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Empirical Analysis of Regional Economic Coordinated Development Based on the Economic Network Structure

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Abstract

With the rapid development of regional economy, the economic relationship of the urban system is more active, and it is developing in an unprecedented way, structure, speed and scale, and gradually showing the characteristics of the network connection. Based on the theoretical and empirical analysis, this paper analyzes the related issues of regional economic coordinated development from the analysis of the resources and environment carrying capacity. In the empirical part, we measure the environmental carrying capacity of resources in Xi'an City based on three indexes as the supply of natural resources, ecological environment tolerance and economic social conditions support. The result shows that index score as 0.0034, 0.5286 and 0.6070, at the same time, resources and environment carrying capacity has coordination relationship with population, capital and industrial development.

Keywords*: Economic network, social network analysis, coordinated development, environment carrying capacity*

1. Introduction

China's economy has been growing rapidly since the reform and opening up, but the gap between the East and the West in China's economic growth is gradually expanding. After reform and opening up, the eastern coastal city with convenient portal effect and the development of special policy, economic rapid development, with relatively backward western regions form a larger gap[1]. Although after western big development, middle called strategic support, but due to regional differences in factor endowments greatly by natural conditions, geographical location and other restrictions, between the East, middle and west area of China and between provinces presents non coordinated economic development trend. This will not only affect the overall development of the country, but also may pose a threat to social stability so as to reduce the regional economic gap, and strive to coordinate regional economic development in China's primary objectives. So what is the coordinated development of regional economy and how to achieve are important issues to be resolved[2-3]. [1]

The Eighteenth National Congress of the CPC pointed out that our country accelerate the improvement of the socialist market economic system and accelerate the transformation of the mode of economic development must adhere to the road of new industrialization with Chinese characteristics, informatization, urbanization and agricultural modernization, promote information technology and industrialization depth of integration, industrialization and town coordination between the benign interaction, urbanization and agricultural modernization. With the group competition becoming the main form of competition, taking the city cluster as the main body to promote the process of urbanization in China has become an important choice of the road of urbanization in

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China. Urban cluster not only in groups in each spatial structure of explicit integration also includes the integration of economic, social and cultural fields, a multi-level recessive. Therefore, between the cities of the urban cluster exist close economic ties has become one of the important features of urban cluster. With the rapid development of regional economy, the economic relationship of the urban system is more active, and it is developing in an unprecedented way, structure, speed and scale, and gradually showing the characteristics of the network connection.

Based on the theoretical and empirical analysis, this paper analyzes the related issues of regional economic coordinated development from the analysis of the resources and environment carrying capacity[4]. Firstly, the coordination of regional economic development framework, that the carrying capacity of resources environment is the basis for the coordinated development of the regional economic impact of the congenital resource and environment factors corresponding to the economic activity in the absence of external forces is the difference of bearing capacity so that it shows the resources environment, but through the market mechanism can reduce the resources environmental carrying capacity gap and through the function orientation and mobility of factors to promote economic growth per capita decreased significantly, realize the harmonious development of economy; and then construct the evaluation model of resource environmental bearing capacity, from natural resources, the supply capacity of ecological environment and economic and social conditions to support the measure three aspects of Xi'an city's resources and environment carrying capacity, affected by the study on the spatial structure of the city cluster, city cluster economic ties in the modern sense, and followed the regional network node Context and other aspects. Along with the spatial structure of the urban spatial structure evolved from single center to multi center, the research on the economic connection of the urban cluster has also developed from the economic link between the nodes[5]. The research angle of view includes the discussion of the regional economic connection mechanism, and discusses the connection between the city in the area from different angles of transportation, industry, capital, information, technology and so on. Based on the economic links between cities, it is important to study the economic link in the urban agglomeration from the perspective of the whole network. The research object of the whole network of the city cluster can be the dominant network such as the aviation network, the land transportation network, and so on.

