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The Impact of Rural Revitalization on Urban Rural Income Gap

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Abstract: *With the comprehensive completion of China's poverty alleviation goals and tasks. China's agricultural and rural work has reached a new level and is stepping into a new journey to achieve the second Centennial goal. However, in terms of the current development situation in China, the digital economy enabling Rural Revitalization and development is still in its infancy. Combined with the coupling model of digital economy and rural revitalization, the main problems in the coupling process are analyzed. Considering the influence of the five dimensions of rural revitalization and the three dimensions of digital economy, the evaluation index system table of digital economy and rural revitalization is established. The data in the table are preprocessed by linear interpolation method, and the positive and negative indicators are obtained by standardized matrix. Then, based on the entropy method and comprehensive evaluation function, a coupling evaluation model is established to analyze the coupling coordination type of digital economy and rural revitalization from 2013 to 2021, which is mainly a "football" type transition. In order to predict the adjustment strength, conditions and time needed for China to reach the basic level of urban-rural income gap of OECD member countries, grey prediction models were established respectively under the condition of the current adjustment strength unchanged and the adjustment strength and conditions obtained from regression prediction. The final result is that our Congress will reach the basic level of the United States and other OECD member countries in 2055, with the current adjustment force unchanged.When the country continues to increase support for the digital economy and rural revitalization Strategy. China will reach the basic level of the United States and other OECD member countries in 2046.*

Keywords: *Rural Revitalization, Digital economy, Entropy method coupling evaluation model, Grey prediction model*

1. Introduction

1.1 Background

With the comprehensive completion of the poverty alleviation goal and task, the focus of China's "agriculture, rural areas and farmers" work has historically shifted to comprehensively promoting rural revitalization, which marks that China's agricultural and rural work has reached a new level and is on a new journey to achieve the second centennial goal. However, in terms of the current development situation in China, the digital economy enabling rural revitalization and development is still in its infancyAccording to the relevant data released in the white paper on the development of China's digital economy (2022). China's digital economy accounted for 39.8% of GDP in 2021, and the trend of digital industrialization and industrial digitalization has been continuously strengthened. However, different from the accelerated development of China's overall industry digitalization, the penetration of agriculture as the primary industry in the digital economy of the three major industries was only 8.9%, rising slowly, while the proportion of developed countries was 14% in the same period. Which reflects the current situation of China's insufficient breadth and degree of integration of digital economy and real economy. The existing coupling degree evaluation models are classified into eight types: proportion evaluation model, elasticity coefficient evaluation model, entropy change evaluation model, spatial geometry evaluation model, efficacy function evaluation model, grey correlation evaluation model, comprehensive function relationship evaluation model, system dynamic evolution evaluation model, etc. These models can accurately evaluate the level of coupling and coordinated development, but it is difficult to evaluate the relative development of two or more subsystems. When voting and scoring one of the indicators, the commonly used analytic hierarchy process completely does not consider the correlation between the hierarchical weights, which is too subjective and ultimately leads to the inability to provide new solutions

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for decision makers. This also urges us to use better methods to establish more reasonable models.

2. Data preprocessing

2.1 Data sources

The data mainly refer to China Statistical Yearbook, China Rural Statistical Yearbook, National Bureau of statistics, etc. In order to ensure the continuity of data, the data from 2002 to 2021 are selected as the sample study interval for the three dimensions of digital economy and the five dimensions of Rural Revitalization.

The foundation of constructing the mathematical model of the coupling of digital economy and rural revitalization is to select a scientific and reasonable evaluation index system. This paper establishes the evaluation index system of digital economy and Rural Revitalization by referring to the existing research results of Li Yanling[1], Zhu Hongjin[2]. (table 1)

Table 1: Evaluation index system of digital economy and Rural Revitalization

system	index	Index weight
Digital economy	Digital infrastructure Agricultural digitization Agricultural digital industrialization	0.498 0.329 0.278
Rural Revitalization	Industrial prosperity Ecologically livable Rural civilization Effective governance Affluent life	0.165 0.267 0.243 0.134 0.085

The per capita disposable income of rural residents and the per capita disposable income of urban residents from 2013 to 2021 are selected. Since there is no per capita disposable income of rural residents in 2013, the rural-urban income gap is expressed by the ratio of per capita disposable income of urban residents to that of rural residents[1-2].

