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Research on the Measurement and Influencing Factors of Rural Revitalization Development Level——An Empirical Analysis Based on China's Provincial Panel Data from 2013 to 2020

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Abstract: *Based on the five subsystems of Rural Revitalization, the evaluation system is constructed, the entropy method is used to measure the development level of Rural Revitalization in China from 2013 to 2020, and the Tobit model is used to analyze the influencing factors. The study shows that the development level of Rural Revitalization in China has been steadily improving, showing a decreasing development pattern in the eastern, northeast, central and western regions, and the "catch-up effect" in the western region is significant. Government support, technological progress, infrastructure and education level have a significant positive impact on Rural Revitalization and development.*

Keywords: *rural revitalization, development level, influencing factors, entropy method, tobit model*

1. Introduction

The biggest imbalance in China's economic development is the imbalance between urban and rural areas, and the vigorous implementation of Rural Revitalization strategy has become an important measure to promote the common prosperity between urban and rural areas. In view of this, it is of great significance to objectively evaluate the development level of Rural Revitalization and analyze its influencing factors to promote rural development. At present, many scholars at home and abroad have carried out many studies on Rural Revitalization, which are mainly divided into two aspects. On the theoretical level, focus on the connotation interpretation[1], problem challenge[2]and development path[3]of the whole or five subsystems of Rural Revitalization. On the empirical level, focus on the coupling coordination between Rural Revitalization and digital finance[4]and the measurement of regional development level[5]. However, there are few studies on measuring the development level and influencing factors of Rural Revitalization from the national level, so it has become the main breakthrough point and research content of this paper.

2. Construction of Evaluation System for Rural Revitalization

At present, many scholars generally construct the index system of Rural Revitalization from the five aspects of industry, ecology, rural style, governance and life, but the specific indicators have not formed a unified standard. Based on the Strategic Plan for Rural Revitalization (2018-2022) and existing research, this paper constructs an evaluation system for Rural Revitalization covering five first-level indicators and 15 second-level indicators of industrial prosperity, ecological livability, rural civilization, effective governance and affluent life (Table1), as follows:

Industrial prosperity is the foundation of rural revitalization and an important part of promoting rural prosperity. Specifically, the development of rural mechanization and modernization is a powerful driving force for the development of rural industry, and the dividend of industrial prosperity will ultimately fall on industrial bebefits. Therefore, this paper chooses three indicators to measure the prosperity level of rural industry, including per capita total mechanical power in rural areas, per capita total output value of agriculture, forestry, animal husbandry and fishery in rural areas, and the level of agricultural economic structure. Ecological livability is the key to rural revitalization and a precious wealth of the countryside. The ecological livable environment should not only be reflected in the public environment, but also in the family environment. Therefore, this paper chooses the three indicators, the popularization rate of rural sanitary toilets, the number of health technicians per 10,000 people in rural areas, and the coverage rate

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of rural greening to evaluate the level of rural ecological livability. Rural civilization is the guarantee and an important embodiment of rural residents' pursuit of good cultural spirit. This paper selects the number of cultural stations per 10,000 people in rural areas and the per capita cultural consumption expenditure in rural areas to measure the level of rural civilization.Effective governance is the foundation and an important cornerstone of rural activities. Good governance is reflected in the environment, common development, and many other aspects.Therefore, this paper selects three variables to measure it: waterlogging control, soil erosion control area, rural-urban income ratio, and rural poverty incidence. Affluence of life is the foundation of rural revitalization and the ultimate goal of promoting common prosperity, which is reflected in the real income and housing of farmers. Therefore, this paper selects three indicators to evaluate it: rural per capita disposable income, rural Engel coefficient and rural per capita village housing area.

