 2011-2021. According to the population distribution of different regions in Chengdu City in 2011, 2016 and 2021, the population of Chengdu City is divided into three circles in descending order of population density(See Table 1 and Figure 2):

Table 1: Population Distribution Circle in Chengdu City by Population Density

The First Circle	($m > 4,000$)	Qinyang District, Jinjiang District, Wuhou District, Jinniu District, and Chenghua District
The Second Circle	($750 < m < 4,000$)	Xindu District, Wenjiang District, Pi County, Qingbaijiang, Longquanyi, Xinjin County, and Shuangliu County
The Third Circle	($m < 750$)	Jintang County, Chongzhou City, Pengzhou City, Dujiangyan Irrigation Project City, Qionglai City, Pujiang County, Dayi County

Note: m refers to population density (person/m²)

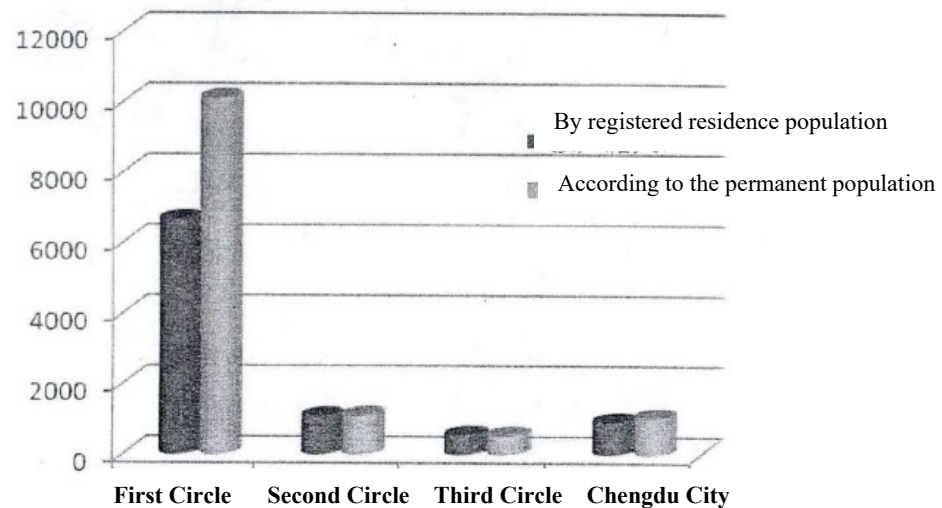


Figure 2: Population Density of Different Circles in Chengdu City

3. Correlation Analysis on Population Distribution and the Development of Regional Economy

According to the trend of population development in different districts and counties in Chengdu City from 2011 to 2021, and the comparative analysis on the non-agricultural output value in each region, it can be known that there is a generally positive correlation between population size and the corresponding non-agricultural output value in the region, which suggests that the larger the population size, the higher the proportion of non-agricultural output value in the districts and counties of Chengdu City. As shown in the figures, the overall trend of the population density curve is similar to that of the GDP curve, which shows that there are some correlations between the population density and regional GDP in Chengdu City. Therefore, it can be inferred that there is a positive correlation between population aggregation and economic aggregation, which can promote each other and help to form the economies of agglomeration.

3.1 Population Characteristics Closely Related to Economic Development

The relevant analysis is adopted to discuss the population characteristics closely related to economic development. Correlation analysis is a statistical method for studying the closeness among the variables. Taking 19 districts (counties or cities) in Chengdu City in 2021 as samples, it can be seen that the correlation coefficients between GDP per capita and population density, proportion of employed population, proportion of population with college degree or above and proportion of non-agricultural population are 0.712, 0.391, 0.881 and 0.896, respectively. Since GDP per capita has a large correlation coefficient with the proportion of people with college degree or above and the proportion of non-agricultural population (greater than 0.8), it can be inferred that the education and urbanization of the population in Chengdu City are closely related to economic development^[3].