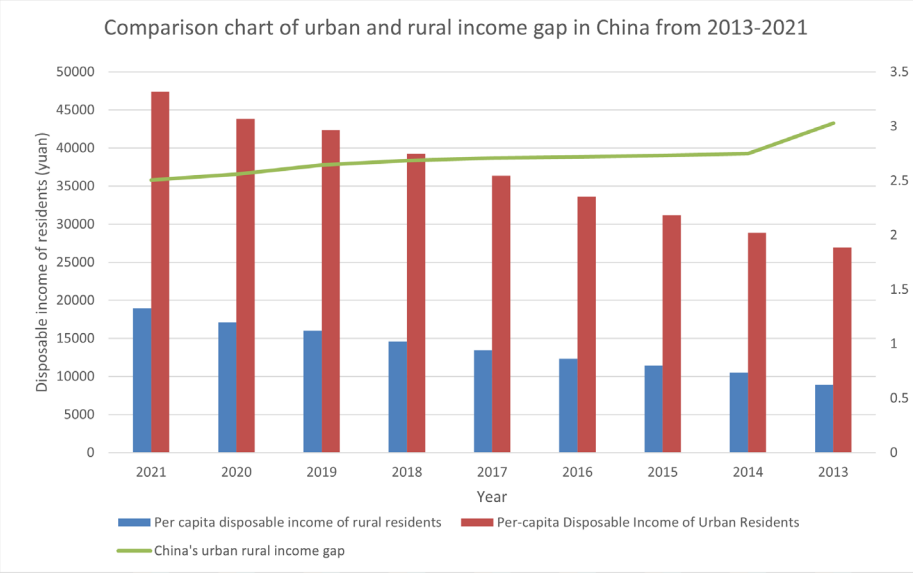

Figure 1: Comparison of income gap

As shown in figure 1, the income gap between urban and rural residents in China has changed significantly from 2013 to 2021. As a whole, the income gap of residents in China shows an inverted U-shaped trend of expanding first and then narrowing.

2.2 Data preprocessing

The relevant data collected were checked in MATLAB. It was found that the original data in the index

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was not empty or more than 0 columns, but there was a small amount of missing data. The missing data was supplemented by linear interpolation (for example, the missing data of grain yield per unit area after 2018 was inserted). Since there are different dimensions and dimensional units between different evaluation indexes, in order to eliminate dimensional differences and ensure the accuracy of data analysis results. It is necessary to standardize the data. Normalize the processed standardized matrix.

3. Model building

3.1 Constructing the coupling mathematical model of digital economy and Rural Revitalization

According to the results of data cleaning, we propose a coupling degree evaluation model to find the main problems of the coupling between digital economy and rural areas by integrating the five dimensions of Rural Revitalization and the three dimensions of digital economy.

Coupling refers to the dynamic correlation between two or more subsystems which are interdependent and mutually opposed. The positive interaction between the two is positive coupling, and the relationship of mutual restriction is negative coupling. The coupling degree evaluation model is used to analyze the coordinated development level of things. The benign coupling degree of the coupling interaction relationship of coordination degree can reflect the quality of coordination.

3.2 Calculation of weight: entropy method

Entropy method[3] is derived from a concept in information theory: information entropy. Information entropy is a measure of the degree of order of a system. The greater the information entropy, the more chaotic the system, the greater the uncertainty, and the smaller the weight. On the contrary, the smaller the information entropy, the more orderly the system, the smaller the uncertainty, and the greater the weight.

