China Educational Resources Analysis Based on GINI Coefficients

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Abstract.

This article is based on the Gini coefficient to analyze the current educational status in China, and the Gini coefficient is calculated by the educational resources in different provinces. To diversify the sample, the work includes four different educational parameters: number of graduate students, number of institutions of higher learning, and number of high schools and middle schools. Based on the Chinese identity data from 2013 to 2021, this work calculates a line plot of the Gini coefficient, applying the correlation between the Lorentz curve and dynamic conditions. Concerning the different levels of education developments in China, it can draw the following conclusions: the Gini coefficient on the number of postgraduate students and institutions of higher learning is decreasing year by year, and the Gini coefficient on the number of high schools and middle schools appear an opposite trend. Regarding China's basic national conditions, the research results show that postgraduate and institutions of higher learning education resources are more equal. Still, the trend for middle and high school is on the contrary.

Keywords: Gini Coefficient, Educational Resources, Inequality, Provinces.

1 Introduction

There are many methods to categorize educational resources. According to the attributes and management levels, they can be divided into national resources, local resources, and individual resources; according to the academic qualifications, they can be divided into basic education resources and higher education resources; according to the composition, they can be divided into fixed resources and mobile resources; according to the knowledge level, they can be divided into brand resources, teacher resources, and student resources; according to the policy orientation, it can be divided into planned resources and market resources, etc. The following will introduce the educational resources of different academic levels, divided into postgraduate graduates, universities, high schools, and middle schools. The Gini coefficient is introduced to better analyze the current situation of Chinese education. The government usually has a proper policy on the demand and supply of education to reach equality in education. There are four factors affecting individual demand for education [1]. Kumba thought that in developing education, Gini is necessary for measuring the inequality of schooling in relative terms [2]. In addition, ensuring people's access to education and raising the population's educational level are basic tasks of the state.

2 Literature Review

In today's society, educational resources have been a great concern of governments and the education community. Education plays an important role in human capital accumulation [3]. Educational equity refers to everyone having equal access to education and resources. However, the differences between different regions and social groups make it difficult to achieve educational equality. Gruber and Kosack thought it was widely believed that education was a tonic that increased inequality, and this tonic was often accompanied by development [4]. However, most developing-country governments prefer their education spending toward higher education, which disproportionately benefits the elite. In the indicators of evaluating educational resources, the Gini coefficient is widely used. This article will explore the impact of the Gini coefficient on educational equity.

Based on speculation and experience, Simon Smith Kuznets put forward the inverted U-shaped curve hypothesis of the relationship between economic development and the change in income gap [5]. Aiming to prove the inverted-U curve relationship by comparing the Gini coefficients of countries with different income levels. Income inequality means that the vast majority of wealth is concentrated in the hands of a few rich people, while the vast majority of the poor only have a small amount of wealth. This situation will lead people with more wealth to invest more, including education and human capital investments.

The Gini coefficient of education is a pedagogical term published in 2013. It is used to measure the degree of equalization of educational opportunities. It calculates and describes the level of equality in education based on the average years of education and the population proportion at each level. This method is often used internationally to describe the level of equality in education. The value

is between 0 and 1, and the smaller the value, the more equal the distribution. For example, Thomas et al. used this method to calculate the Gini coefficient of years of education for people over 15 in 140 countries between 1960 and 2000. They found that the degree of education inequality in most countries is decreasing yearly, and the degree of education inequality is negatively related to the level of education development[6]. Lopez et al. also constructed the Gini coefficient of educational achievement and investigated the link between educational distribution and growth [7].

The Gini coefficient can help quantitatively assess educational fairness in different regions. For example, it can be understood by comparing the Gini coefficients in different regions whether the allocation of educational resources is balanced. If, in a certain area, the high Gini coefficient shows that the distribution of educational resources in the region is uneven, educational opportunities are unfair. Through the calculation of the Gini coefficient, the government can be targeted. Formulate policies to increase support for areas with relatively scarce educational resources to improve educational equity in society.

With all the studies presented above, this paper studied the connection and relationship between the Gini coefficient and inequality in educational resources. And explore the possibility of achieving fair and optimized allocation of educational resources, especially the need for appropriate policy intervention to reduce educational inequality in different groups and regions.

3 The Model

The Gini coefficient is the most widely used measurement to evaluate a country's inequality. It was first proposed by the Italian statistics and sociologist Corrado Gini in 1912. The incoming Gini coefficient has usually been studied, but this concept could be applied to any frequency distribution. So, this paper uses the Gini coefficient to study China's education inequality. To better understand the education Gini coefficient, there's an introduction to the income Gini coefficient. The income Gini coefficient measures the degree to which the cumulative income distribution of groups in society falls short of a perfectly equal income distribution. Thus, it ranges from 0 (where there is no such shortfall, and every group controls as much of the income as their share in the population) to 1 (where the richest group disposes of all income, so there is perfect inequality). So, when it comes to education, the Gini coefficient is closer to 0, which means the education source is more equal; if the data is closer to 1, it means the education gap is bigger.

