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Principal Component Analysis of Anhui Agricultural Industrialization

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Abstract. This paper is discussed the Anhui agricultural industrialization using the method of principal component analysis. The indexes include per capita net income of farmers in Anhui province, non-agricultural employment rate, urbanization rate, the total power of agricultural mechanization, universal ratio of rural water, car villages, the proportion of industrial waste water by sewage treatment in total emission. Results show that Anhui agricultural industrialization is still at a relatively low level, thus accelerating the pace of agricultural industrialization has become the key of economic development in Anhui province. Finally, this article provides the specific policy recommendations to accelerate agricultural industrialization and reduces the gap of income.

Keywords. Agricultural Industrialization，Principal Component Analysis，Index System Introductions

Introductions

The statistical data of Anhui from 2006 to 2010 shows that the gap of income between urban and rural residents in Anhui province is continued expanded. The gap between urban and rural residents is essential to the agriculture, and they correspond to three aspects, the industrialization of agriculture, rural urbanization and increasing the income of peasants. The important thing among them is the industrialization of agriculture. Industrialization of agriculture will realize the increase in farmers' income, and improve the rural economic development level, thus promote the development of the local economy.

What is the agricultural industrialization? Although definitions vary as to what industrialization of agriculture actually represents, one description provided by the council on food, agricultural and resource economics is as follows: Industrialization in agriculture refers to the increasing consolidation of farms and to vertical coordination among the stages of the food and fiber system. The internal structure of agriculture is optimized fundamentally. Integration and development in industrial and agricultural is realized.

Agricultural industrialization is the development of a region important to the performance of the agricultural economy.

This paper we propose the method of principal component analysis to discuss agricultural industrialization. The indexes include per capita net income of farmers in Anhui province, non-agricultural employment rate, urbanization rate, the total power of agricultural mechanization, universal ratio of rural water, car villages, the proportion of industrial waste water by sewage treatment in total emission. As a multivariate statistical method, principal component analysis (PCA) is a powerful tool to empirical analysis.

1 The empirical model, methods and analysis

In order to analyze problems comprehensively and systematically, we must consider a number of factors. These factors referred to indicators which involved in the multivariate statistical analysis and they reflected the agricultural industrialization. The indexes of Anhui agricultural industrialization have correlation to each other, and they tend to get information from the statistical data which reflect to the extent overlap.Variables in the multivariate statistical method will increase the computational cost and increased complexity of the problem. The process of carrying out quantitative analysis will get more information, which involved fewer variables. Principal component analysis was generated to adapt to this requirement, and the idea is the tool to solve such problems.

PCA is known as matrix data analysis.It is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of uncorrelated variables.

For example, We set up a number of indicators in the target system, and the number of such indicators are often large. There is a link between these indicators. Often, operation of PCA can be thought of as revealing the internal structure of the data in a way which best explains the variance in the data. In this case, the principal component analysis of the characteristics that can convert a large number of linear correlation index of indicators into the small number of linear independent. That is to say, this is done by using only the first few principal components so that the dimensionality of the transformed data is reduced. The number of principal components is less than or equal to the number of original variables.

2. Empirical Analysis of Anhui Agricultural Industrialization

2.1 Basic Ideas in Index System

The methods of industrial agriculture are technoscientific, economic, and political. They include innovation in agricultural machinery and farming methods, genetic technology, techniques for achieving economies of scale in production, the creation of new markets for consumption, the application of patent protection to genetic information, and global trade.

Only, single indicator can not fully show the level of agricultural industrialization in the region. It must establish a comprehensive assessment of the index system of agricultural industrialization, and scientific evaluation of agricultural industrialization approach is necessary.

Industrialization of agriculture is focused on the consumer. It implies that changes in agriculture are occurring so that the industry can better meet the demands of consumers. Anhui is a major agricultural province, and it is rich in agricultural resources. How to change the resource advantage into economic advantage of agricultural products is the key to revitalize the rural economy of Anhui. The development of agricultural product processing industry can improve the quality and agricultural products that value-added, and transfer rural labor. The focus of value-added agriculture is always on the final food product rather than the initial bulk commodity. Value-added agriculture is expected to provide higher profit margins, and it adds more value to the agricultural product. It can improve economic and social benefits, and promote rural economic development. Developing agricultural products can stimulate the development of related industries, and promote the process of industrialization in rural areas of Anhui. Appropriate understanding of the level of agricultural industrialization of Anhui and the existing problems and shortcomings, can speed up the process of agricultural industrialization. The promotion of prosperity and development of agricultural economy is the evaluation process of industrialization in agriculture to the highest standards. Often, the unity of the speed and efficiency can be thought of the important in agricultural industrialization, and we insist on the principle of comprehensive and coordinated development of the agricultural economy and rural society.

