Analysis of the Influence Factors of the Sustainable Development of Regional Industrial Economy Based on the Generalized C-D Production Function

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Abstract — In this paper, the author studies on the influence factors of the sustainable development of regional industrial economy based on the generalized C-D production function. Linear production of traditional industrial system had been difficult to maintain, a new production mode must be found to meet sustained and healthy development of human society, and industrial ecology offers a new direction to change traditional linear production mode. In this paper, the author researched about the problem by using generalized C-D production function and the result reveals that the performance can be improved when we use the generalized C-D production function.

Keywords - influence factors; sustainable development; regional industry economy; generalized c-d production function.

I. INTRODUCTION

Industrialization has dominated material production and economic development of human society since the Industrial Revolution in the 18th century. However, the traditional industrial production causes serious damage to the global ecology while meeting increasing material demands of people. Gradually people recognized that linear production of traditional industrial system had been difficult to maintain, a new production mode must be found to meet sustained and healthy development of human society, and industrial ecology offers a new direction to change traditional linear production mode. Nowadays, ecological mode has been urgent need of industrial development for countries, and played an increasingly important role in regional economy. As a developing country, China is currently in the mid-term of industrialization, enterprises are still used to traditional linear production which is characterized by extensive production with a large consumption of resources, this phenomenon leads to serious problem of industrial pollution and resources waste, and prevent the sustainable development of society and economy and the improvement of human living quality. Therefore, to turn extensive production mode of China’s traditional industrial development into green and eco-model has been the urgent need of development of China’s industry, and development of eco-industry has been the inevitable requirement and the only way for China to realize harmonious society. Under this situation, we take regional industrial ecosystem as an object to study, with a view to provide theory and practice reference for strengthening the process of industrial ecology and recycling economics, analyzes the relation between regional industrial ecosystem and above theories, and by taking above relation as the basic framework of the theory of regional industrial economy, Cheng’s [2] paper constructs a systematic and comprehensive theory of regional industrial ecosystem framework, and then build a theoretical foundation of the study. In order to analyze the operating mechanism and the efficiency of regional eco-industrial system comprehensively and systematically, he constructs regional eco-industrial system, gives the definition of regional industrial ecosystem and indicates its characteristics. On this basis, he investigates the overall structure, the industry chain structure and spatial structure of regional industrial ecosystem, and studies the function of regional industrial ecosystem from the aspects of production, aggregation, diffusion, and ecology. Based on the analysis of structure and function of regional industrial ecosystem, Li’s paper [3] investigates the operating mechanism of regional industrial ecosystem. From aspects of internal coupling and external coupling, Li studies coupling mechanism of regional industrial ecosystem. From aspects of enterprises’ internal demand, governmental action, resources depletion and technology feasibility, he analyzes dynamic factors of regional industrial ecosystem, and establishes of the dynamic mechanism model of regional industrial ecosystem. Then his paper indicates the non-linear essence of the evolution of regional industrial ecosystem, and establishes the logistic model of the evolution mechanism of regional industrial ecosystem. Furthermore, he researches symbiotic mechanism of regional industrial ecosystem from aspects of cost-push mechanism, efficiency-driving mechanism, environment-oriented mechanism and endogenous mechanism.

Zhang’s [4] paper uses emerge analysis to study the assessment of eco-efficiency of regional industrial ecosystem. On the basis of introduction of Emery evaluation theory, he constructs and analyzes emerge flow system of regional industrial ecosystem and designs assessment index system of regional industrial eco-system. Zhang takes Harbin industrial ecosystem as a study case, applies designed assessment index system to analyze and evaluate eco-efficiency of...
II. THE GENERALIZED C-D PRODUCTION FUNCTION

Although China’s industry economy has entered the industrialization intermediate stage and made the fast progress, China’s industry economy is facing the stern challenge, contradiction and difficult. Such as, the manufactured products added value is not high, most of the product is in the low situation of global value chain and the industry economy overall benefit is not high by contrast with the developed country and areas. Analyzing intrinsic driving influence of the grows of China’s industry economy by using scientific method in order to discover the existent question and scarcity in the run-time of industrial economic.