3.3 Model description

Using the concept of coupling, the coupling relationship between digital economy and Rural Revitalization can be defined as the process of mutual promotion and coordinated development between digital economy and Rural Revitalization subsystems, driving the allocation of rural resources, adjusting the industrial structure and promoting the development of rural econ- omy, as shown in figure 2. Rural Revitalization is the foundation of digital village and the ultimate goal of developing digital economy.

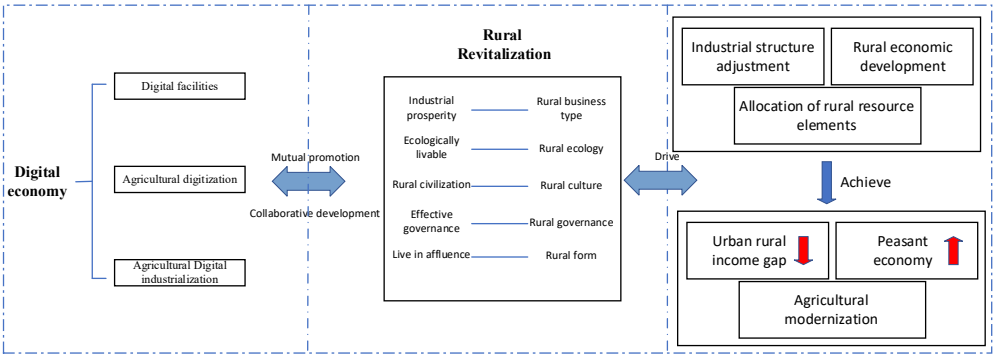

Figure 2: Coupling diagram of digital economy and Rural Revitalization

3.4 Result analysis

Using entropy method to determine the weight, combined with the comprehensive evaluation function, we can get the comprehensive evaluation index of China's digital economy and Rural Revitalization from 2013 to 2021. The digital economy development index from agricultural digitization, digital basic measures. According to figure 3 and figure 4, China's digital economy has developed steadily in the past eight years, and the momentum of development has been increasing.

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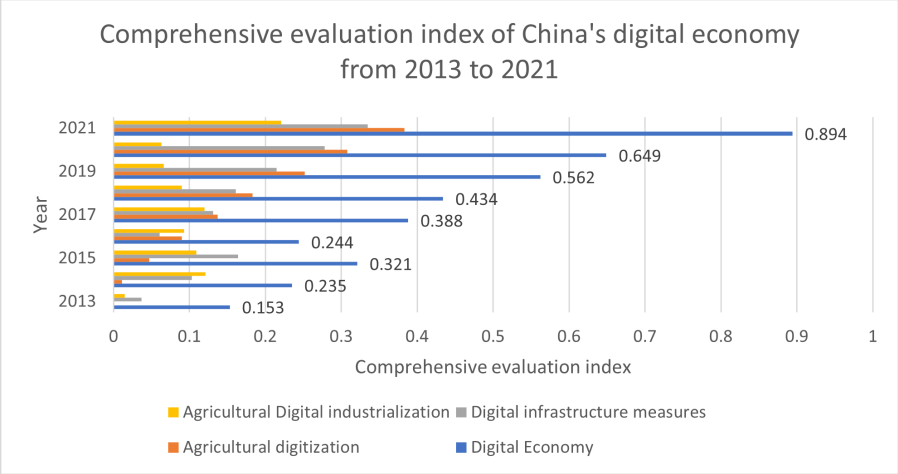

Figure 3: Comprehensive evaluation index of digital economy

It can be seen from figure 4 that, different from the rising trend of the digital economy index year by year, the comprehensive evaluation index of Rural Revitalization has shown a trend of declining instead of rising since 2015, and the rise has been slow in recent years. Starting from the five indicators of rural revitalization, it is not difficult to find that although the evaluation indexes of the five indicators show a slow upward trend. Agricultural science and technology is still a short board.The industrial chain is not perfect. And the income gap between urban and rural areas is growing.The number of people employed in the primary industry is getting smaller and smaller. The rural labor force is aging and feminized.