2.2The basic framework of indicator system

Per capita net income of rural is a reflection of the level of agricultural productivity, and it is development indicators. Structural indicators reflect the strength of a regional agricultural economy, agricultural technology advancement and improvement of the competitiveness. They speed up industrial restructuring and upgrading. The structure of agricultural labor force indicators reflected the process of industrialization, and can make labor from low productivity sectors to high productivity sectors of the transfer process. Representation is non-agricultural labor force indicators for the proportion of total agricultural labor force. Agricultural technology is a broad concept, which includes agricultural mechanization. Mechanization is the core of the new and the main features of agricultural industrialization. Agricultural mechanization level is a measure of essential new industrialization process of agriculture. Specific target is the total power of agricultural mechanization. It is science and technology indicator. Infrastructure indicators include number of villages benefited from water, car villages. Resources and environmental indicator is the proportion of industrial wastewater treatment by sewage treatment in total emission.

2.3 Empirical analysis

PCA is one of the most widely used dimensionality reduction techniques for data analysis and compression. It is based on transforming a large number of variables into a smaller number of uncorrelated variables PCA is employed to reduce the high dimensional data vectors. The identification index of a network connection is represented as a single number.

We can obtain the variance of each principal component, which corresponds to the original principal components. In general, we only extract the first few principal components. The front four rate of cumulative eigenvalue contribution is 94.342 percent. It is more than 85 percent of the principle, so we select the first four eigenvalues. We decided to use four new variable to replace the original seven variables.

Integrated model values based on principal component can be calculated, the results can be seen from table 1.

According to the agricultural industrialization evaluation index system, we select the indicators of Anhui province during the year from 2005 to 2009. Average data of the five year is the raw data.We standardized the raw data, and then use SPSS software for data processing. We selected the comprehensive scores and total score in cities, such as Huaibei, Bozhou City, Huangshan City, Hefei, Chaohu City, Luan, Anqing City, Chuzhou, Wuhu City. The score of the cities are sorted to their average level of agricultural industrialization and the development of a comparative analysis.

Table 1. Table 1 principal component scores

City	principal component scores	rankings
Bozhou	1.47	1
Luan	1.16	2
Hefei	0.46	3
Anqing	0.21	4
Chaohu	0.05	5
Chuzhou	-0.30	6
Huaibei	-0.43	7
Chizhou	-0.47	8
Wuhu	-0.73	9
Huangshan	-1.41	10

2.4. The results of principal component analysis

Combined principal component analysis, we can get the following results:

Comprehensive value of Bozhou city and Luan is higher respectively, and they are the first and the second rows. Agricultural industrialization and urban development of the two cities is better. Although they are both the northern city of Anhui province, Bozhou and Huaibei have the different level of industrialization in agriculture. Mechanization of agriculture in its total power in Huaibei is much smaller than that of Bozhou City. The same for level of technology in the northern city of Huaibei ,it is far less than that of Bozhou.

Hefei, Anqing, Chaohu City are three to five rows in turn, and they are belong to middle level of agricultural industrialization in the urban area. Hefei and Chaohu are

closer to the rows , and they are the third and fourth principal components. Urbanization rate of Chaohu is higher, which reach 90.73 percent, while it is only 58.58 percent of Hefei. The two principal component of the gap between the two cities is that the wastewater treatment rate of Hefei is 15.06 percent, while it is only 1.95 percent of Chaohu.

Chuzhou, Huaibei City, Chizhou City, Wuhu City, Huangshan City, they integrated values are negative, and they belong to the level of development in agricultural industrialization, which belong to poor category.

Rank of Chuzhou and Wuhu are relatively lower, one is six, and the other is nine. The scores are negative.The science and technology indicators of Wuhu City are too low, while ratio of non-agricultural employment and the urbanization rate in Chuzhou, is not high.

Luan, Anqing city both are relatively close to the top, and the composite score is relatively high. The western city of Anhui Agricultural industrialization is still quite early level of development. The indicators are not the leader, but they are in the middle front position, which makes the western city to balanced development of agricultural industrialization.

The southern city of Anhui Province is Chizhou, Huangshan. Chizhou and Huangshan are ranked last. Indicator of wastewater treatment is the proportion of resources, and the two city is zero. It is indicated that the two cities need to pay attention to the development of the protection of the environment, and it affects the sustainable development, so it also will affect the level of agricultural industrialization development assessment.

3. Conclusion

From the above analysis, the Anhui Agricultural industrialization is still in the lower level of development, thus accelerating the pace of industrialization of agriculture has become the focus of economic development in Anhui. Anhui Province will speed up the industrialization of agriculture from the following aspects:

In order to promote agricultural income ,we regard industrialization as the base. We will find a market for the agricultural products. In order to promote agricultural mechanization, we will promote the application of the entire agricultural sector comprehensively, thus promote the industrialization of agriculture and the industrialization process. Adjusting the agricultural structure is the main line, which include the adjustment of agricultural structure, the adjustment of the internal structure in agricultural and industry, and adjust the internal structure of urban and rural. Building a harmonious Anhui is the goal of the resource environment. We must put rural and agricultural ecological environment as a priority. Rural and agricultural development is based on natural resources and it is the time for us to strengthen agricultural sustainable development capacity, and promote the harmonious development between man and nature.

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