2. Literature Review

2.1. Urban Cluster Economic Network

Network from the perspective of the system, the structure properties can be characterized by the nodes and links, nodes represent the system of the individual and the attachment is the relationship between the individual, so the boundary clear network structure model, the measurement should include two parts: individual contact measurement and the characteristics of the network structure measurement. Urban cluster economic network structure model includes the measurement of the strength of economic ties and the measurement of the characteristics of economic network structure. There are two main methods for quantitative analysis of city: the empirical method and the theoretical model method[6-7]. Because the empirical method is mainly through a large number of actual investigations to determine the strength of the link between cities, such as the collection of air traffic, trade volume, traffic flow, *etc*., and therefore more suitable for a single variable in the dominant network measure. Theoretical model of rule by from practice abstracted model to calculate and compared with the empirical method, in spite of the presence of defects in some discrepancies with the actual situation, but has workload is small, the use of simple, suitable for the comprehensive analysis of the advantages, therefore, practice more the theory model method. By the revelation of the

law of universal gravitation, in economic dynamics of economic gravity theory thinks, economic links between cities also exist mutual attraction of regularity, and in terms of distance decay principle, the contact strength decreases with the increase of the distance between each other[8]. After Ravenstein bring gravity model introducing sociology and Reilly introduced gravity model into the economics, Zipf (1942) first time introduce gravity model of urban system spatial interaction analysis, from the gravity model widely used in distance decay effect and spatial interaction studies[9].

This study is to explore the economic links between cities, so the city "quality" should focus on the characterization of the city's economic development level; the total output is the primary indicator of the quality measure. Considering the people as the main body of economic activities, the city of economic links, so the population size should also measure "quality" one of the important indicators of city. With the development of urban economy, the scale of the development of the city has been advancing in depth and in the horizontal direction. The development level of the city and the area of the land in the area are obviously related to. Based on the above research, this paper argues that the scale of urban development is related to regional total population, regional area and regional economic scale. For distance measurement, physics uses the spatial distance between objects, but in the economic link measure, the actual traffic factors should be taken into account, and therefore, the distance cannot be used. Measure traffic distance can choose traffic mileage or traffic time[10]. When there are many traffic routes and a variety of modes of transportation, the traffic time to measure distance in traffic difficulties in operation. In view of the highway traffic is still the mainstream mode of transportation. This research adopts the shortest highway traffic mileage between cities as the distance between city values. Through empirical study, it is found that the intensity of urban economic linkage intensity is inversely proportional to the square of the distance between the city and the city, and the distance attenuation coefficient is 2. Network analysis will be the link between the nodes as an analysis unit, so the network structure is the link between the nodes. Network structure is characterized by the complex links between nodes, which also shows diversity with the different nodes, and the network structure will affect the behavior of the network nodes. For the formation of a number of cities in the node of network, can be a social structure, economic structure of formed by connecting nodes of network structure for insight into the characteristics of the city cluster has a certain significance. Analyze the social network and social network analysis (SNA) is a social science studies the relationship between the actors important method, is the new paradigm of the study of the relationship between social. It tries to relational schema is described by means of graph theory, algebraic modeling techniques, and explore the relation schema members or the overall impact on the structure of the applicable in the research group of the interactive relationship and population structure. Network theory, the "relationship" as the unit of analysis, the structure is viewed as the relationship between actors, the structure not only is the behavior of the structure of the economy can also be social and political structure, but the most important is influence to the structure as well as on how much influence the behavior of members of the network.

2.2. The Coordinated Development of Regional Economy

As early as 1830s, domestic and foreign scholars began to pay attention to the coordinated development of regional economy, but from the middle of the twentieth Century began to formally put forward the issue of regional economic coordinated development. In the middle of, scholars have different understanding of the concept of coordinated development of regional economy from the middle of 1990s. But most scholars define the coordinated development of regional economy is the description of the inter regional economic relationship and the contact area between is dynamic, around the same time the development is common and sustained, economic disparities gradually narrowing. As a result, many researchers in the understanding of regional economic

coordinated development are based on the economic relationship between the regions, emphasizing the regional relations. The coordinated development of regional economy is a process, through which the economic exchanges between the regions are formed, and the process of the development of regional synchronization is realized. The latter also emphasizes the coordinated development of regional economy development from disequilibrium to relative balance[11]. The quantitative study on the coordinated development of regional economy, scholars mainly create models and application of indicators to determine the degree of coordinated development between regions. Through selection and regional economic coordinated development related indicators, using specific evaluation methods of practical judgment of China's regional economy coordination and coordination characteristic analysis, and the research on the spatial pattern of regional economic space linked. According to own on regional economic coordinated development of the re definition and analysis for judgment standard of regional coordination, regional differences and regional differences in the economic development of economic relations, regional economic growth can be a good measure of whether the coordination problem.

