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ORIGINAL ARTICLE

Research on the Application of Ridit Analysis Method to Human Capital in Different Regions

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Abstract:

Due to the weakness of human capital stock, there is a big gap in the knowledge development level between Gansu Province and the developed areas, which leads the gap of the economic level of Gansu Province to be gradually widened. Various reasons lead to the long-term social development of Gansu province in the backward edge. Ridit analysis is a statistical analysis method used to deal with rank variables, which is simple and easy to understand and easy to compare. This paper uses the education level of the population to qualitatively describe the human capital of every region, and analyzes the education level of the population of 14 cities in Gansu Province by the Ridit test method, and also makes reasonable suggestions according to the conclusions, so that the human capital structure of Gansu Province is more reasonable. Human capital management is the best way to build core competitiveness to gain competitive advantage under the knowledge economy condition, and a more reasonable human capital structure can promote the better development of the region.

Keywords: human capital; Ridit analysis; level of educational

Introduction

Human capital is composed of knowledge, technology, ability and health quality of economic value in working people, and it is a reflection of the quality of workers[1]. There are many factors affecting the formation of human capital. Education level and health status are two key factors, and education level is a decisive factor in human capital stock. Mankiw et al.[2] found that many economic growth theories emphasize the important role of education. Most empirical studies have also used education indicators to measure human capital and found a positive correlation between education and economic growth, such as Kyriacou[3].

As the largest industry in the country, education must be economically competitive in order to comply with the country's strategic sustainability goals[4]. With the rapid development of the knowledge economy, education level plays a more and more important role in the development of social economy. Most scholars believe that education can promote regional economic development, mainly by promoting the evolution of human capital structure in the direction of advanced[5-6]. Human capital is the most important form of capital in the modern economy, and American economists Schultz and Becker created the theory of human capital in the 50s of the 20th century. Based on their empirical analysis, they found that “the rate of return on investment in human capital is greater than the rate of return on investment in physical capital”, noting that in the United States, 4/5 economic growth comes from

human capital[7]. Investment in human capital and accumulation of knowledge positively affect the formation process of other factors of production such as physical capital, thereby promoting sustained economic growth[8]. Human capital is an important foundation for maintaining economic growth, and from an economic point of view, the allocation and utilization of human capital resources in Gansu Province is the trend of future economic development of Gansu Province and the key to solve employment problems. Due to the influence of many factors such as the humane and geographical environment of Gansu Province, the education level of different regions is also very different. The structure of human capital has also undergone tremendous changes, which are highlighted by the declining proportion of human capital with low education level and the continuous increase in the proportion of human capital with high education level[9]. The stable development of the economy is an important guarantee and plays positive promotion role in improving the education level of the population, and the improvement of the education level of the population also plays a positive role in promoting economic development, and the two complement each other[10]. As an important criterion for measuring the speed of economic growth, especially in backward areas, education is of great significance to the promotion and implementation of the development strategy of Gansu Province. In order to achieve a more rational human capital structure in Gansu Province and accelerate the development of education in Gansu Province, this research project is hereby launched.

2. Ridit analysis

When dealing with data, many people still habitually use the chi-square test if the variable is hierarchical data. For example, the efficacy of two drugs on bronchitis is studied. Among them, the efficacy is divided into four levels (cure, effective, effective, ineffective), and the chi-square test can only reflect whether there is a difference between the variables, and when there is a difference, it is impossible to further compare the levels of each level. Ridit analysis makes up for this shortcoming.

The nonparametric test Ridit analysis method, also known as the reference unit analysis method, was proposed by Bross[11]. Bross applied the method to the Cornell University Automobile Collision Damage Research Project (ACIR) for the first time, which analyzed the number of passengers injured to different degrees according to the position of the car taken by the passenger, and provided a certain basis for the degree of different injuries suffered by the passenger in the accident. Jiang Jing et al.[12] used Ridit analysis to study mainly influencing factors of the happiness of urban elderly in China, and found that the happiness of urban elderly in China decreases with age, and decreases with the decrease of economic satisfaction. Ridit analysis method is a statistical method for dealing with multi-class ordered classification, its basic idea is that it firstly need to determine a standard group as the selected population, if there is a group of cases significantly more than other groups or the group is a recognized reference group, then select the group as the standard group, when the number of cases between two or more groups is similar, and the recognized standard group cannot be found, the total in the corresponding level of each group is used as the standard group[13]. According to the sample structure of the reference group, the original response number of each group was transformed into Ridit score, and the converted Ridit score was used to make a fair comparison between the strengths and weaknesses of each treatment. Ridit analysis mainly investigates whether there are differences between two or more groups of grades. Ridit analysis is a comparison method based on non-parametric perspectives and does not need to consider the possible distribution of data [14].