Table 1: Evaluation Index System of Rural Revitalization

System layer	Indicator layer	Explanation of indicator (unit)	Attribute
The industry is flourishing	Per capita total mechanical power in rural area	Total power of agricultural machinery/total rural population (kW/person)	Positive
	Per capita gross output value of agriculture, forestry, animal husbandry and fishery in rural areas	Gross output value of agriculture, forestry, animal husbandry and fishery/total rural population (yuan/person)	Positive
	Level of agricultural economic structure	Non-grain sown area/total sown area (%)	Positive
Ecological livability	Popularization rate of sanitary latrines in rural areas	Households using sanitary latrines/total number of households (%)	Positive
	Number of health technicians per 10,000 people in rural areas	Number of health technicians/total rural population (person)	Positive
	Rural green coverage	Green Coverage/Total Village Area (%)	Positive
Rural civilization	Number of cultural stations per 10,000 people in rural areas	Number of township cultural stations/total rural population (unit)	Positive
	Per capita cultural consumption expenditure in rural areas	Per capita cultural consumption expenditure in rural areas (yuan/person)	Positive
Governance is effective	Incidence of rural poverty	Rural poor population/total rural population (%)	Negative
	Ratio of rural to urban income	Per capita disposable income of rural residents/disposable income of urban residents (%)	Negative
	Area of waterlogging control and soil erosion control	Waterlogging control + soil erosion control area (thousand hectares)	Positive
Live a rich life	Per capita disposable income in rural areas	Per capita disposable income in rural areas (yuan/person)	Positive
	Rural Engel coefficient	Total food expenditure/total consumption expenditure (%)	Negative
	Per capita village housing area in rural areas	Village housing area/total rural population (m2/person)	Positive

3. Research methods and data sources

3.1 Entropy method

This paper uses entropy method to measure the development level of Rural Revitalization in China. Entropy weight method is a more objective evaluation method, whose principle is to determine the weight based on the size of the index data, the larger the weight, the greater the influence on the evaluation system. Compared with other methods, it can eliminate the subjective and artificial interference and make the measurement results more scientific. The specific operations are as follows:

① Data standardization processing:

$$X_{ij} = (x_{ij} - min(x_{ij}))/(max(x_{ij}) - min(x_{ij})) \quad \text{(Forward)}$$

$$X_{ij} = (max(x_{ij}) - x_{ij})/(max(x_{ij}) - min(x_{ij})) \quad \text{(Negative)}$$

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Where, xij is the original value of the jth index of the ith province, and xij is the standardized result.

② Constructing a normalized matrix P (in the formula, n is a year): $p_{ij} = X_{ij}/(\sum_{i=1}^{n} X_{ij})$

③ Calculate the entropy value of the jth index: $e_j = -\frac{1}{ln(n)}\sum_{i=1}^{n} P_{ij} ln(P_{ij})$

④ Calculate that redundancy of the information entropy: $d_j = 1 - e_j$

⑤ Calculate the weight of each index: $w_j = (1 - d_j)/(\sum_{j=1}^{m} d_j)$

⑥ Calculate the development level index of Rural Revitalization in China: $GGJH_i = \sum_{j=1}^{m} w_j p_{ij}$

3.2 Tobit Model

In this paper, the dependent variable is the value of Rural Revitalization Development Level calculated by entropy method, which is a variable between 0 and 1. The least squares estimation may cause the bias of the estimation results. Therefore, the panel Tobit regression model is selected to analyze the influencing factors of Rural Revitalization Development Level. The general model meets the following requirements: $Yi = \alpha 0 + \alpha i Xi + \mu i$

Where, Yi is the limited dependent variable, α0 is the constant term, αi is each parameter to be estimated, Xi is each variable, and μi is the residual disturbance term.

3.3 Data sources

Due to the lack of some data in Hong Kong, Macao and Taiwan, this paper investigates 31 provinces in China from 2013 to 2020. The original data come from China Statistical Yearbook, China Rural Statistical Yearbook, China Population and Employment Statistical Yearbook and the official website of the National Bureau of Statistics. For the individual missing data, they were complemented by the interpolation method.

4. Level of Rural Revitalization and Development

The development level index of Rural Revitalization in China from 2013 to 2020 was calculated by using the entropy method(Table2). During the investigation period, the overall development level of Rural Revitalization in China was generally low, but the development effects were obvious and maintained a rising trend. Specifically, it increased from 0.2992 in 2013 to 0.3903 in 2020, with an average annual growth rate of 5.00%. From the provincial perspective, the development level of Rural Revitalization presents a distribution pattern of "Eastern > Northeast > Central > Western" in space, with significant regional differences. Specifically, the five provinces with the highest scores are mostly in the eastern region, namely Inner Mongolia (0.4527), Jiangsu (0.4319), Fujian (0.4150), Shandong (0.3943) and Shanghai (0.3888), which are inseparable from the development foundation and location advantages of the eastern region. On the contrary, the five provinces with the lowest scores are Yunnan (0.2850), Shanxi (0.2899), Guizhou (0.2921), Qinghai (0.2934) and Ningxia (0.2932), mostly western provinces, reflecting a certain degree of spatial agglomeration in the level of Rural Revitalization and development in China. From the perspective of growth rate, the five leading provinces are Hunan (6.45%), Yunnan (6.25%), Guangxi (6.14%), Guizhou (5.94%) and Heilongjiang (5.51%). The western provinces account for 3/5, showing a strong "catch-up effect".