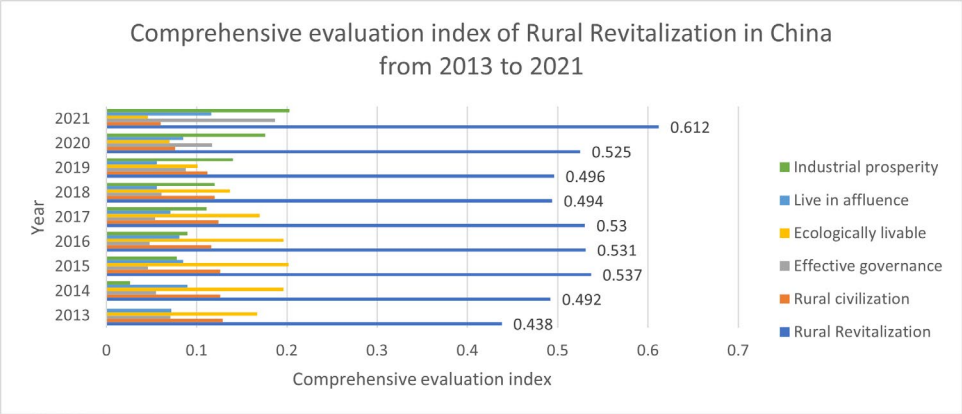

Figure 4: Comprehensive evaluation index of Rural Revitalization

Table 2 shows the coordination types after modeling the coupling model of digital economy and Rural Revitalization:

Table 2: List of coupling coordination types of digital economy and Rural Revitalization from 2016 to 2021

Year	C	T	D	Coordination comparison type
2013	0.437934	0.295772	0.359901	Mild maladjustment type
2014	0.46762	0.363641	0.412366	Critical coordination type
2015	0.483777	0.428926	0.455527	
2016	0.464318	0.38746	0.424152	
2017	0.49398	0.458877	0.476105	
2018	0.498961	0.464145	0.481238	
2019	0.4997	0.514023	0.506811	Reluctantly coordinated
2020	0.497199	0.586871	0.540177	
2021	0.491107	0.752947	0.608093	Primary coordination type

ISSN 2616-7433 Vol. 5, Issue 18: 118-124, DOI: 10.25236/FSST.2023.051820

From 2013 to 2021, the level of coordinated development in China has changed from mild imbalance to primary coordinated development, and there is a benign coupling between the two subsystems. The coupling coordinated development of digital economy and rural revitalization is obtained through the coupling coordination degree model (fig. 5). From 2013 to 2015, the coupling degree showed an upward trend, and Rural Revitalization achieved preliminary development. However, from 2015 to 2019, the coupling degree presents a "U" trend, and the coupling stage transits from the high decoupling stage to the low coupling stage. It reflects that the coupling development degree of the two systems is low, the scope is not wide, the mode is not perfect, and the support is insufficient. From 2013 to 2021, the coupling degree increased slowly. After eight years of development, the coupling degree only increased from 0.43 to 0.49. Although the coupling coordination degree did not increase, it decreased in the middle, but showed an upward trend, rising from 0.35 to 0.61. The level of coordinated development has changed from mild imbalance to primary coordination, indicating that the two subsystems are in a benign state of development.