The characteristic of grade data is that the variable value has a certain level, and all levels (I, II, III,...). Not strictly equivalent to numeric values in the arithmetic sense (1, 2, 3,...). As a non-parametric statistical method, Ridit converts grade data into a set of continuous measurement data, calculates Ridit value, and compares the difference of Ridit value. The results of comprehensive analysis and evaluation of the research data are simple and clear and easy to compare [15].

2.1. Statistical data and hypothesis testing problems

According to the education level of the population aged 3 and above in Gansu Province, six levels

are set: non-schooling (including preschool education), primary school, junior high school, senior high school (including secondary school), university (including junior college), and postgraduate. The data in this paper are all from the Gansu Statistical Yearbook of the 7th National Population Census in 2020, and the aggregated data are shown in Table 1 (unit: thousand people).

Table 1 Statistical table of population education level in various regions of Gansu Province

Area	Non schooling	Primary school	Junior high school	Senior high school	University	Graduate student	Total
Lanzhou	263.78	724.17	1181.97	816.00	1162.74	83.35	4232.01
Jiayuguan	14.90	51.15	83.88	65.19	84.91	1.40	301.43
Jinchang	34.26	103.11	130.62	73.29	82.94	2.07	426.29
Baiyin	125.56	434.37	448.78	226.86	219.97	3.34	1458.89
Tianshui	371.33	960.69	884.53	350.93	306.87	5.40	2879.73
Wuwei	149.68	418.20	456.78	207.94	182.09	2.91	1417.60
Zhangye	92.83	333.26	351.20	153.69	161.51	2.92	1095.39
Pingliang	257.97	579.01	502.72	223.39	218.65	3.14	1784.89
Jiuquan	84.37	253.11	337.96	164.95	181.79	2.60	1024.78
Qingyang	227.22	710.74	678.75	259.01	221.83	3.51	2101.06
Dingxi	326.34	905.95	678.67	266.06	248.78	3.53	2429.34
Longnan	464.33	801.04	626.60	225.11	200.91	1.99	2319.98
Linxia	417.44	881.48	401.28	153.34	138.16	1.62	1993.31
Gannan	113.61	301.64	97.49	51.16	98.53	1.90	664.33
Total	2943.61	7457.91	6861.22	3236.92	3509.68	119.67	24129

As the distribution of educational qualifications varies greatly among prefecture-level cities in Gansu Province, it can be seen from Figure 1 that the population with primary and junior high education accounts for the highest distribution of educational qualifications among different prefecture-level cities, while the distribution structure of the proportion of the other population with educational qualifications differs greatly. According to the demographic table of Gansu Province, the distribution proportion of different educational qualifications was obtained, and the standard deviation calculated was shown in Table 2. It can be seen that among the 14 prefecture-level cities in Gansu Province, the standard deviation of university education is the largest, which is 33.67, followed by non-schooling and primary school, with little difference. Standard deviation can reflect the degree of dispersion of data. According to the data, it is obvious that the difference in the distribution of educational qualifications among prefecture-level cities in Gansu Province mainly comes from the difference in the proportion of university, non-schooling and primary school population. Among them, the proportion of university educated population in Jiayuguan city is the highest, which is 4 times that of Linxia, which has the lowest proportion. The proportion of the population with primary education is the lowest, which is 0.37 times that of Gannan, which has the highest proportion of the population with primary education. In addition, as the capital city of Gansu Province, the proportion of graduate students in Lanzhou is 1.97, far ahead of other prefecture-level cities, and the proportion of college-educated people is also in the lead, indicating that the higher education level of Lanzhou is generally higher than that of other prefecture-level cities, and the level of social and economic development is also in a leading position [16].