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Table 2: Score of China's Rural Revitalization Development Level from 2013 to 2020

Region		2013	2014	2015	2016	2017	2018	2019	2020	Mean value
East	Beijing	0.3286	0.3420	0.3854	0.3973	0.3699	0.3773	0.4203	0.4209	0.3802
	Tianjin	0.3547	0.3764	0.3774	0.3859	0.3561	0.3618	0.3711	0.3130	0.3621
	Hebei	0.2907	0.2962	0.3085	0.3103	0.3333	0.3237	0.3520	0.3633	0.3223
	Shanghai	0.3806	0.3848	0.3882	0.3722	0.3875	0.3930	0.4156	0.3881	0.3888
	Jiangsu	0.3569	0.3831	0.4033	0.4210	0.4494	0.4561	0.4853	0.4998	0.4319
	Zhejiang	0.3294	0.3504	0.3555	0.3810	0.3870	0.4062	0.4245	0.4305	0.3831
	Fujian	0.3742	0.3932	0.4001	0.4130	0.4102	0.4255	0.4465	0.4573	0.4150
	Shandong	0.3546	0.3708	0.3825	0.3826	0.4006	0.4107	0.4208	0.4321	0.3943
	Guangdong	0.2856	0.3012	0.3024	0.3238	0.3238	0.3566	0.3724	0.3844	0.3313
	Hainan	0.3384	0.3647	0.3678	0.3527	0.3947	0.3927	0.3889	0.3929	0.3741
Central	Shanxi	0.3010	0.3012	0.3055	0.3025	0.3012	0.3157	0.3364	0.3441	0.3135
	Anhui	0.2839	0.2935	0.3023	0.3136	0.3240	0.3295	0.3467	0.3609	0.3193
	Jiangxi	0.2937	0.3022	0.3134	0.3250	0.3375	0.3468	0.3687	0.3817	0.3336
	Henan	0.3198	0.3333	0.3396	0.3447	0.3270	0.3497	0.3700	0.3758	0.3450
	Hubei	0.3125	0.3346	0.3456	0.3601	0.3728	0.3794	0.3972	0.4023	0.3631
	Hunan	0.2755	0.3111	0.3390	0.3624	0.3760	0.3862	0.4136	0.4267	0.3613
West	Inner Mongolia	0.3799	0.3988	0.4171	0.4453	0.4789	0.4776	0.5008	0.5233	0.4527
	Guangxi	0.2475	0.2678	0.2818	0.2957	0.3182	0.3323	0.3635	0.3758	0.3103
	Chongqing	0.2466	0.2583	0.2669	0.2947	0.3003	0.3138	0.3380	0.3533	0.2965
	Szechwan	0.2939	0.3111	0.3218	0.3373	0.3575	0.3642	0.3825	0.3961	0.3455
	Guizhou	0.2349	0.2458	0.2666	0.2862	0.3011	0.3136	0.3370	0.3517	0.2921
	Yunnan	0.2287	0.2425	0.2522	0.2721	0.2992	0.3081	0.3278	0.3496	0.2850
	Tibet	0.2632	0.2808	0.2956	0.3114	0.3198	0.3532	0.3641	0.3780	0.3208
	Shanxi	0.2570	0.2661	0.2732	0.2827	0.2913	0.3067	0.3177	0.3249	0.2899
	Gansu	0.2672	0.2790	0.2897	0.2971	0.3114	0.3259	0.3517	0.3688	0.3114
	Qinghai	0.2638	0.2670	0.2730	0.2848	0.2982	0.3098	0.3191	0.3317	0.2934
	Ningxia	0.2500	0.2681	0.2853	0.2834	0.2957	0.2965	0.3249	0.3415	0.2932
	Xinjiang	0.2966	0.3175	0.3266	0.3372	0.3447	0.3750	0.4013	0.4127	0.3514
Northeast	Liaoning	0.2990	0.3213	0.3386	0.3441	0.3525	0.3569	0.3751	0.3886	0.3470
	Jilin	0.2517	0.2661	0.2738	0.2864	0.3035	0.3145	0.3464	0.3711	0.3017
	Heilongjiang	0.3157	0.3324	0.3451	0.3671	0.3758	0.3988	0.4348	0.4596	0.3787
Nationwide	Mean value	0.2992	0.3149	0.3266	0.3379	0.3484	0.3599	0.3811	0.3903	0.3448