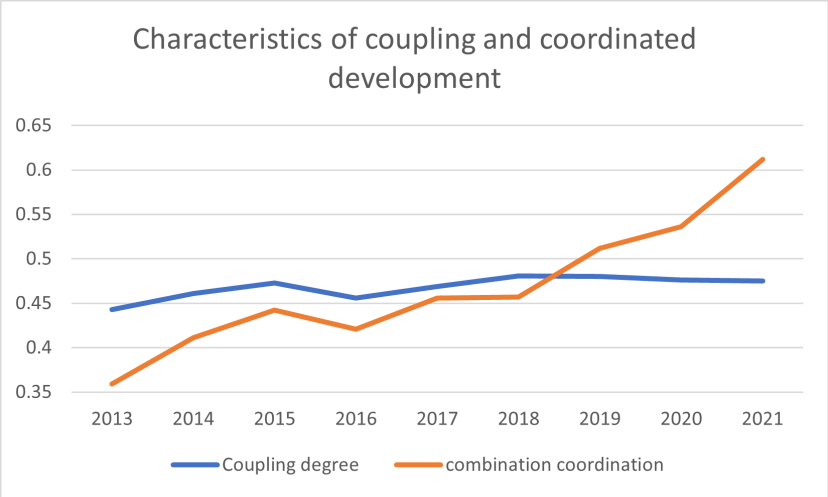

Figure 5: Characteristics of coupling and coordinated development of digital economy and Rural Revitalization

3.5 Policy suggestions on solving the income gap between urban and rural areas

After consulting a large number of literatures and in the process of modeling, we found that the main problems leading to the obvious income gap between urban and rural areas are: 1.Weak digital infrastructure and weak Internet infrastructure measures; 2. The application of agricultural digitalization is relatively few in rural areas and has not reached the degree of popularization; 3. The digital quality of rural residents is not high; 4. there is a shortage of digital talents.

In this regard, we suggest: First, increase government coordination and investment, focus on improving and protecting people's livelihood, and continue to strengthen rural infrastructure and development environment. On the one hand, special funds for rural infrastructure can be set up to encourage social capital with digital technology capabilities and entity operation experience to participate in the construction and operation of rural information network infrastructure through PPP (cooperation between government and social capital), public construction and private sector, and independent investment.On the other hand, it can speed up the filling of the information equipment gap between urban and rural areas, establish a rapid and effective information transmission mechanism, and form a classified and accurate agricultural and rural data resource database to deal with rural development, disaster prevention and control and epidemic prevention and control.

3.6 How to reach the basic level of urban rural income gap in OECD member countries

It mainly studies what actions or measures China needs to take, how much regulation, under what conditions, and how long it will take to reach the basic level of OECD member countries' urban-rural income ratio below 1.25. In question 2, we have established the influencing factors of the digital economy and Rural Revitalization that affect the income gap between urban and rural areas in China, and built a regression model between the significant indicators and the income gap between urban and rural areas in China. Considering that there are few data in the question, conventional prediction models such as neural

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network need a lot of data, in order to further narrow the gap between the two.The regression prediction model and grey prediction model are established to predict the change trend of narrowing the income gap between urban and rural areas in China, so as to get the basic level of urban and rural income below 1.25 with how much adjustment, under what conditions and for how long. Finally get the actions and measures that China needs to take in the future.

3.7 Constructing the regression prediction and grey prediction model for the income gap between urban and rural areas in China

Grey prediction can predict the system containing known and unknown information, find the law of data change, generate a sequence with strong regularity, and then establish the corresponding differential equation model to predict the development of things[4]. The algorithm has significant prediction effect for the system with short time series, small amount of data and incomplete information, but the accuracy of the grey prediction model needs to be tested before prediction. The grey prediction model is used to predict how long the urban-rural income ratio will reach the basic level below 1.25 under the condition that the existing adjustment efforts remain unchanged. Using the regression model and the grey prediction model, we can predict how long the urban-rural income ratio will reach the basic level below 1.25 when the digital economy and Rural Revitalization actions or measures remain on the rise.

3.8 Result score

Through the regression prediction model and grey prediction model[5], the prediction diagram of the income ratio of urban and rural residents can be obtained (Fig. 6). It can be seen that, with the existing adjustment efforts unchanged, the Chinese Congress will reach the basic level of the United States and other OECD member countries in 2055. At that time, the secondary index data of digital economy and Rural Revitalization will reach the independent variable value predicted by the regression model. By 2046, China will reach the basic level of the United States and other OECD member countries.