Table 2 Distribution proportion of educational qualifications in prefecture-level cities in Gansu Province in 2020 (unit:%)

Area	Non schooling	Primary school	Junior high	Senior high	University	Graduate student

			school	school		
Whole province	12.20	30.91	28.44	13.42	14.55	0.50
Lanzhou	6.23	17.11	27.93	19.28	27.47	1.97
Jiayuguan	4.94	16.97	27.83	21.63	28.17	0.46
Jinchang	8.04	24.19	30.64	17.19	19.46	0.49
Baiyin	8.61	29.77	30.76	15.55	15.08	0.23
Tianshui	12.89	33.36	30.72	12.19	10.66	0.19
Wuwei	10.56	29.50	32.22	14.67	12.84	0.21
Zhangye	8.47	30.42	32.06	14.03	14.74	0.27
Pingliang	14.45	32.44	28.17	12.52	12.25	0.18
Jiuquan	8.23	24.70	32.98	16.10	17.74	0.25
Qingyang	10.81	33.83	32.31	12.33	10.56	0.17
Dingxi	13.43	37.29	27.94	10.95	10.24	0.15
Longnan	20.01	34.53	27.01	9.70	8.66	0.09
Linxia	20.94	44.22	20.13	7.69	6.93	0.08
Gannan	17.10	45.41	14.68	7.70	14.83	0.29
Standard Deviation	27.79	27.37	22.52	23.33	33.67	2.06

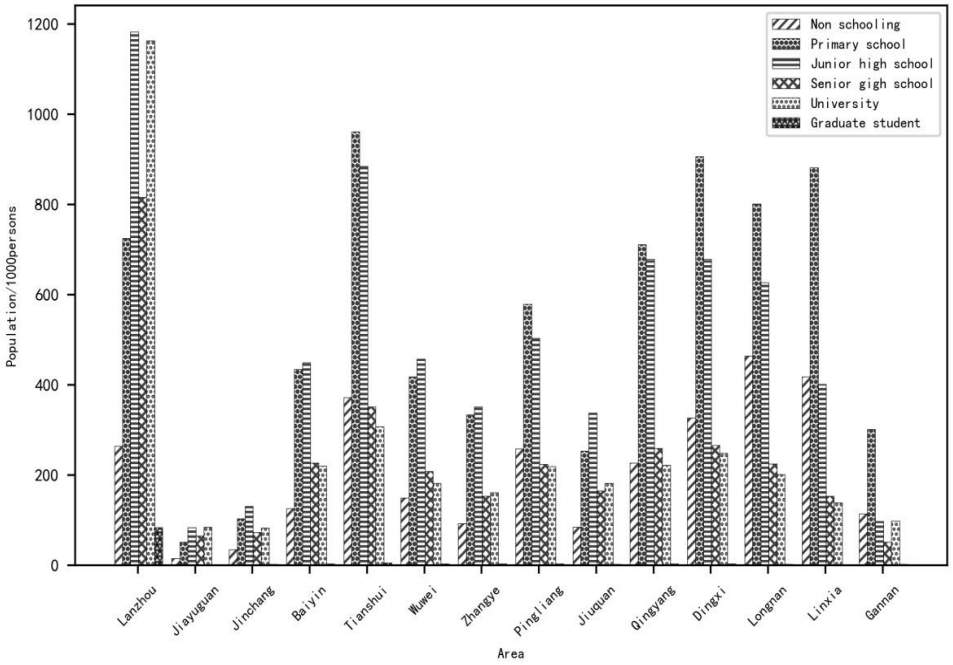

Figure 1 Education distribution of prefecture-level cities in gansu province during the seventh national population census in 2020

In order to better understand the education level of each prefecture-level city in Gansu Province, which prefecture-level cities have the best education level, which are the second and which are the worst, we need data and charts to answer this question. Therefore, the question that needs to be examined is whether there are differences in educational attainment among the 14 prefecture-level cities in Gansu Province.

The hypothesis testing question is:

H_0: A_1, A_2, ...There is no order of strength between A_r;

↔ H_1: There exists at least a pair of A_i, A_j,such

that $A_i \neq A_j$ is true.

Note: $A_1, A_2, \ldots, A_r$ represents different comparison groups, namely prefecture-level cities in Gansu Province.

