

**RESEARCH ON THE INFLUENCE FACTORS OF EMPLOYMENT  
BASED ON GREY CORRELATION ANALYSIS- A CASE STUDY OF  
JIANGSU PROVINCE IN CHINA**

Hui Shi

College of Economics and Management, Nanjing  
University of Aeronautics & Astronautics, Jiangsu, China

**ABSTRACT**

China has the highest population in the world, since the financial crisis, the domestic employment has been facing a grim situation. As a province which is strong in economy and owns large population, Jiangsu has the stock of talent which takes a leading position in the country, and the overall employment situation is relatively stable. However, Jiangsu Province's total employment shows a slight downward trend in the past few years, the situation is not optimistic. In this paper, based on the employment function derived from the Cobb-Douglas production function and the previous literatures, the following indicators are chosen as the influence factors of employment: wage, consumption level, domestic investment, FDI, the degree of population aging, industrial structure, urbanization level and infrastructure investment. Then this paper uses grey correlation model to make an empirical analysis on the data of Jiangsu Province in 1998-2017, the result shows that these factors have significant impact on employment. Among these factors, the economic structure has the biggest impact on employment, the second is the degree of population aging, and the last one is domestic investment. Then we use the grey prediction model to forecast the employment level for the next few years. In the end, we put forward the corresponding suggestions to improve the employment situation in Jiangsu Province based on the empirical result.

