Linear Regression Analysis of GDP Growth and Urbanization Rate in Mainland of China

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Abstract

Urbanization rate and per capita GDP are important indicators to measure the level of economic development. Changes in the two and the profound changes they bring have been hot topics in the field of human geography in recent years. Studying the correlation between the two from a geographical perspective has important theoretical and practical significance. Based on the per capita GDP data and urbanization rate data in mainland of China, a linear regression analysis model was used to conduct research and analysis on the two. By analyzing the urbanization rate and per capita GDP, we found a high correlation between the level of economic development and the urbanization rate, which verified the theory that "economic development is the endogenous decisive force of urbanization" and revealed that the construction of new urbanization still depends on economic development.

Subject Areas

Business Management

Keywords

GDP per Capita, Urbanization Rate, Linear Regression, Correlation, Mainland of China

1. Introduction

Urbanization/urbanisation, also known as urbanization, refers to the transformation of a country or region from a traditional rural society dominated by agriculture to a rural society with the development of social productivity, advancement of science and technology and adjustment of industrial structure. The historical process of the gradual transformation of modern urban society dominated by non-agricultural industries such as industry (secondary industry)

and service industry (tertiary industry) [1].

Real GDP per capita is an effective tool for people to understand and grasp the macroeconomic operating conditions of a country or region, that is, "GDP per capita". It is often used as an indicator to measure economic development in development economics and is the most common indicator. One of the important macroeconomic indicators [2]. Comparing the GDP achieved by a country during the accounting period (usually one year) with the country's permanent population (or registered population), the GDP per capita is obtained, which is a standard for measuring the living standards of people in various countries, often combined with purchasing power parity for a more objective measurement.

This article selects mainland of China as the research object. According to data released by the National Bureau of Statistics on May 11, 2021, the results of the seventh census: the population living in cities and towns is 901,991,162, accounting for 63.89%. It is generally believed that when the urbanization rate of a country is between 30% and 70%, it is in the stage of rapid development [3]. That is to say, urbanization in mainland of China is bidding farewell to the period of rapid growth and entering a new stage of high-quality development. The connotation of high-quality development of new urbanization can be summarized as the organic unity of high-quality urban construction, high-quality infrastructure, high-quality public services, high-quality living environment, high-quality urban management and high-quality citizenization [4]. Economically, mainland of China has bid farewell to the era of rapid economic growth and has entered a critical period of medium-to-high-speed economic development and high-quality development. Analyzing the relationship between economic growth and urbanization rate is of great significance to the development of new urbanization in the future high-quality development stage.

This article combines qualitative and quantitative analysis methods, which can not only bring into play the comprehensive, detailed and in-depth advantages of qualitative analysis methods, but also bring into play the systematic, objective, standardized and scientific advantages of quantitative analysis and prediction methods. On the basis of the construction of the indicator system, the latest national statistics are verified.

2. Research Methods and Data Sources

2.1. Research Methods

Correlation analysis is used to describe whether there is a relationship between variables, while regression analysis studies the influence of the relationship, reflecting the degree of influence of one X or multiple X on Y. However, correlation analysis can only study the direction and degree of correlation between variables, but it cannot obtain the specific form of the relationship between variables, nor can it infer the changes in another variable from the changes in one variable, which must be done through regression analysis. Therefore, this study

first conducts relevant analysis on the per capita GDP data and urbanization rate data of each province in the country, and then determines whether regression analysis is needed.

Regression analysis involving only two variables is called single regression analysis [5]. The main task of single regression is to estimate one of the two related variables from the other variable. The estimated variable is called the dependent variable and can be set to Y; the estimated variable is called the independent variable and is set to X. Regression analysis is to find a mathematical model $Y = f(X)$, so that Y can be estimated from X using a functional formula. When the form of $Y = f(X)$ is a straight line equation, it is called linear regression. This equation can generally be expressed as $Y = A + BX$. According to the least squares method or other methods, the values of the constant term A and the regression coefficient B can be determined from the sample data. After A and B are determined, with an observed value of X, an estimated value of Y can be obtained. Whether the regression equation is reliable and how big the estimated error is should be tested for significance and error calculation. Whether there is a significant correlation and the size of the sample, etc., are factors that affect the reliability of the regression equation.