Since this paper is to compare the education level of the population in various prefecture-level cities in Gansu Province, it belongs to whether there are differences in the strength of the comparative multi-processing, the Kruskal-Wallis test method can be used:

$$W = 12 \sum_{i=1}^{r} O_{i\cdot} (R_{i\cdot} - 0.5)^2 \#(1)$$

When H_0 is true, W approximates the χ^2 distribution of degrees of freedom $v = r - 1$, and rejects the null hypothesis when W is too large. Here r is the number of comparison groups, $O_{i\cdot}$ is the number of responses for the i th processing, and $R_{i\cdot}$ is the Ridit score for the i th processing.

2.2. Ridit score calculation method

The total of corresponding grades in the comparison group was selected as the standard group, and each "grade" (non-schooling, primary school, junior high school, senior high school, university and postgraduate) was converted into Ridit values. Table 3 is the calculation table of Ridit scores of the reference group [17], From the last row, the total is 12064.5, which can confirm the mean $Ridit\bar{R} = 0.5$ in the reference group. According to the formula:

$$\bar{R}_{\iota} \pm \frac{1}{\sqrt{3O_{i\cdot}}} \#(2)$$

It can be obtained that the 95% confidence limit is $0.5 \pm 0.0037 = (0.4963,\ 0.5037)$, where $O_{i\cdot}$ is the response number for i th treatment.

Table 3 Ridit score calculation table of reference group

Step	Non schooling	Primary school	Junior high school	Senior high school	University	Graduate student	
(I)total	2943.61	7457.91	6861.22	3236.92	3509.68	119.67	24129
(II)total/2	1471.80	3728.95	3430.61	1618.46	1754.84	59.83	
(III)accumulate	0	2943.61	10401.52	17262.74	20499.66	24009.34	
(II)+(III)	1471.80	6672.56	13832.13	18881.2	22254.5	24069.17	
R=(II+III)/24129	0.0610	0.2765	0.5733	0.7825	0.9223	0.9975	
Add up	179.56	2062.11	3933.54	2532.94	3236.98	119.37	12064.5

The steps in Table 3 can be viewed as a way to assign numbers (or weights) to graded categories of educational attainment. In other words person education level used to be described by words such as "high school", now his education level is described by a number that is 0.7825.

2.3. Ridit values and confidence limits in different regions

The average Ridit value of each comparison group is always between 0 and 1. If the ranking is from worst to best, the larger the average Ridit value is, the better it is. Otherwise, smaller is better. However, we can't judge the difference of each group simply by the size of the average Ridit value of each group, but must use confidence interval or statistical test method to judge. Ridit value in this paper is calculated according to the total group, so the difference can be compared by whether the confidence intervals of the two groups overlap. If there is more overlap, there is no significant difference between the grades of the two groups. If there is no overlap, there is a significant difference [18]. The average Ridit score of each region and its 95% confidence interval were calculated from Table 1 and Table 3, and the collated results were shown in Table 4.

Table 4 Summary of Ridit analysis results in different regions

Area	Ridit score	Confidence interval	W	p-value
1.Lanzhou	0.63516	0.62629 0.64404		
2.Jiayuguan	0.64314	0.60988 0.67639		
3.Jinchang	0.56627	0.53830 0.59423		
4.Baiyin	0.52696	0.51185 0.54208		
5.Tianshui	0.47171	0.46095 0.48247	1802	0.000
6.Wuwei	0.50804	0.49270 0.52337		
7.Zhangye	0.52153	0.50409 0.53897		
8.Pingliang	0.47266	0.45899 0.48633		
9.Jiuquan	0.55447	0.53644 0.57251		
10.Qingyang	0.48084	0.46825 0.49344		
11.Dingxi	0.45307	0.44136 0.46478		
12.Longnan	0.41918	0.40719 0.43116		
13.Linxia	0.37540	0.36247 0.38833		
14.Gannan	0.42003	0.39763 0.44243		

After calculating $W = 1802$ according to equation (1), this example is 14 groups, $r = 14$, freedom $v = 14 - 1 = 13$, $\chi^2 = 1802$ greater than $\chi^2_{0.975}(13) = 24.7356$, $p < 0.05$, so the null hypothesis is rejected under 95% confidence interval. In other words, there are significant differences in the education level of the population in 14 cities (prefectures) of Gansu Province.