**Keywords:** Employment, Production Function, Influence Factor, Grey Relation

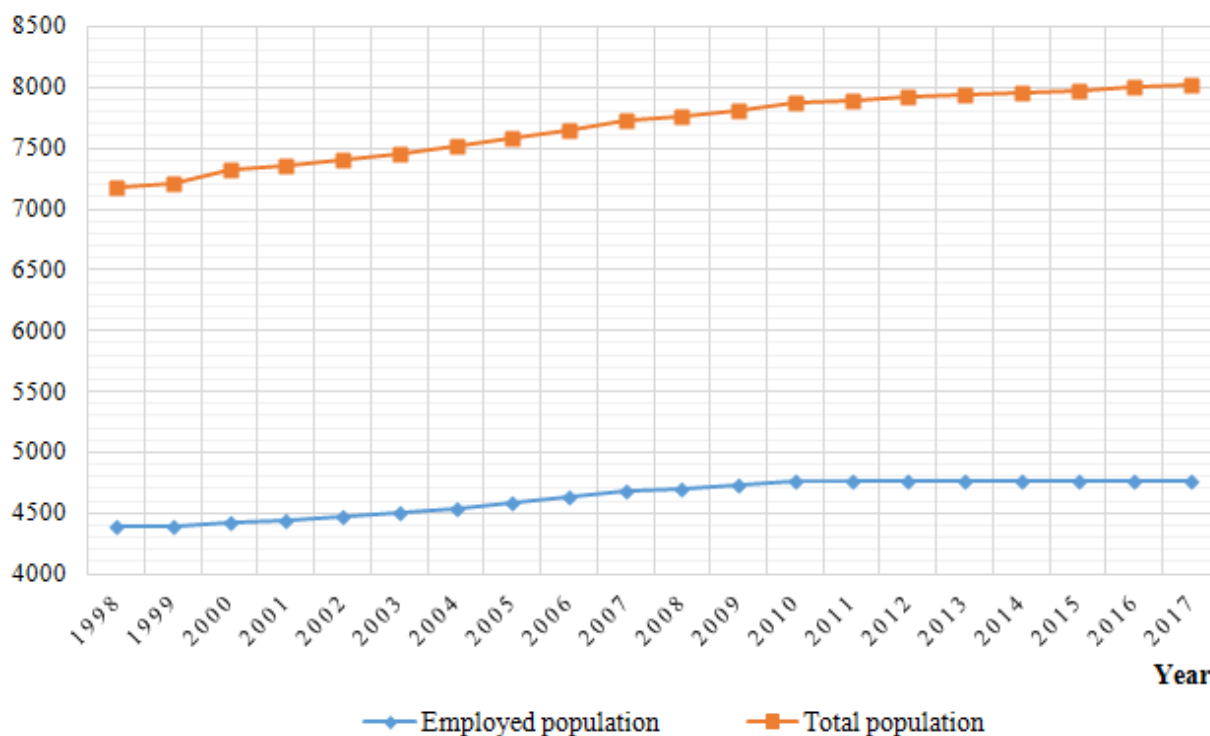
**1. INTRODUCTION**

China's State Council issued the "13th Five-Year Plan for Employment Promotion" in 2017, which proposed that employment is the foundation of people's livelihood and the cornerstone of economic development. It is required to adhere to the employment priority strategy and give full play to the role of employment in fostering new momentum of economic development and

promoting economic transformation and upgrading. The role of economic transformation and upgrading. As one of the main objectives of China's macroeconomic policy, full employment has always been an important social issue related to social stability and economic development.

China has the world's highest population, and its rural population is particularly large. Since the financial crisis, China's employment has been facing a more severe situation. In order to solve the employment problem, China began to implement the employment priority strategy during the “Twelfth Five-Year Plan” period, and even eased the employment situation by slowing down the economic growth rate. At present, the effect has been shown preliminarily, the employment situation is generally stable, but the employment pressure brought about by the large population base has not been eliminated, and the employment structure still needs to be improved. As a strong economic province, Jiangsu Province ranked fifth in the national populous provinces in 2017, and its talent stock is also at the national leading level. Figure 1 shows the number of employed people and the total population in Jiangsu Province from 1998 to 2017.

**Unit:10,000 people**



**Figure. 1: Number of employed and total population in Jiangsu Province from 1998 to 2017**

It can be seen that the number of employed people in Jiangsu has been on the rise since 1998-2010, but the growth rate of employment has slowed down and stabilized since 2010, and there has even been a slight downward trend since 2015-2017. Compared with the trend of the total population, the employment situation in Jiangsu Province is generally stable. However, when the total population of Jiangsu increased steadily in 2014-2016, the number of employed people in the three years has declined. That is to say, although the employment situation in Jiangsu Province has been relatively stable in recent years, there has been a slight downward trend, therefore the employment situation is not optimistic now. Based on the above background, this paper explores the factors affecting employment in Jiangsu Province, first we make the theoretical analysis and select appropriate indicators, then use the grey correlation model to analyze the impact of these factors on the employment of Jiangsu Province, and further propose the corresponding recommendations.

A large number of scholars have studied the different factors affecting employment. Gregory Mankun (1992) argued that wage rigidity has an important impact on employment. When the real wage is higher than the wage level that makes the supply and demand reach equilibrium, the supply of labor will be higher than the demand of labor, therefore the rigidity of wages makes the employment rate greatly reduced[1]. Carter (1988) found that urbanization has an important impact on labor employment when studying the relationship between cities and national economic development[2]. Duffy-Deno and Dalenberg (1993) used the demand structure equation to study the employment effects of infrastructure, and obtained the conclusion that the more complete the infrastructure, the greater the supply and demand of labor[3]. Similarly, Liu (2016) used the panel data model to explore the employment impact of infrastructure investment in China, the analysis showed that the increase in infrastructure investment will have a positive impact on employment in the long run, but in the short term it will generate negative impacts on employment, and employment will also be affected by factors such as fiscal expenditures, wage levels, and investment in education[4]. Gruber Et al. (2009) used natural experimentation to study the impact of social security and retirement on youth employment, the results showed that the retirement age delay caused by population aging will not cause young people to lose employment opportunities, on the contrary, it will reduce the unemployment rate of young people[5]. Ding(2008) studied the effective influencing factors of urban employment with the data of Guangdong Province, found that capital investment has a positive effect on employment, while real wage and employment rate have a negative correlation[6]. Also taking urban employment as the research object, Zhao, Pan and Wang (2014) used VAR model and principal component analysis to start their research, the results showed that the industrial structure, consumption level, urbanization level and technological progress level make the main factors affecting employment[7]. Sheng (2013) applied the stepwise regression method to refine the long-term and short-term factors affecting employment, then used the long-term cointegration

model and VAR model to analyze the impact of long-term and short-term factors on employment separately, the empirical results showed that FDI, wage levels, consumption expenditures and money supply are long-term factors that can affect urban employment; while exports and money supply are short-term factors that affect employment[8]. From previous studies, we can see that the factors which have effective impact on employment through rigorous empirical researches include wage level, urbanization, infrastructure construction, FDI, money supply, consumption level, population aging, economic structure and so on.