Industry is the pillar and the core of the national economy, industrial economic efficiency is the roll booster of economic modernization to power. To enhance the efficiency level of industrial economic operation, is an urgent need to change our industry "big but not strong" situation, but also in the Scientific Outlook on Development down key to construct the harmonious society lies. At present, China’s industrial base system is not strong, and the information age trend will push the reform and development of China’s industry, the core content of industrial efficiency as the transformation of economic development mode, has become one of the frontier research topics in the field of modern economic growth theory and land demand prediction, which mainly based on CD production function model, and analyzes the using status of construction land in YuLin. Considering that the influencing factor such as population, economic development etc, and his paper shows three factors which have significant correlation influence on the construction land demand through analyzing the relationship between intra-area construction land demand and economic development. Ha’s [6] paper takes the existing social economy statistical data and construction land data as foundation in YuLin, and using trend forecasts and other prediction technique works out the numerical value of GDP, investment in the fixed assets, and total population in YuLin. On this basis, Dickinson’s [7] paper uses three prediction techniques (CD production function model, Multiple linear function prediction model, Category Prediction) to predict the demand of construction land in 2010 and 2020 in YuLin. At last, according to contrastive analysis, the paper finally obtains a more scientific and rational construction land demand.

III. THE GENERALIZED C-D PRODUCTION FUNCTION AND RELATED ALGORITHM

At present the research of production function model is quite complete. The C-D model is mainly applied for empirical analysis of input factors in the economic growth. The content is becoming more deepened and enrich, which included institutional factors, industry structure factors, human resource factors. Least square method is the major estimation method about production function model parameter. The quintile regression is used less and just stay in the level of empirical analysis. In Fang’s paper [8], the Cobb-Douglas production function (CD production function) model with two explanatory variables is used as an example to do quintile regression method research of cross-sectional data and panel data production function model parameters estimated. On the basis of the results of the analysis of scholars, quintile regression method of cross-sectional data and panel data production function model is proposed respectively through theoretical methods and Monte Carlo
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State clearly in the preface of WTO, “Recognizing that their relations in the field of trade and economic endeavor should be conducted with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, and expanding the production of and trade in goods and services, while allowing for the optimal use of the world’s resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to seek both to protect and preserve the environment and human health and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development”, this make sustainable development become one important topic of free trade. The liberalization of trade favors all the parties of international community in their relations in the field of trade and economic endeavor.

The basic equation of C-D production function is shown as:

\[ Q = A \times L^a \times K^b \] (1)

\[ u_i = U_i \sin \omega_i t \] (2)

Set \( \omega_i t = Y \), \( \omega_i t = X \), then

\[ X = 2\pi k + \pi - \alpha_i - \pi M \sin Y \]

\[ u_{p1}(X,Y) = \left\{ \begin{array}{ll}
0 & 0 < 2\pi k + \pi - \alpha_i - \pi M \sin Y \\
\pi & \geq 2\pi k + \pi - \alpha_i + \pi M \sin Y
\end{array} \right. \] (3)

The double Fourier series of function \( u_{p1}(X,Y) \) is given:

\[ u_{p1}(X,Y) = \frac{A_{00}}{2} + \sum_{n=1}^{\infty} \left( A_{n0} \cos nX + B_{n0} \sin nY \right) + \sum_{m=1}^{\infty} \sum_{n=1}^{\infty} \left[ A_{mn} \cos (mX + nY) + B_{mn} \sin (mX + nY) \right] \] (4)

In the above formula

\[ A_{mn} + jB_{mn} = \frac{2}{(2\pi)^2} \]

\[ \int_0^\pi \int_0^\pi u_{p1}(X,Y) e^{j(mX + nY)} dXdY \] (5)