2.2. Data Sources

This article selects the per capita GDP data and urbanization rate data of various provinces in mainland of China in 2020, establishes a linear regression model, and uses SPSS software for analysis. The data comes from the National Bureau of Statistics, as shown in Table 1.

3. Result Analysis

3.1. Correlation Analysis between Urbanization Rate and per Capita GDP

Correlation analysis is a statistical analysis method that studies the correlation between two variables or two or more random variables with the same status. This article uses the currently more commonly used Pearson correlation coefficient, which is between −1 and +1. The closer the absolute correlation coefficient is to 1, the more closely the data points fall on a straight line. If the variables are positively correlated, the stronger the correlation, the closer the correlation coefficient is to −1; the stronger the negative correlation, the closer the correlation coefficient is to −1. If the correlation coefficient is close to 0, it indicates that there is no significant correlation.

On this basis, we first explore the correlation between industrial structure and employment structure. This article uses SPSS to conduct correlation analysis on the data, and the results are shown in Table 2.

According to Table 2, the following conclusions can be drawn: the correlation coefficient is 0.806, and the significance level is less than 0.01. It shows that there is a very high degree of positive correlation between the two, and the linear

Table 1. Per capita GDP data and urbanization rate data of each province in the country in 2020.

Area	GDP per capita/yuan	Urbanization rate
Beijing	167,640	86.50%
Tianjin	90,176	83.15%
Hebei	47,691	56.43%
Shanxi	47,334	58.41%
Inner Mongolia	68,357	62.71%
Liaoning	57,713	68.10%
Jilin	45,753	56.98%
Heilongjiang	36,518	59.55%
Shandong	72,619	61.18%
Henan	57,051	51.71%
Jiangsu	127,285	69.61%
Zhejiang	110,450	68.90%
Anhui	60,763	54.69%
Jiangxi	55,061	56.00%
Hubei	73,297	60.30%
Hunan	60,391	56.02%
Guizhou	49,206	47.52%
Fujian	110,506	65.82%
Guangdong	96,138	70.70%
Shanghai	159,385	88.13%
Guangxi	44,671	50.22%
Chongqing	80,027	65.50%
Sichuan	58,029	52.29%
Yunnan	50,474	47.69%
Tibet	54,285	31.14%
Shaanxi	67,545	58.13%
Gansu	34,059	47.69%
Qinghai	49,455	54.47%
Ningxia	56,445	58.88%
Xinjiang	54,684	50.91%
Hainan	58,557	59.06%

relationship is very stable. It shows that the higher the per capita GDP, the higher the urbanization rate, and economic development is the endogenous decisive

Table 2. Correlation results between industrial structure and employment structure.

		per capita/yuan	urbanization rate
	Correlation		
		per capita/yuan	urbanization rate
per capita/yuan	Pearson correlation	1	0.806**
	Sig. (two-tailed)		0.000
	Number of cases	31	31
urbanization rate	Pearson correlation	0.806**	1
	Sig. (two-tailed)	0.000	
	Number of cases	31	31

**Correlation is significant at the 0.01 level (two-tailed).

Table 3. Model summary table.

Model	R	R square	Adjusted R-squared	Standard estimate error
		Model summary[b]		
1	0.806[a]	0.649	0.637	7.10397%

a. Predictor variable: (constant), GDP per capita/yuan; b. Dependent variable: urbanization rate.

Table 4. Coefficient summary.

Model		unstandardized coefficient		Standardized coefficient	t	Significance
		Coefficient[a]				
		B	standard error	Beta		
1	(constant)	−64440.632	3.063		12.908	0.000
	per capita/yuan	2259.604	0.000	0.987	7.327	0.000

a. Dependent variable: urbanization rate.

force of urbanization.

3.2. Regression Analysis of GDP per Capita and Urbanization Rate

The above analysis shows that per capita GDP and urbanization rate are significantly related. In order to explain the relationship between the two in a deeper level, SPSS software is used to conduct linear regression analysis on the two.