## **2. THEORETICAL ANALYSIS**

### **2.1 Cobb-Douglas production function**

The Cobb-Douglas production function was created by the American mathematician C.W.Cobb and the economist Paul H. Douglas. Based on a general form of production function that studies the relationship between capital input, labor input, and output, they added the factor of technological development. The Cobb-Douglas production function is the most widely used production function in the field of economics, it is often used to describe and predict the relationship between output and input of a country, region or a particular firm, and occupies a very important position in the research and application of economics. The specific formula of the production function is as follows:

$$Q = A(t)L^\alpha K^\beta \mu \quad (\alpha > 0, \beta > 0, \mu \leq 1) \quad (1)$$

Where Q is total output, L is labor input, K is the capital input, and A(t) represents the level of comprehensive technology development, when L and K remain unchanged, A(t) will have a direct impact on total output Q;  $\alpha$  represents the elastic coefficient of labor output,  $\beta$  represents the elastic coefficient of capital output, and  $\mu$  is a random disturbance term. It can be seen from formula 1 that the main factors determining the output level are labor input, capital investment and the level of comprehensive technology development.

### **2.2 Employment function**

Based on the Cobb-Douglas production function, the relationship between labor input and output can be derived, and the employment function can be further introduced. Assuming that a country is open to the outside world, then the country's investment includes foreign direct investment (FDI) in addition to domestic fixed asset investment. We add FDI to the production function of formula 1, then set  $\mu=1$ , the expression is as follows:

$$Q = AF(K_d, K_f, L) = AK_d^\alpha K_f^\beta L^\gamma \quad (2)$$

Where Q is total output, L is labor input, K is capital investment, A represents the technical level, K<sub>d</sub>, K<sub>f</sub> represent the domestic investment and FDI respectively; α, β and γ represent the elasticity of domestic capital elements, the elasticity of foreign capital elements, and the output elasticity of labor factors respectively. According to the expression above, the formula for the production cost is expressed as:

$$C = WL + \lambda(K_d + K_f) \quad (3)$$

Where W represents real wage, λ represents the unit cost of capital. The profit function is the difference between the production function and the cost function. The expression is as follows:

$$\pi = AK_d^\alpha K_f^\beta L^\gamma - \lambda(K_d + K_f) \quad (4)$$

According to the reality, the countries, regions and enterprises all want to maximize profits, then:

$$\frac{\partial \pi}{\partial L} = \gamma AK_d^\alpha K_f^\beta L^{\gamma-1} - W = 0 \quad (5)$$

Continue to further process and get the employment function:

$$\ln L = \frac{1}{1-\gamma} \ln \gamma + \frac{\alpha}{1-\gamma} \ln K_d + \frac{\beta}{1-\gamma} \ln K_f - \frac{1}{1-\gamma} \ln W + \frac{1}{1-\gamma} \ln A \quad (6)$$

According to the derived formula 6, there is a clear relationship between the number of employed people in a country or region and their wage levels, domestic and foreign investment, and technical level. Based on the employment function, we can add other suitable variables according to the previous literature and the actual situation in Jiangsu Province, so as to comprehensively study the factors affecting employment.

### 3. SELECTION OF INDICATORS

#### 3.1 Employment level

Employment refers to activities carried out for the purpose of obtaining remuneration or labor income for a citizen of legal age who has the will and ability to work. This paper uses the employment rate (the proportion of employed population to total population) to indicate the employment level, we use Y to represent it. Since the statistical caliber of the number of employees in Jiangsu Statistical Yearbook before 1998 is different from the present, the time

span of the sample selected in this paper is 1998-2017. In addition, the employed people in this paper refer to the employees on duty, therefore those employees who have retained their labor relations but have actually left the unit are not included.