3.2 Economic Factors Affecting Population Distribution

The factors which have an impact on the population distribution are nature, economy, politics, history and society. Taking the research purpose of this paper into consideration, it focuses on studying the impact of economic factors on population distribution. Taking 19 districts (counties or cities) in Chengdu City in 2021 as the research object, it selects the relevant population and economic indicators, and adopts the stepwise regression method to discuss the economic factors affecting the population distribution. Stepwise regression method refers to the analysis method that each independent variable enters the regression equation in order and predicts a dependent variable with two or more independent variables. Firstly, adopt the population density for population distribution; Secondly, select the economic factors from production and consumption. Since the population density is an average indicator, the selected economic factors also adopt the corresponding per capita indicators, which consists of GDP per capita, per capita output value of the primary industry, per capita output value of the secondary industry, per capita output value of the tertiary industry, per capita fixed assets

investment, and per capita retail sales of consumer goods; Then conduct the multiple regression analysis with the stepwise regression method by taking the population density as the dependent variable^[4]. The regression results are as follows (Table 2):

Table 2: Stepwise Regression Results with Population Density as the Dependent Variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6392.732	382.072		16.732	0.000
	per capita output value of the secondary industry	-2.286	0.183	-0.949	-12.464	0.000
2	(Constant)	3483.835	772.089		4.512	0.000
	per capita output value of the secondary industry	-1.350	0.267	-0.561	-5.051	0.000
	per capita output value of the tertiary industry	0.103	0.025	0.448	4.037	0.001

With the Adjusted R Square of 0.896 for Scheme 1 and 0.945 for Scheme 2, it can be seen that the regression fitting is better in Scheme 2. Therefore, it selects Scheme 2. The regression model is: $PD=0.103T-1.350F+3483.835$

(PD: population density, T: per capita output value of the tertiary industry, F: per capita output value of the primary industry)

According to the regression equation, the economic factors affecting the population distribution are mainly industrial factors, especially in the primary and tertiary industries. The per capita output value of the primary industry has a negative impact on population distribution, while the per capita output value of the tertiary industry has a positive impact, which suggests that the more developed the tertiary industry, the higher the population density, and the more concentrated the population distribution; The more developed the primary industry, the lower the population density, and the more dispersed the population distribution.

4. Basic Judgment and Policy Reflection on Population Distribution and Economic Development in Chengdu City

4.1 Basic Judgment

As a western mega city with a population of 10 million, its population distribution and economic development have a significant impact on the Go-West Campaign. From the analysis mentioned above, it can be seen that there is a close relation among the education, urbanization and economic development in Chengdu City; The development of industries has a significant impact on population distribution, especially in the primary and tertiary industries^[5]. The overall population distribution and economic development in Chengdu City have a better matching in the region, and show a tendency to concentrate in the first circle. The concentration of economic development is higher than that of population distribution. However, there are some problems between population distribution and economic development in different circles:

- ① The population distribution in the first circle has a better matching with the economic development, but show a gradual downward trend.
- ② The population distribution in the second and third circles is almost the same as the trend of economic development, but the matching decreases as the concentration of economic development increases.
- ③ The population distribution in the third circle has a poorer matching with the economic development, and its economic vitality is the weakest in the region.

4.2 Policy Reflection

4.2.1 Further improve the population concentration and take the advantage of the population aggregation effect

According to the unbalanced model of regional development and the fluctuation process of regional economy and population distribution changes, the spatial concentration of population and economy is an inherent law of regional development in a long term, and the unbalanced development is the focus of regional spatial structure evolution^[6]. Although the economy in Chengdu City is more developed in the western region, it shall follow the unbalanced development strategy of population and economy. Since 2013, Chengdu City has launched the "Three Concentrations", which are the concentration of industry to the concentrated development area, the concentration of land to large-scale management, and the concentration of farmers to the concentrated residential areas. The concentration of farmers to the concentrated residential areas has made full use of the population aggregation. With several years of practice, the concentrated residential areas of farmers in the central urban area have fully integrated with urban communities, while the concentration in the second and third circles is limited. With the rapid development of regional economy and the increase of economic concentration, the population concentration fails to adapt to the economic development. Since 2021, the matching between population and economy has dropped gradually in the second and third circles. Therefore, it shall accelerate the urbanization in the second and third circles, take the advantage of the population aggregation effect and adapt to the economic development by building the concentrated residential areas for farmers and new rural communities.