The Ridit analysis results are represented by the figure. Figure 2 shows the confidence intervals of Ridit values in different regions. The middle horizontal line is the reference unit 0.5, and Lanzhou is above the middle horizontal line, indicating that the education level is better than that of the reference group. Although the average Ridit confidence interval of Wuwei was above the reference unit 0.5, its 95% confidence limit overlapped with that of the reference group, so the difference was not significant. Linxia and Gannan are all below, and the 95% confidence limit does not overlap with the reference group, indicating that the education level is poor; The education level was divided into three groups: Lanzhou, Jiayuguan, Jinchang, Baiyin and Jiuquan had a better education level, Wuwei and Zhangye had little difference compared with the reference group, while Tianshui, Pingliang, Qingyang, Dingxi, Longnan, Linxia and Gannan had a worse education level.

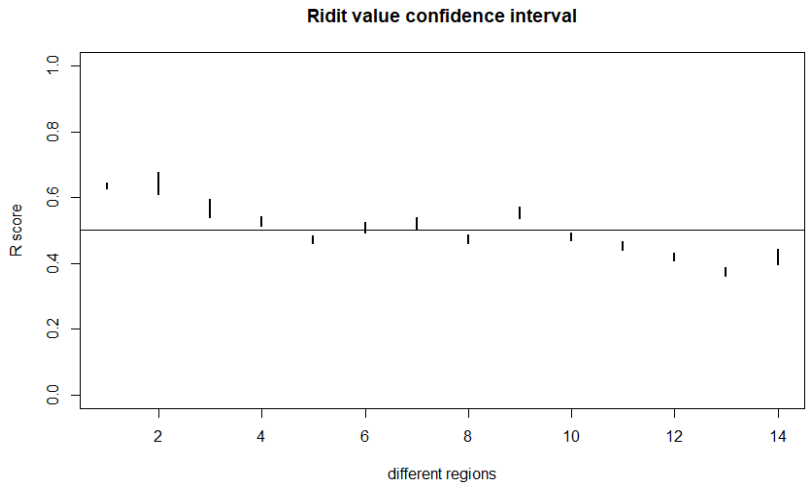

Figure 2 Confidence intervals for Ridit values in different regions

3. Conclusion and suggestion

Rapid economic growth depends on material capital investment, human capital investment and other comprehensive factors, The rapid accumulation of material capital has been passed

in current era, and it needs to move to the human capital driven stage, that is, the so-called "industrial upgrading", which needs to talent, rely on research and development. If we still follow the old path of material capital expansion, such investment, it is difficult to obtain long-term ideal returns, and there is a high probability of failure, so that human capital is the power source of long-term healthy development. The talent gap between regions is the gap that really deserves attention.

In recent years, the education cause of Gansu Province has been developing rapidly, and the human capital stock of Gansu Province is constantly changing both in time and space. Generally speaking, it is in a rising trend, and the educational level of the population is constantly improving. Due to the different starting points and uneven development levels of education development in different regions of Gansu Province, there are certain differences in the level of education development in different regions. In order to develop, allocate and effectively utilize the human capital of Gansu Province, we must have a scientific and correct understanding of the stock and current situation of human capital in Gansu Province, and on this basis, formulate a more reasonable human resource development strategy. On the basis of the overall steady rise, it has achieved more balanced development.

All in all, we must speed up and attach importance to the development of education, and form a virtuous circle of mutual promotion between education and economy through continuous system innovation, so as to provide strong intellectual support for high-quality economic development and inject strong impetus into national rejuvenation.

First, clarifying the differences and characteristics of education development in different regions, which is conducive to administrators and decision-making departments to grasp the current situation of education development in Gansu Province as a whole. And to adopt relevant policies of "teaching students according to their aptitude" for each region, so as to better promote the overall healthy development of education in Gansu Province.

Second, a good social atmosphere should be created, a more equal system supply should be found and government, should guide the public to form a reasonable understanding of education investment.

Third, further to optimize the education system and improve the efficiency of education departments.

Fourth, it is also necessary to constantly publicize the superiority and necessity of education, which is an essential basic force to maintain the transmission of knowledge and promote social progress.

Fifth, the educational resources should be reasonably distributed and carry out strong education support to relatively poor areas.

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