### **3.2 Salary level**

Salary level means the labor remuneration paid to employees by the unit or employer in the form of money. Generally speaking, the higher the salary level, the more attractive the position, high salary will improve the enthusiasm of people's work, then the employment situation will become better. We use the average wage of on-the-job workers to measure this index, expressed in  $X_1$ .

### **3.3 Investment**

The investment mentioned in this paper is divided into domestic investment and foreign investment, mainly referring to capital investment. More capital investment will increase the demand for production materials, which will promote the increase in employment. We use fixed assets investment and foreign direct investment (FDI) as indicators to measure, using  $X_2$  and  $X_3$  to represent them respectively.

### **3.4 Consumption level**

Consumption refers to the purchase and experience of material products and services carried out by residents in order to meet their needs for survival, development and enjoyment. In order to satisfy their own consumption and maintain their desired quality of life, people must obtain certain income through labor. When the consumption level of society increases, they need to increase labor to meet higher consumption, so as to achieve the role of promoting employment. The consumption of this article mainly refers to personal consumption, which is measured by the per capita living expenditure of residents, expressed in  $X_4$ .

### **3.5 Population aging**

Population aging refers to the phenomenon that the elderly population accounts for a high proportion of the total population caused by the extension of life expectancy. Generally speaking, when a country or region accounts for more than 7% of the elderly population over 65 years old, it means entering an aging society. The aging of the population is accompanied by a delay in the retirement age, then the increase in the proportion of the middle-aged and elderly population in the social position may reduce the employment rate of young people and thus have a certain impact on employment. However, according to the research of some other relevant scholars, the deepening of the aging degree will not reduce the level of employment, but will play a certain

role in promoting the economy<sup>[9]</sup>. We use the proportion of the elderly population aged 65 and over in Jiangsu Province as the index to measure Population aging, expressed as  $X_5$ .

### **3.6 Economic structure**

Economic structure refers to the proportion of the added value of the primary, secondary and tertiary industries to GDP. With the development of economy and society, the tertiary industry occupies more and more labor, and its ability to absorb labor is becoming stronger. At the same time, the increase in the proportion of tertiary industry's output value also means the rise of technological development level, which can play a certain role in promoting employment. This paper uses the value added of the tertiary industry as a percentage of GDP to measure the economic structure, expressed as  $X_6$ .

### **3.7 Urbanization**

Urbanization level means the extent to which the population of a country or region gathers to the city, it is an important indicator for measuring of economic development. If an area has a high level of urbanization, it means the rural population around the city is constantly pouring into the city to find jobs to obtain higher incomes, which can improve the overall labor utilization rate and promote employment. We use the proportion of urban population to the total population as a measure of urbanization, expressed as  $X_7$ .

### **3.8 Infrastructure investment**

As the forerunner capital of society, infrastructure investment has a certain employment quantity creation effect. Since the boundary of infrastructure is relatively broad and the amount of infrastructure investment is not clearly defined, in view of the availability of data, we use the total fixed asset investment of the following six segments to measure infrastructure investment: "Electricity, Gas and Water Production and Supply", "Transportation, Warehousing and Post Industry", "Information Transmission, Computer Services and Software Industry", "Water Conservancy, Environment and Public Facilities Management", "Education", "health, social security and social welfare industry", expressed as  $X_8$ <sup>[10]</sup>.

## **4. DATA SOURCES AND RESEARCH METHODS**

### **4.1 Data source**

The original data is taken from the Jiangsu Statistical Yearbook 1999-2018. Since the physical meanings of the variables are different, the dimensions of the data are not necessarily the same, so it is not convenient to compare, or it is difficult to get a correct conclusion when comparing.