Take the formula (3) into formula (5)

\[ A_{mn} + jB_{mn} = \frac{E}{6\pi^2} \]

\[ \int_0^\pi \int_0^\pi \frac{2\pi \pm \pi - \pi M \sin Y}{2\pi \pm \pi - \pi M \sin Y} e^{j(mX + nY)} dXdY \]

\[ = \frac{E}{j6m\pi} e^{j(m\pi - \alpha_i)} \left[ \frac{1}{\pi} \int_0^\pi e^{j(m\pi \sin Y)} e^{-j\alpha Y} dY - \frac{1}{\pi} \int_0^\pi e^{-j(m\pi \sin Y)} e^{j\alpha Y} dY \right] \] (6)

By Bessel function,

\[ \frac{1}{\pi} \int_0^\pi e^{j(m\pi \sin Y)} e^{-j\alpha Y} dY = J_n(m\pi \sin Y) \frac{e^{\sin \pi \alpha}}{2} \]

\[ \frac{1}{\pi} \int_0^\pi e^{-j(m\pi \sin Y)} e^{j\alpha Y} dY = J_n(m\pi \sin Y) \frac{1-e^{\sin \pi \alpha}}{2} \]

Then,

\[ A_{mn} + jB_{mn} = \frac{E}{j6mn} J_n(m\pi \sin Y) \left[ \frac{1}{2} - J_n(m\pi \sin Y) \frac{1-e^{\sin \pi \alpha}}{2} \right] \] (7)

IV. THE INFLUENCE FACTORS OF THE SUSTAINABLE DEVELOPMENT OF REGIONAL INDUSTRIAL ECONOMY

State clearly in the preface of WTO, “Recognizing that their relations in the field of trade and economic endeavor should be conducted with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, and expanding the production of and trade in goods and services, while allowing for the optimal use of the world’s resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and human health and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development”, this make sustainable development become one important topic of free trade. The liberalization of trade favors all the parties of international community in their relations in the field of trade and economic endeavor.

The calculation of trade favors all the parties of international community in their relations in the field of trade and economic endeavor.
concept “need”; the other is a concept “limit”. The content of sustainable development is still uncertain that make to meet the needs of present and the need of future, become a relative concept. So, we can only do a dynamic definition of sustainable development, it is unable to make static definition. Secondly, the concept of sustainable development is the response of the international communities to face the conflicts of environment and development for a long time.

Figure 1 shows the regression analysis result of the eastern part. Figure 2 shows the regression analysis result of the central part while figure 3 shows the regression analysis result of the western part.

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**Figure 1. The regression analysis result of the eastern part**

**Figure 2. The regression analysis result of the central part**

**Figure 3. The regression analysis result of the western part**
V. CONCLUSIONS

In this paper, the author studies on the influence factors of the sustainable development of regional industrial economy based on the generalized C-D production function. The overall distribution characteristics of the economic growth of Beijing and China can be reflected through the quintile regression method, which can be used by the government for understanding the overall growth and appropriate decision. Regression method makes up the shortage of least square method about estimation parameter of production function model. Next, different angles, such as cross-sectional data panel data quintile regression can be used for quintile regression research.

Gradually people recognized that linear production of traditional industrial system had been difficult to maintain, a new production mode must be found to meet sustained and healthy development of human society, and industrial ecology offers a new direction to change traditional linear production mode. Nowadays, ecological mode has been urgent need of industrial development for countries, and played an increasingly important role in regional economy. As a developing country, China is currently in the mid-term of industrialization, enterprises are still used to traditional linear production which is characterized by extensive production with a large consumption of resources, this phenomenon leads to serious problem of industrial pollution and resources waste, and prevent the sustainable development of society and economy and the improvement of human living quality. Linear production of traditional industrial system had been difficult to maintain, a new production mode must be found to meet sustained and healthy development of human society, and industrial ecology offers a new direction to change traditional linear production mode. In this paper, the author researched about the problem by using generalized C-D production function and the result revels that the performance can be improved when we use the generalized C-D production function.

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