Not only will the level of economic development of a region population restraint effect, environmental resources endowment also limit the number of people. The academic circles began to research resources and environment factors of population and economic relations among join. The research team of Chinese Academy of Sciences Chinese situation analysis between population resources and economic ties from theory, that the increase of population and shortage of resources is the direct factor influencing economic growth China. Research of foreign scholars on the relationship between the environment and economy earlier, after 1990 will the empirical analysis, the important results is EKC, scholars on consideration of economic coordinated development between the areas is based on China's increasingly area gap, a lot of research has a strong practical significance, and based on the coordinated development of regional economy meaning definition, quantitative analysis and policy consideration, but the interpretation of the definition is still not enough, the lack of comprehensive and systematic definition. The study on the relationship of development within the region are mainly involved in population, economy and the relationship between resources and environment, most research and carrying capacity on resource and environment for empirical analysis on bearing capacity evaluation. In view of the above two aspects, the carrying capacity of resources and environment of regional coordinated development is insufficient.

3. Regional Economic Coordinated Development Model

3.1. Evaluation of Resources and Environment Carrying Capacity

There are many factors affecting the carrying capacity of resources and environment. The model is mainly used to measure the level of the resources and environment carrying capacity in the region, which is used to explain the level of the bearing capacity of regional resources and environment. Ecological environmental bearing capacity index is mainly used in the treatment of domestic waste harmless treatment rate, the annual average concentration of sulfur dioxide and the per capita waste water emissions. The former is the representative of the capacity of the ecological environment, and the latter is the representative of the ecological pressure. Ecological environment pollution is mainly waste gas, waste water and waste. Air pollution is mainly from sulfur dioxide, the annual average concentration can better explain the air condition, and the index followed the principle of operation. The per capita waste water discharge is measured by the water pollution situation. The harmless treatment rate of domestic waste represents the pollution purification ability. Economic and social conditions in support of the class are mainly selected per capita GDP, the proportion of the third industry, the per capita disposable

income of urban residents and urban population density. Per capita GDP is a common measure indicators of the level of economic development in the region, and the proportion of the third industry can explain the development situation in the industry, urban residents per capita disposable income measure people's living standards, urban population density is illustrated in the social condition of the main population pressure situation. In this paper, the urban population density is calculated by dividing the urban area, which mainly reflects the city's population pressure.

The regional economic coordinated development defined in this paper is different from other systems, and the main features are as follows:

1) ***Comprehensive:*** coordinated development of regional economy is the overall concept, not only is the relation of various parts of the sub system in the area of adaptation and matching, or relationship between regional economic coordination. Is not only a single factor, or economic, resource environment and other elements of the comprehensive, reflecting the concept of harmony between man and nature.
2) ***Matching:*** the coordinated development of regional economy is not the reduction of the total gap of the regional economy, which emphasizes the connotation of the realization of the sustainable development of the regional internal subsystems. Within the region sustainable development emphasizes the resources and the environment is not variable resource endowments and economic, population match is water, air and other natural resources, topographic features and population distribution, industry positioning is to match, if economic growth does not exceed the carrying capacity of resources and environment, is the realization of the match.
3) ***Hierarchy:*** similar to the classification of the main functional areas, according to the resources and environment carrying capacity, the regional economic coordinated development also has the degree of points and corresponding. The main function area is defined as the priority, focus, restriction and prohibition of the development of the four types of regions, and then the corresponding degree of regional coordination is very, basic, less and not very coordinated.

3.2. Coordination Degree Model

The first is to evaluate the overall coordination degree of the difference of environmental carrying capacity and economic growth. According to the definition of economic growth, the most direct measure of economic growth is the per capita output or per capita income, this paper describes the economic growth of GDP per capita. The variation coefficient is used to measure the difference of the environmental carrying capacity and the difference of economic growth. The specific calculation formula for the coordination degree is:

$$C = \left\{ \frac{f_t \times g_t}{\left| \left(f_t + g_t \right) \div 2 \right|^2} \right\}^K \tag{1}$$

Among them, C is the coordination degree; K is the adjustment coefficient, f_t is the comprehensive resource environment carrying capacity coefficient of t time; g_t is the t time of the per capita GDP coefficient of variation. In this paper, the variation coefficient of the comprehensive resources and environment carrying capacity is calculated according to the coefficient of variation coefficient, which is based on the coefficient of variation coefficient:

$$f_t = \frac{\sqrt{\sum_j \left(z_{jt} - \overline{z_t} \right) / n}}{\overline{z_t}} \tag{2}$$

$$g_t = \frac{\sqrt{\sum_j \left(x_{jt} - \overline{x_t}\right) / n}}{\overline{x_t}} \tag{3}$$