And considering the smoothness of the sequence, it is necessary to carry out dimensionless data processing, the original data are normalized as shown in Table 1:

**Table 1: Normalized data**

Year	Y	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>
1998	1.014	0.235	0.127	0.347	0.368	0.813	0.866	0.587	0.198
1999	1.010	0.261	0.137	0.331	0.366	0.867	0.883	0.650	0.198
2000	1.001	0.293	0.150	0.329	0.363	0.773	0.890	0.773	0.208
2001	1.001	0.337	0.165	0.367	0.407	0.780	0.905	0.794	0.230
2002	1.002	0.384	0.193	0.540	0.442	0.872	0.910	0.833	0.303
2003	1.002	0.446	0.267	0.788	0.429	1.001	0.895	0.872	0.424
2004	1.001	0.517	0.342	0.605	0.479	0.946	0.858	0.898	0.493
2005	1.002	0.596	0.437	0.657	0.574	0.959	0.883	0.941	0.512
2006	1.004	0.676	0.504	0.869	0.655	0.967	0.903	0.967	0.517
2007	1.005	0.778	0.614	1.092	0.745	1.004	0.928	0.991	0.490
2008	1.005	0.900	0.754	1.253	0.838	1.016	0.952	1.012	0.570
2009	1.004	1.020	0.948	1.263	0.928	1.054	0.982	1.036	0.812
2010	1.003	1.151	1.160	1.421	1.058	0.961	1.027	1.129	0.888
2011	1.000	1.307	1.317	1.602	1.249	1.005	1.052	1.153	1.085
2012	0.997	1.457	1.587	1.783	1.413	1.038	1.079	1.174	1.328
2013	0.995	1.648	1.800	1.659	1.681	1.112	1.128	1.194	1.623
2014	0.993	1.756	2.079	1.405	1.798	1.169	1.166	1.215	2.112
2015	0.990	1.910	2.297	1.211	1.928	1.120	1.205	1.239	2.486
2016	0.987	2.065	2.470	1.224	2.076	1.239	1.240	1.261	2.592
2017	0.984	2.266	2.652	1.254	2.201	1.305	1.248	1.282	2.929

**4.2 Grey correlation analysis**

This paper uses the grey correlation analysis model to study the factors affecting employment. The grey system association method measures the size of the correlation between two systems or factors and describes the relative changes of factors in the system development process. The grey correlation degree is divided into Deng's correlation degree, absolute correlation degree, relative correlation degree, comprehensive correlation degree, similar correlation degree and close correlation degree. For the sake of simplicity, when the system characteristic behavior sequence and the related factor sequence pass the grey correlation operator at the top of the tower, only the absolute correlation order needs to be considered<sup>[11]</sup>. The grey absolute correlation degree is considered from the relationship of absolute quantity, and the formula is as follows:



$$\varepsilon_{0i} = \frac{1 + |s_0| + |s_i|}{1 + |s_0| + |s_i| + |s_i - s_0|} \tag{7}$$

Among formula 7:

$$\begin{aligned} |s_0| &= \left| \sum_{k=2}^{n-1} x_0^0(k) + \frac{1}{2} x_0^0(n) \right|; \\ |s_i| &= \left| \sum_{k=2}^{n-1} x_i^0(k) + \frac{1}{2} x_i^0(n) \right|; \\ |s_i - s_0| &= \left| \sum_{k=2}^{n-1} (x_i^0(k) - x_0^0(k)) + \frac{1}{2} (x_i^0(n) - x_0^0(n)) \right| \end{aligned} \tag{8}$$

$\varepsilon_{0i}$  in formula 7 is the grey absolute correlation degree of two sequences,  $0 \leq \varepsilon_{0i} \leq 1$ . Generally speaking, the larger  $\varepsilon_{0i}$ , the higher the degree of association between the two sequences.

### 5. EMPIRICAL ANALYSIS

After the preliminary processing of the data obtained in the yearbooks, we calculate the grey absolute correlation degree of the employment level of Jiangsu Province(Y) and the other eight indicators( $X_i; i=1, 2, \dots, 8$ ) by using the Grey Modeling Software, then the results are sorted as shown in Table 2.

**Table 2: Absolute correlation degree and the ranking**

Factor	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>
Correlation with Y	0.5262	0.5232	0.5295	0.5316	0.5965	0.6292	0.5460	0.5255
Ranking	6	8	5	4	2	1	3	7

It can be seen from Table 2 that the absolute correlation degree between the eight indicators and the employment level Y is greater than 0.5, indicating that these factors have a great impact on employment. The impact on the employment level from large to small is: economic structure, population aging, urbanization, consumption levels, FDI, wage levels, infrastructure investment, and fixed asset investment.

