

Co-integration Analysis on the Relationship between Urbanization Level and Employment Structure in Beijing

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Abstract. In this paper, the co-integration theory and Granger causality test theory are used to analyze the relationship between urbanization level and employment structure in Beijing. The results show that there is a long-term equilibrium relationship between urbanization level and employment structure. The improvement of urbanization level promotes the adjustment of the employment structure in Beijing.

1. Introduction

Employment is related to the national economy and the people's livelihood. From the macro level, employment growth and economic development are closely related. From the micro level, employment growth is related to the family and individual living standards. Urbanization is an important strategy of China's economic and social development. It is of great significance to expand the domestic demand, adjust the economic structure and change the mode of economic development. It is conducive to the coordinated development of the region and the development of urban and rural area. It further promotes social harmony. The process of urbanization includes the change of population occupation, the adjustment of industrial structure and the change of geographical location. Since the reform and opening, China's employment structure has rapidly changed, and urbanization is promoted smoothly. It is of great theoretical and practical significance to study how to make urbanization play the positive role effectively and optimize the employment structure for promoting the sound and rapid development of economic society.

Foreign scholars have carried out researches early on the industrial structure, employment structure and urbanization. Petty (1691) and Clark (1940) first describe the law of change of the employment structure with the economic development [1,2]. Kuznets (1966) studies the changes in the proportion of jobs and the proportion of employment in three industries, and points out that industrialization in the process of modern economic growth leads to the development of urbanization [3]. The above studies have shown that with the progress of urbanization, the proportion of industrial output and the proportion of employment will show from "one, two, three" to "two, three, one" until "three, two, one" [4]. The law has been confirmed by the economic development of the vast majority of countries, which is called "Petty - Clark - Kuznets" theorem. Lewis (1972) and Paul Krugman (1998) expound the relationship between employment, industry and urbanization from the perspective of the transfer of rural surplus labor force, the dual economic structure and the spatial aggregation of factors of production [5,6].

Domestic scholars are also constantly doing researches on the industrial structure, employment structure and urbanization. Xu Xiaodan (2011) calculates the deviation of China's industrial structure and employment structure [7]. Wang Qingfeng (2009) measures the overall coordination of China's industrial structure and employment structure [8]. Zeng Xiangquan et al. (2013) study the efficiency of rural labor absorbed by urban areas under different urbanization patterns, urbanization levels and industrial structure in China's various provinces and regions [9]. However, the research on the direct relationship between employment structure and urbanization is still relatively lacking.

For Beijing, it has a pivotal position in political and economic aspects. At the same time, Beijing's urbanization level ranks in the forefront of our country, which leads to a large number of agricultural

surplus labor force migrating to the town, resulting in population agglomeration. It has a great influence on the labor market in Beijing, and continues to affect the employment structure. Although Beijing's economy is developing continuously and the industrial structure is constantly adjusting, it is of great significance to study the impact of urbanization on the employment structure in Beijing in face of a steady flow of rural surplus labor.

This paper summarizes the existing research results on the level of urbanization and employment structure, constructs the econometric analysis model, makes an empirical study on the relationship between urbanization and employment structure in Beijing, and contributes to the adjustment of related policies about urbanization and employment structure in Beijing.

2. Empirical analysis of the relationship between urbanization and employment structure

2.1 Variable selection and data description

The data selected in this paper is from 1978 to 2015, and is from the "Beijing Statistical Yearbook". The paper uses the ratio of Beijing's urban population to the total population as the level of urbanization in Beijing (X), the ratio of primary employment in Beijing to total employment population as Beijing's primary industry employment level (Y₁), the ratio of secondary industry employment in Beijing to total employment population as Beijing's secondary industry employment level (Y₂), and the ratio of tertiary industry employment in Beijing to total employment population as Beijing's tertiary industry employment level (Y₃). The paper analyses and tests the co-integration relationship between X and Y₁, Y₂ and Y₃. In order to eliminate the influence of heteroscedasticity and the sharp fluctuation of the data, the paper chooses the logarithm of the original sequence that is denoted as lnX, lnY₁, lnY₂, lnY₃. After calculation, the correlation coefficient between urbanization and the employment level of the primary, secondary and tertiary industries is -0.94, -0.79 and 0.95 respectively.

2.2 Sequence stability test

The premise of co-integration analysis is the time series is not steady, so the smoothness of the time series is tested before co-integration analysis [10]. In this paper, the ADF test method is used to test the smoothness of the time series. The original hypothesis of the ADF test is that the time series has the unit root, which means the time series is not steady. The alternative assumption is that the time series does not have the unit root, which means the time series is steady. The sequence is tested with Eviews 9 software. The results are shown in Table 1 below.

Table 1. Unit Root ADF Test Results

Sequence	ADF Test Value	Critical Value (10%)	Conclusion
LnX	-3.079	-1.611	Steady
Lny ₁	-4.832	-1.611	Steady
Lny ₂	-3.656	-1.611	Steady
Lny ₃	-6.037	-1.611	Steady

From the test results, we can see that lnX, lnY₁, lnY₂, lnY₃ sequences reject the null hypothesis, which means there is no unit root. We can determine that lnY₁, lnY₂, lnY₃ and lnX sequences are zero order single sequence, i.e. I (0). So the next test can be carried out.