The range of the coordination degree of C for 0-1, the greater the value of that index more coordinated. Although the coordination degree can reflect the degree of coordination between the indicators, but it is difficult to reflect the index of the development level, which both are coordinated to a better or worse coordination. Is the level of coordination of the development level is high or low, is the difference between the two are small or large. Therefore need to introduce the coordinated development degree D to comprehensive evaluation of coordination and level, the calculation formula is as follows:

$$D = \sqrt{C \times (1 - T)} \tag{4}$$

$$T = a \cdot f_t + \beta \cdot g_t \tag{5}$$

Among them, D is the coordinated development degree, the range is 0-1; t for resources and environment bearing force and per capita GDP difference degree of development; beta and for specific weight. Due to the importance of the two indicators are the same, and weight each for 0.5, t value more novel Ming difference is smaller, it means better development, and when 1-T increase, D value will be bigger.

4. The Empirical Analysis

4.1. Index Weight

The method of determining weights is generally divided into subjective assignment method, such as the expert scoring method, and the objective evaluation method such as principal component analysis, factor analysis. Because the subjective evaluation method is more subjective, different experts often have different opinions; it is difficult to ensure the accuracy of the weight, so this paper uses the objective evaluation method of the principal component analysis method to set the weight. Use SPSS software to resources and environment carrying the indexes of comprehensive evaluation index system of principal component analysis and selection of 2014 national 30 provinces, cities and autonomous region resource environmental bearing capacity of relevant data, according to the table 1 results show KMO value is 0.751, principal component analysis of fitness for the general, principal component analysis. And Bartlett's spherical degree test Sig=0<0.5, through the inspection, can carry on the principal component analysis.

Table 1.The Result of KMO Statistical Test and Bartlett Test

Kaiser-Meyer-Olkin		0. 751
Bartlett test	Approximate chi-square	185.293
	df	55
	Sig.	0.000

Table 2. Index Layer each Factor Weight

First level indicator	Second level indicator	weight
Natural resources supply	Percentage of Urban Non construction area	0.079
	Surface relief index	0.075
	Per capita water resources	0.092
	Proportion of mining industry employees	0.031
Ecological environment tolerance	harmless treatment rate of garbage	0.108
	S02annual average concentration	0.051
	Per capita waste water discharge	0.113
Economic and social conditions support	Per capita GDP	0.129
	Third industry specific gravity	0.089
	Per capita disposable income of urban residents	0.125
	Urban population density	0.108

4.2. Difference of Resources and Environment Carrying Capacity

Because of the negative value of the above evaluation scores, the data are transformed into positive value in order to calculate the variation coefficient of the resource environment carrying capacity. In this paper, the author uses the min max norm method proposed by Han Jiawei:

$$X' = [(X - \min A)/(\max A - \min A)](\max A' - \min A') + \min A'$$

Among them, X' is the new data obtained after processing, X is the original data, maxA and minA respectively represent the maximum and minimum of the original data, and the new evaluation score is obtained by calculating:

Table 3. Resource and Environment Carrying Capacity

year	Natural resources supply	Ecological environment tolerance	Economic and social conditions support	comprehensive
2010	-0.119	-0.084	0.064	-0.139
2011	-0.141	-0.039	0.065	-0.115
2012	-0.151	-0.033	0.061	-0.123
2013	-0.140	0.049	0.056	-0.036
2014	-0.127	0.010	0.048	-0.069
2015	-0.160	0.039	0.069	-0.053

Table 4. New Index Score of Resource and Environment Carrying Capacity

year	Natural resources supply	Ecological environment tolerance	Economic and social conditions support	comprehensive
2010	0.1121	0.2054	0.5943	0.0595
2011	0.0549	0.3221	0.5974	0.1221
2012	0.0290	0.3396	0,5868	0.1030
2013	0.0562	0.5550	0.5735	0.3323
2014	0.0001	0.5476	0.5962	0.2915
2015	0.0034	0.5286	0.6070	0.2866

In order to measure the economic growth of the two regions of the state, we use the difference coefficient of Xi'an city and Zhengzhou city per capita GDP, according to the theory of this paper, the mobile factors (population, capital) and industry will achieve coordinated development through economic growth. At the end of the year, the resident population represents the size of the labor force, the investment rate represents the capital flow, and the third industry output value represents the industrial development.