According to the situation in Jiangsu Province, the economic structure ( $X_6$ ) has the greatest impact on employment, and the correlation degree between the two has reached 0.63. This is because Jiangsu has been promoting steady economic development in recent years, and vigorously promoting the adjustment of industrial structure. The added value of the tertiary

industry accounts for an increasing proportion of GDP, and its corresponding service industry is also developing rapidly. The ability of the tertiary industry to attract labor is particularly large, so the industrial structure plays a significant role in promoting employment.

Second is the degree of population aging. As mentioned above, population aging may theoretically reduce the employment rate of young people and thus affect the overall employment level, but this statement only applies to a society with a constant number of jobs. In the actual society, with the growth of the population and the development of the economy, the demand for jobs in the society is often increasing, so it is unreasonable for the older workers to “crowd out” the positions of young people. In fact, the deepening of the population aging means that the development of science and technology has improved people's quality of life and extended their life expectancy, and with the increasing demand for services such as health care, the aging of the population plays a positive role in promoting the employment level and economic development of the society. Similarly, The third factor urbanization means that rural surplus labor flows into cities, accompanied by the rapid development of the economy, which also promotes employment levels.

The factors at the bottom are infrastructure construction and fixed asset investment. This may be due to Jiangsu's strong economic strength, its infrastructure construction is relatively complete, and FDI's pulling effect on employment is more obvious than domestic investment. However, their role in promoting employment cannot be ignored.

## **6. FORECAST OF EMPLOYMENT LEVEL IN JIANGSU PROVINCE**

### **6.1 Grey prediction model**

The Grey Prediction Model GM (1,1) model of first-order single variable and GM (n, h) model of n-order h variable. It also has the characteristics of difference equations, differential equations and exponential equations. .

### **6.2 Grey prediction of employment rate in Jiangsu Province**

In general, the GM (1,1) model can be predicted as long as there are more than 4 pieces of data. In the case of rich information, the statement that "the more data, the more accurate the predictions" has not been verified. We need to judge according to the growth rate and error value of the employment rate. In order to screen the appropriate model, considering the timeliness, we select the data of recent years and establish the GM (1,1) model of different dimensions to make

a testing prediction for the employment rate in Jiangsu Province in 2017. The results are shown in Table 3.

**Table 3: Testing prediction of grey GM(1,1) model**

	Predictive value (%)	True Value(%)	Error (%)
4 dimension	59.298	59.255	0.72
5 dimension	59.317	59.255	1.04
6 dimension	59.330	59.255	1.25
7 dimension	59.338	59.255	1.39
8 dimension	59.333	59.255	1.31

From the above result, , the error value of the 4-dimension model prediction is relatively minimal in the GM (1,1) model, so we the 4-dimension model as the optimal model to predict the employment rate in Jiangsu Province in the next few years. The forecast results in the next five years are shown in Table 4.

**Table 4: Prediction of employment rate in Jiangsu Province from 2018 to 2022**

Year	2018	2019	2020	2021	2022
Predictive value (%)	59.058	58.858	58.659	58.461	58.263

Through the predictions above, the employment rate in Jiangsu Province will decline year by year in the next five years, indicating that the employment level in Jiangsu Province will continue to decline in the future, and some big problems still exist in employment. It is extremely urgent for the government to formulate corresponding policy measures.

## **7. POLICY RECOMMENDATIONS**

1) Accelerate the pace of industrial restructuring and vigorously develop the tertiary industry. As the largest manufacturing province in China, Jiangsu has achieved rich economic results relying on manufacturing industry. However, according to the trend of global economic development, the development degree and proportion of tertiary industry has become an important basis to measure the level of economic development of a country or region, therefore adjusting the industrial structure of Jiangsu has also become an important task of economic development of Jiangsu. In recent two years, Jiangsu's service industry has developed rapidly, and the growth rate of the added value of the tertiary industry has exceeded the GDP growth rate. The proportion of the added value of the tertiary industry in GDP has exceeded half especially in

southern Jiangsu, we can say the effect of industrial restructuring in Jiangsu is remarkable. However, compared with the developed countries in Europe and the United States, Jiangsu's service industry still has a lot of room for development and progress. Accelerating the pace of industrial restructuring can give full play to the strong ability of the tertiary industry to absorb labor force, thus promoting employment and economic development.