Establish a model: Assume that the dependent variable Y is the urbanization rate and the independent variable X is GDP per capita, then the linear regression model is:

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

Among them, $(\beta_0 + \beta_1 X)$ the influence of the explanatory variable x on the explained variable y, that is, the influence of the independent variable on the dependent variable, and ε represents the influence of uncertain random factors on

the dependent variable *y*. In order to further study whether the assumptions of the established regression model are established, the residuals were used to create the data shown in the figure below (See Table 3).

Judging from the goodness of fit of the data shown in the figure above, R2 is close to 1, which indicates that the prediction accuracy of the equation is high.

As can be seen from the above figure, the regression coefficients are −64440.632 and 2259.604 respectively. Therefore, the linear regression equation of GDP per capita, the linear relationship between the two is very significant. In addition, β is 0.987, indicating that the more investment, the higher the GDP (See Table 4 and Table 5, Figure 1).

Table 5. Residual statistics table.

Residual Statistics[a]					
	minimum value	maximum value	average value	standard deviation	Number of cases
Predictive value	49.3280%	87.7119%	59.9481%	9.50348%	31
residual	−23.99984%	17.69703%	0.00000%	6.98457%	31
standard predicted value	−1.117	2.921	0.000	1.000	31
Standardized residuals	−3.378	2.491	0.000	0.983	31

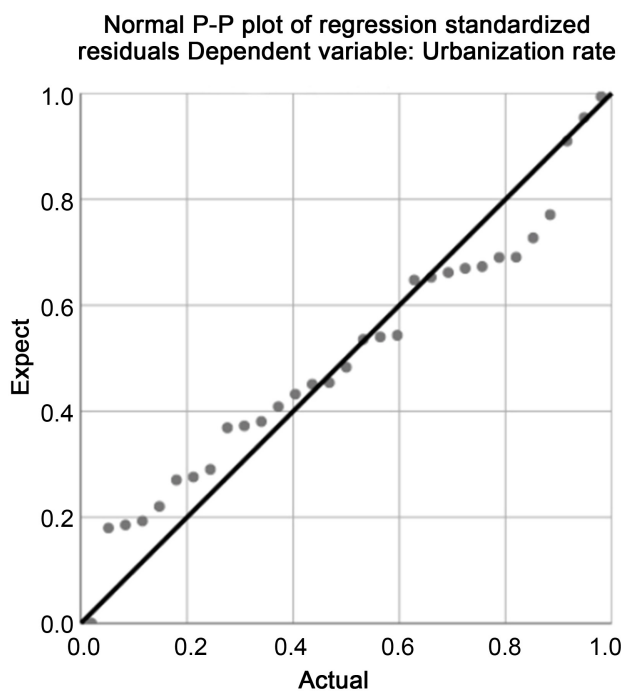a. Dependent variable: urbanization rate.

Figure 1. Normal PP plot of regression standardized residuals.

4. Conclusion

This article analyzes their per capita GDP data and urbanization rate in mainland of China and finds that there is a strong correlation between the two. It can be seen that the growth of per capita GDP will promote the urbanization process. This is in line with the actual situation in mainland of China and the relevant experience of developed countries in recent decades, and also verifies the theory that "economic development is the endogenous decisive force of urbanization" [1]. However, there is no upper limit to economic growth, but there is an upper limit to the urbanization rate. When urbanization reaches a certain level, improving the quality of urbanization is a new goal of urban development, and the concept of new urbanization came into being. In short, on the new track of new urbanization, economic development is still the top priority.

Conflicts of Interest

The author declares no conflicts of interest.

References

[1] Li, Q., Chen, Y.L. and Liu, J.M. (2012) Research on the "Promotion Model" of China's Urbanization. *Chinese Social Sciences*, No. 7, 82-100+204-205.

[2] Cai, F. and Du, Y. (2000) Convergence and Differences in Regional Economic Growth in China—Enlightenment for the Western Development Strategy. *Economic Research*, No. 10, 30-37+80.

[3] Li, Y.N. (2013) The Road to Dual Transformation of China's Economy. China Renmin University Press, Beijing.

[4] Fang, C.L. (2019) Regularity and Key Directions of High-Quality Development of New Urbanization in China. *Geographic Research*, **38**, 13-22.

[5] Jin, P. (2018) Economic Research on "High-Quality Development". *China Industrial Economics*, No. 4, 5-18.