4.2.2 Optimize industrial layout and establish pillar industries in the third circle

The industrial layout has a significant impact on the economic development. The reasonable and effective industrial layout will help to promote the economic development; And the unreasonable industrial structure will have an influence on the economic development. Therefore, optimizing the industrial layout plays an important role in the economic development in Chengdu City. In recent years, with the rapid development of the economy in the first circle in Chengdu city (i.e. the central urban area), the industry has upgraded. The focus of industrial enterprises on manufacturing is gradually shifting towards the second circle, forming an industrial layout where the first circle attaches great importance to developing the tertiary industry and the second circle concentrates on developing the secondary industry. The third circle is far away from the central urban area, with an agricultural population proportion of more than 60%. Therefore, it shall focus on developing the primary industry. However, its natural environment with many mountains and few fields and dams is not conducive to agricultural production, which results in less advantages of industrial development and the weaker economic vitality in the region. Therefore, it shall make efforts to develop the modern agriculture, strengthen the combination of the primary, the secondary and tertiary industries, take the advantage of the local natural conditions to cultivate the raw material forest of wood and bamboo industry, build the famous, special, excellent, new, and fruit forest bases, develop the ecological tourism and leisure projects, establish the pillar industries in circles, and improve the economic development.

4.2.3 Strengthen the cooperation among the circles and promote the overall development of regional economy

Although the overall economic development in Chengdu City is in a good state, there is a significant gap among different circles. The urbanization and economy of the first circle are much better than those of the second and third circles. Therefore, it shall make use of the capital and technological advantages of the first circle to enhance, support, assist, and lead the second and third circles, and promote common economic development. In addition, the high population density in the first circle will have a negative impact on resources, environment and employment. The labor-intensive enterprises within the circle shall be gradually shifted to the second and third circles to alleviate the rapid population expansion when further improving the population policies. So it shall strengthen the cooperation among different circles, maintain the economic vitality in the central urban area, drive the development of other circles, and promote the overall development of regional economy^[7].

4.2.4 Improve the quality of the population, strengthen the construction of talents, and enhance the urban human capital

Improving the quality of population is not only the core of population modernization, but also one of basic national policies in China. There is a direct proportion between the improvement of population quality and labor productivity, and the changes in quality of population have a profound impact on the

whole social and economic development. Therefore, great attention shall be paid to improving the population quality, for example, developing the education, optimizing the human resource conditions, and enhance the vocational, adult and elderly education, especially the education and training of the rural population, and strengthening the economic vitality of the population. In addition, it is necessary to improve the construction of talents and enhance the urban human capital. It shall take the advantage of the dense local universities in Chengdu City, focus on the talent cultivation, and launch the preferential policies to retain the talents; It shall focus on strengthening the cooperation with universities in key areas and taking the advantage of the talents^[8]. Making use of the human capital helps to maintain the core competitiveness of advantageous industries of aviation, information, commerce and transportation.

5. Conclusion

In order to better promote economic agglomeration and achieve sustainable development of cities, we should have a correct understanding of the population growth trend, reasonably layout population development, do a good job in population management, and promote the optimization of industrial distribution and employment structure. Firstly, reasonably layout the population size of the three levels and guide the population to gather in urban areas; Secondly, further optimize the employment structure and actively expand employment; Once again, through policy support, build an open pattern of talent exchange and cooperation; Finally, we will improve measures to ensure talent resources and provide services and management for the floating population.

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