2) Create a good investment environment and increase the intensity of attracting foreign investment. The role of investment in promoting employment is very obvious, adequate capital is the prerequisite for the smooth development and expansion of production and services, and the demand for labor will increase accordingly. In particular, the introduction of foreign capital is very important to alleviate the severe employment situation in China. Therefore, we need to improve and standardize the relevant laws and regulations to increase the legal protection of foreign investment in China; we can further strengthen infrastructure construction and improve the investment service mechanism, so as to create a good investment environment for the introduction of foreign investment and further improve the level of employment.

3) Improve the mechanism of labor remuneration and promote residents' consumption. The stimulation of labor wage to employment is the most direct, perfecting the labor remuneration mechanism in Jiangsu Province can improve people's enthusiasm for work and raise employment level, and can also promote the improvement of people's living standards. What's more, rising wages can stimulate consumption, which in turn can stimulate production, thereby increasing the demand for labor and promoting employment.

4) Speed up the urbanization process and promote the transfer of rural surplus labor force. With the adjustment of industrial structure, the development of primary industry is declining, and the rural people who originally engaged in small-scale agricultural production have gradually become surplus labor force. With the deepening process of urbanization, these rural labor force has a trend of transferring to cities, on the one hand, farmers' income can be improved; on the other hand, the increasing demand for labor force in cities can be met. Therefore, it is necessary to speed up the urban and rural household registration reform, improve the working environment of these migrant workers, and provide them with institutional safeguards, so as to speed up the process of urbanization and improve the employment situation.

## REFERENCES

- [1] N. Gregory Mankiw, "Macroeconomics". Worth Publishers, 2009.
- [2] Carter Robert A, "Innovation in Urban Systems: The Interrelationships between Urban and National Economic Development". *The Annals of Regional Science*, vol.22, no.3, pp.66-79, 1988.
- [3] Duffy-Deno K. T. and Dalenberg D. R, "The Municipal Wage and Employment Effects of Public Infrastructure". *Urban Studies*, vol.30, no.9, pp.1577-1589, 1993.
- [4] Chao Liu. Theoretical and empirical analysis of the impact of infrastructure investment on employment in China. Hunan Normal University, 2016.
- [5] Gruber, Jonathan and D. A. Wise Gruber J, "Social Security Programs and Retirement Around the World: The Relationship to Youth Employment: List of Contributors, Indexes". *Journal of Pension Economics & Finance*, vol.8, no.3, pp.400-401, 2009.
- [6] Huanfeng Ding, "Research on the Factors Affecting Effective Employment in Cities——Based on the Empirical Study from 1978 to 2005". *Reform and Strategy*, vol.25, no.04, pp. 118-120, 2009.
- [7] Li Zhao, Zhiyuan Pan and Dongxia Wang, "An Empirical Study on the Influencing Factors of Urban Labor Employment——Based on Principal Component Analysis and VAR Analysis of the model". *Macroeconomic Research*, vol.34, no.5, pp.117-126, 2014.
- [8] Hongsheng Sheng, *Empirical Analysis of Factors Affecting Employment in China*. Inner Mongolia University of Finance and Economics, 2013.
- [9] Zhenwu Zhai and Zheng Ruiqi, "Discussion on the Relationship between Population Aging and Macroeconomics". *Population Research*, vol.40, no.2, pp.75-87, 2016.
- [10] Dongbo Tang, "Crowding in or out: the impact of China's infrastructure investment on private investment". *Financial Research*, vol.58, no.8, pp.31-45, 2015.
- [11] Sifeng Liu, "Grey System Theory and Its Application". Science Press, 2014.

## Authors' information

Hui Shi, College of Economics and Management, Nanjing University of Aeronautics & Astronautics, No. 29, Jiangjun Boulevard, Jiangning District, Nanjing City, Jiangsu Province, China. Tel: 1-565-167-1565. E-mail: 15651671565@163.com.