5. Influencing factors of rural digital economy

By reviewing the existing literature, this paper argues that the factors affecting the level of rural revitalization and development may be as follows: ① Government support, expressed by the ratio of local government expenditure to local GDP. The development of Rural Revitalization can not be separated from the hard investment of the government's real gold and silver to provide impetus for it. ② Technological progress, expressed by the number of professional authorizations per capita. Rural revitalization is a modern and comprehensive revitalization, which inevitably requires certain scientific and technological support. ③ Rural infrastructure, represented by the density of rural roads. Good infrastructure is the foundation of Rural Revitalization and development. (4) The industrial structure is measured by the ratio of the total output value of the tertiary industry to the GDP of the region. The upgrading of industrial structure is conducive to improving the development of rural industries. ⑤ Education level, expressed by years of education of rural residents. Farmers with good cultural literacy are more conducive to the promotion of rural revitalization.

Based on the Tobit model, the above factors are empirically tested (Table3). The analysis shows that government support, technological progress, infrastructure and education level all have a significant impact on the development of rural revitalization. Among them, the impact of government support is positive and significant at the level of 1%, indicating that the government plays an important role in promoting rural revitalization, and the higher the government support, the more conducive to improving the level of rural revitalization. The impact of technological progress is positive and significant at the 1% level, indicating that improving the level of technology is an effective means to promote rural revitalization, and we should focus on improving the level of technology-enabled rural revitalization.

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The impact of infrastructure is positive and significant at the level of 5%, indicating that strengthening rural infrastructure construction and promoting the interconnection of urban and rural infrastructure are conducive to improving the level of rural revitalization. The impact of industrial structure is positive but not significant, indicating that it is necessary to further stimulate the development momentum of rural modernization industry and promote rural revitalization and development. The impact of education level is positive and significant at the level of 1%, indicating that the education level of farmers is proportional to the level of rural revitalization and development, and the two develop in a coordinated manner.

Table 3: Regression results of Tobit model

Explanatory variable	Regression Coefficient	Standard error	P value
Government support	0.6105***	0.1320	0.000
Technological progress	19.4897***	3.4585	0.000
Infrastructure	0.210**	0.0095	0.029
Industrial structure	0.0098	0.4330	0.821
Level of education	0.1299***	0.0033	0.000
Constant term	0.1253***	0.3655	0.001

Note: *, * * and * * * mean significant at the 10%, 5% and 1% levels, respectively

6. Research conclusions and policy implications

Based on the panel data of 31 provinces in China from 2013 to 2020, this paper analyzes the development level and influencing factors of Rural Revitalization in China. The conclusions are as follows: The development level of Rural Revitalization in China is generally low, but the development momentum is strong, the regional differences are significant and the spatial distribution pattern is "eastern > northeastern > central > western". The catch-up effect of the western region is significant. Government support, technological progress, infrastructure and education level have a significant positive impact on Rural Revitalization and development.

Based on the above conclusions, the following policy implications are drawn: First, promote the development level of rural revitalization in China as a whole, the eastern region should be based on advantages, build a model, strengthen the linkage with other regions, strengthen the inclination of infrastructure in the central, western and northeastern regions, and narrow the development gap with the "Pareto optimality" of facilities allocation as a breakthrough. Second, all regions should promote rural revitalization by strengthening policy support, promoting technological innovation and improving the education level of residents, focusing on optimizing the upgrading of rural industrial structure, upgrading the development level of tertiary industry to promote rural revitalization.

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