Table 5. Economic Growth Related Coefficient of Variation

year	Per capita GDP	population	capital	Industry development
2010	0.2950	0.5540	0.0454	0.7602
2011	0.2649	0,5598	0.2137	0.7589
2012	0.2370	0.5670	0.1909	0.7558
2013	0.1912	0.5651	0.1856	0.7386
2014	0.1632	0.5650	0.1620	0.7102
2015	0.1554	0.5637	0.1316	0.6999

4.3. Differences between the Coordination Degree

It can be seen that there is a certain correlation between the resources and environment carrying capacity of Zhengzhou city and city, that is, the difference of resources and environment carrying capacity is reduced, and the per capita GDP is reduced to a certain extent. The correlation coefficient was 0.695, and the correlation coefficient was, which was significantly related to the level of 0.05 by using SPSS.

Table 6. Correlation between Difference of Bearing Capacity and per Capita GDP

factor	index	carrying capacity	Per capita GDP difference
Difference of resources & environment carrying capacity	Pearson correlation	1	.695*
	Significant (bilateral)		.026
	N	10	10
Per capita GDP difference	Pearson correlation	.695*	1
	Significant (bilateral)	.026	
	N	10	10

And then use the coordination degree model of both the coordination degree analysis, the differences between the scores of the force and per capita GDP variability coefficients were substituted into the coordinated development of the formula for the calculation of resources and environment carrying capacity, calculated resource environmental bearing capacity difference and the difference of per capita GDP coordination degree and coordinated development degree. At the same time, the resources and environment carrying capacity of the first level indicators of the natural resources supply, ecological environment and population, capital and industry development coefficient of variation of two pairs of coordinated development degree. At the same time, the resources and environment carrying capacity of the first level indicators of the natural resources supply, ecological environment and population, capital and industry development coefficient of variation of two pairs of coordinated development degree.

Table 7. Coordination Degree between Resource Environment Carrying Capacity and Economic Growth Difference

year	Coordination degree between REC and Per capita GDP difference	Coordination degree between REC and Population difference	Coordination degree between REC and Capital difference	Coordination degree between REC Industry development difference
2010	0.6277	0.9999	0.0312	0.6304
2011	0.8216	0.9312	0.7444	0.4318
2012	0.7679	0.8543	0.7636	0.2909
2013	0.8839	0.9695	0.8353	0.4212
2014	0.7216	0.4307	0.6770	0.3108
2015	0.6410	0.8582	0.7606	0.1734

5. Conclusion

With the gradually accelerate the process of urbanization, exacerbate the contradictions of resource environment and industrial development, industrial development lead to serious pollution of the environment, and to achieve rapid economic growth, chose to waste resources and pollute the environment for economic development path cost. In order to alleviate the contradiction and realize the sustainable development, we must pay close attention to the resources and environment carrying capacity, re carry on the function localization, select the suitable industry and consider the suitable scale of the industrial development. According to resources and environment carrying force identify important dominant factors and its supporting industries and stick to adapt to the scale of the industry, in the adaptation of the selection of regional industry, industrial structure adjustment based on the main functional area planning. The basis of dividing the main functional areas is the comprehensive consideration of location, factor endowments and economic and social development. Can consider in smaller regional differences in the area to the city as the basic unit, and in a larger geographical differences in to town or county as the basic unit, through this division makes main functional areas, more operational, the effect was more prominent, and to take full account of the development of local industry, to guide the industry planning.

The government should make clear their respective responsibilities and obligations, through the reasonable construction to promote regional cooperation. Actively promote the government information disclosure, clearly inform the industry positioning and selection, by creating a favorable investment environment to increase industrial development, but need to be based on the ecological environment to be reasonable control. First, the government departments to comprehensive analysis of the layout, to determine the direction of industrial development, and the environmental protection departments should be strictly regulated to ensure that the measures are in place to implement. Establish a reasonable ecological compensation mechanism. With the goal of equality of public services and the promotion of common prosperity of the people, there are different compensation for different resources and environment in the region. From the point of view of ecological compensation, even if accept compensation, it is not necessarily to achieve development. Ecological compensation should be based on the idea of sustainable development, to establish a linkage mechanism between compensation and compensation to achieve common development.

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