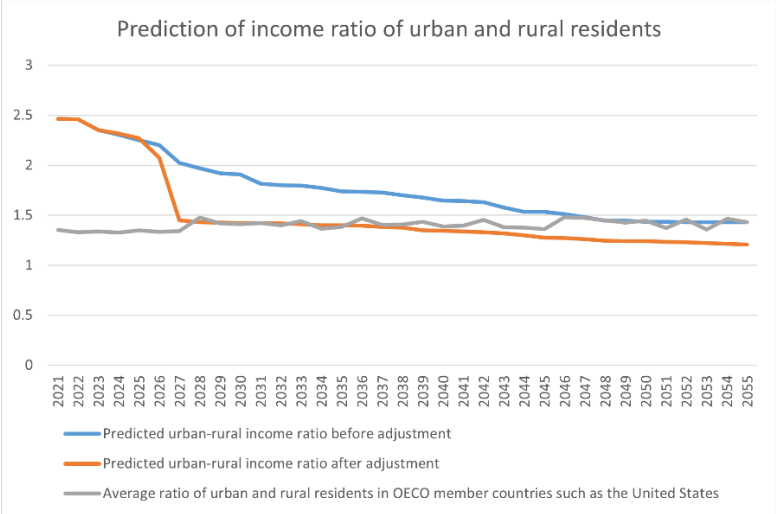

Figure 6: Forecast of income ratio of urban and rural residents

Under the prediction of the model experiment, we should determine the security focus, take tax adjustment measures, use tax to adjust the income gap, and take social security adjustment measures. Compulsory education adjustment measures will narrow the income gap between urban and rural areas and further promote the development of the West and the revitalization of the northeast[5]. Focusing on low-income people, we will improve the development mechanism of urban-rural integration, and increase support for the digital economy and Rural Revitalization Strategy. By 2046, China will reach the basic level of the United States and other OECD member countries.

4. Conclusions

The model fully combines with practice, simplifies many representative data of digital economy and rural revitalization, and refers to a large number of literatures[6]. The model selects a reasonable coupling mathematical model of digital economy and rural revitalization, such as entropy weight method,

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comprehensive development level, coupling degree, coupling coordination, etc. The model is in line with the practical application of the coupling of digital economy and rural revitalization, and has high application value. It can digitize the text and find more practical policies and suggestions from the results. The model uses the ideas of economics, mathematics and modeling to grasp the main factors affecting China's income gap. It transforms complex economic problems into simple mathematical problems and establishes regression models. The output of the model meets the requirements of the project and can solve practical problems. In practical application, the specific corresponding indicators of policies and the degree of policy assistance at the national level may also be important influencing factors, but this paper does not consider the impact of these factors, which affects the accuracy of the model to a certain extent. Combining with the references of many researchers, we can get more representative indicators, expand the time series, refine the indicators, and further consider the impact of provinces on the urban-rural income gap, so as to get a more reasonable and effective model.

References

[1] Han G , Zhou J , Siqi L I ,et al. An Empirical Analysis on the Impact of Rural Financial Development on the Income Gap between Urban and Rural Residents in Heilongjiang Province[J]. Asian Agricultural Research, 2020(2):8.

[2] Sutian M , Hao M A .The Impact of Inflation on Urban-rural Income Gap: A Perspective from Asset Value Maintenance[J].Advances in Information Sciences & Service Sciences, 2013, 5(6):27-35.DOI:10.4156/aiss.vol5.issue6.4.

[3] Fengge,Yao, Shaopeng,et al. Based on Big Data: The Impact of Rural Financial Development on the Urban-rural Income Gap in Heilongjiang Province[C]//2017 IEEE 2nd Advanced Information Technology, Electronic and Automation Control Conference (IAEAC).0[2024-01-02]. DOI:10.1109/IAEAC.2017.8054402.

[4] Zhou P , Yang S , Wu X ,et al.Calculation of regional agricultural production efficiency and empirical analysis of its influencing factors-based on DEA-CCR model and Tobit model[J].Journal of computational methods in sciences and engineering, 2022(1):22.

[5] Gu Jun, Kang Lin.A study on the feasible measures to narrow the income gap between urban and rural areas in China -- Taking the experience of the United States, Japan and South Korea as a reference [J]. Development research, 2011 (02): 82-86.