2.3 Co-integration Test

From the unit root test results, we can see that lnY₁, lnY₂, lnY₃ and lnX sequences are I (0), which satisfies the prerequisite of co-integration test. There may be co-integration relationship. The three sets of time series are respectively used to do ADF co-integration test.

We use the OLS method to estimate the linear combination of sequences to obtain the co-integration test equation between lnY₁, lnY₂, lnY₃ and lnX:

$$\text{LnY}_1 = -3.23 - 3.22 \text{LnX} \tag{1}$$

$$\ln Y_2 = -1.65 - 1.71 \ln X. \tag{2}$$

$$\ln Y_3 = -0.09 + 1.84 \ln X. \tag{3}$$

The unit root test of the residual sequence is carried out to test the smoothness of the co-integration equation of $\ln Y_1$, $\ln Y_2$, $\ln Y_3$ and $\ln X$ without constants and time trends. The results are as follows:

Table 2. ADF Co-integration Test

Sequence	ADF Test Value	Critical Value (10%)	Conclusion
U ₁	-1.848	-1.611	Steady
U ₂	-2.753	-1.611	Steady
U ₃	-1.716	-1.611	Steady

According to the results, all the null hypotheses are rejected and we can get the conclusion that there is no unit root at the confidence level of 10%. Therefore, it can be concluded that u_1 , u_2 and u_3 are stationary sequences. The results show that there is a co-integration relationship between $\ln Y_1$, $\ln Y_2$, $\ln Y_3$ and $\ln X$ from 1978 to 2015. It can be seen from the regression equation that every 1% increase in the level of urbanization in China can reduce the proportion of employment in the primary industry by 3.22%, reduce the proportion of employment in the secondary industry by 1.71%, and improve the proportion of employment in the tertiary industry by 1.84% in the long term. From the above conclusions, it can be seen that the degree of change of the comprehensive level of urbanization has a great influence on the employment of the primary and the tertiary industry, and the impact on the employment of the secondary industry mainly engaged in manufacturing is relatively low.

2.4 Granger causality test

Co-integration test shows that there is a long-term equilibrium relationship between variables, but whether it constitutes a causal relationship also need further test. If the variable X helps to predict Y, X is called Granger reason. When lag period is 1-4, the three groups of time series were tested. The specific test results are in Table 3.

Table 3. Granger Causality Test

Lag Intervals	P=1	P=2	P=3	P=4
Null hypothesis H ₀	P-value	P-value	P-value	P-value
$\ln X$ is not the Granger reason of $\ln Y_1$.	0.69	0.02	0.05	0.08
$\ln Y_1$ is not the Granger reason of $\ln X$.	0.25	0.42	0.69	0.88
$\ln X$ is not the Granger reason of $\ln Y_2$.	0.005	0.05	0.17	0.28
$\ln Y_2$ is not the Granger reason of $\ln X$.	0.95	0.39	0.58	0.78
$\ln X$ is not the Granger reason of $\ln Y_3$.	0.08	0.16	0.39	0.47
$\ln Y_3$ is not the Granger reason of $\ln X$.	0.33	0.52	0.74	0.88

Obviously, at a 10% significance level, $\ln X$ and $\ln Y_1$ have a unidirectional Granger causality when the lag period is 2-4, when the lag is 1-2, $\ln X$ and $\ln Y_2$ have unidirectional Granger Causality, and in the lag period of 1, $\ln X$ and $\ln Y_3$ has a unidirectional Granger causality, that is, the level of urbanization is the Granger reason of the employment proportion of primary industry, secondary industry and tertiary industry, not vice versa.

3. Conclusions

First, according to the analysis, correlation coefficients between urbanization and the proportion of employment in the primary, secondary and tertiary industries are -0.94, -0.79, 0.95, and it can be concluded that the urbanization is negatively correlated with the primary industry, which is strong. And the secondary industry has a negative correlation with urbanization in Beijing, which is normal. The urbanization and the tertiary industry have a positive correlation in Beijing, which is strong.

Second, the urbanization and industrial employment structure have a long-term equilibrium relationship in Beijing. In the long-term equilibrium, urbanization for each additional 1% can make the proportion of primary industry employment fell 3.22%. The long-term elasticity coefficient of the secondary industry employment structure is 1.71, and the long-term elasticity coefficient of the employment structure of the tertiary industry is 1.84.

Third, the Granger causality test further shows that the improvement of the urbanization level has promoted the adjustment of the employment structure of the primary, secondary and tertiary industries, and the influence of the change of the employment structure of the primary, secondary and tertiary industries on the urbanization level is not significant in Beijing.

The healthy and orderly development of urbanization requires strong support of the institutional system. The government should continue to advance urbanization to improve the employment structure and change the mode of economic growth to promote the coordinated development of urbanization and employment. On the basis of realizing the relationship between urbanization and employment structure, the government can promote the development of urbanization and employment structure efficiently.

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