Specifically, according to the data disclosed by the Ministry of Education of the People's Republic of China in the corresponding year, this work uses the number of educational institutions at different levels and the number of graduates to calculate the Gini coefficient of education to identify the change of educational inequality over time and the heterogeneity between regions. The steps for calculating the Gini coefficient of population education in the country and regions in 2013-2021 are as follows:

Step 1: Obtain the original data of the number of schools in each province over the years; the total number of college, junior high school, senior high school, and postgraduate graduates in each province is obtained.

Step 2: Sort the provinces according to the number of schools from less to more.

Step 3: According to the order, the number of schools will be added up by province.

(Cumulative edition), get Lorenz Curve.

Step 4: Calculate the proportion of the area above the Lorenz Curve to the area of the whole triangle.

Step 5: Calculate the education Gini coefficient. Publicity: G=A/ (A+B). (Calculated by the ratio of the unequal area between the Lorentz curve and the 45°line to the completely unequal area)

4 Data and Sources

This paper used 2 types of data to analyze the Gini coefficient of China's education resources: the school quantity of different Chinese provinces and the number of graduate students. These two types of data display the province's distribution of education resources and reflect the education degree status in China. For example, table 1 shows the number of high schools in different provinces.

Table 1. The Number of High Schools in Different Provinces [Owner-draw].

Province	2013	2014	2015	2016	2017	2018	2019	2020	2021
Beijing	291	306	306	305	304	309	318	321	332
Tianjin	193	181	180	182	187	189	187	185	191
Hebei	563	567	578	598	630	655	679	707	738
Shanxi	504	499	505	503	505	512	522	518	517

Inner Mongolia	277	278	284	289	293	299	303	305	307
Liaoning	416	415	412	412	418	414	420	425	431
Jilin	243	240	239	241	244	248	251	257	263
Heilongjiang	379	378	377	372	371	366	368	370	366
Shanghai	243	246	253	256	258	260	258	262	262
Jiangsu	578	567	569	571	564	578	580	585	609
Zhejiang	569	561	563	574	580	591	601	622	631
Anhui	698	694	666	672	662	661	667	661	679
Fujian	544	542	540	533	534	538	544	550	557
Jiangxi	436	442	460	469	475	480	496	519	544
Shandong	547	544	555	580	592	620	640	682	723
Henan	776	774	770	792	813	852	889	925	970
Hubei	563	541	532	532	532	531	532	536	548
Hunan	577	580	575	579	608	626	642	660	686
Guangdong	1015	1012	1019	1031	1030	1013	1008	1035	1076
Guangxi	453	445	445	450	460	468	490	499	521
Hainan	102	104	106	109	116	119	124	127	133
Chongqing	261	258	261	260	255	256	260	264	269
Sichuan	735	732	726	739	754	768	779	792	806
Guizhou	448	438	430	437	451	466	468	471	478
Yunnan	440	446	465	480	509	519	547	601	616
Tibet	29	29	30	31	34	34	35	38	39
Shaanxi	511	506	488	485	473	471	471	464	453
Gansu	428	402	386	379	384	381	376	364	363
Qinghai	105	102	101	106	101	105	108	106	107
Ningxia	62	61	62	62	63	65	65	68	70
Xinjiang	366	363	357	354	355	343	336	316	300

Note: Source: Ministry of Education of the People's Republic of China

For the school quantity, the education level is a great factor in education quality, so in this paper, there are 3 education levels to provide evidence of China's education Gini coefficient. The three education levels are college quantity, high school quantity, and primary school quantity. The data time range is nine years, from 2013 to 2021. Therefore, through the horizontal comparison of these data, it can find out whether each province's educational resources are increasing yearly or not. The different increase rates of school quantity in every province also could reflect the education resource distribution in China.

This data represents the high-degree education resource for the number of graduate students. Normally, only provinces with rich educational resources have a high number of graduate students. It's worth noting that rich education resources do not only refer to having one or a few famous colleges; it means having a lot of famous colleges. Therefore, this data is also an important indicator in this paper to measure the distribution of educational resources in China. The data range of graduate students also included nine years, from 2013 to 2021, and was consistent with school quantity, which provided more convenient data processing for the subsequent data analysis results.

The education Gini coefficient in the following content

is calculated by the school quantity and the number of graduate students, and all these data are downloaded from China's official education website, which ensures the data reliability in this paper. The data analysis and corresponding conclusion are provided.

5 Results and Discussion

For the convenience of readers, the paper has summarized the main results in Figures 1-4 and Tables 2-5. The results are shown in the following content.

The explanation for this result is that the phenomenon of education stratification in China refers to the obvious differences and inequities between different stages of education and levels of education in China's education system. This problem has existed in China for a long time. From the table, it can be seen that there are different levels of provinces' education stratification. In more developed cities, schools are large in scale, advanced in equipment, and superior in educational conditions, while in relatively underdeveloped cities, schools are relatively backward in scale, equipment, and teaching conditions, and high-quality educational resources are lacking.

Based on Figure 2 and Tables 2 and 3, the educational resources are more equal from 2013 to 2021 because the Gini coefficient decreased gradually. National and local governments invest postgraduate students and institutions of higher learning.

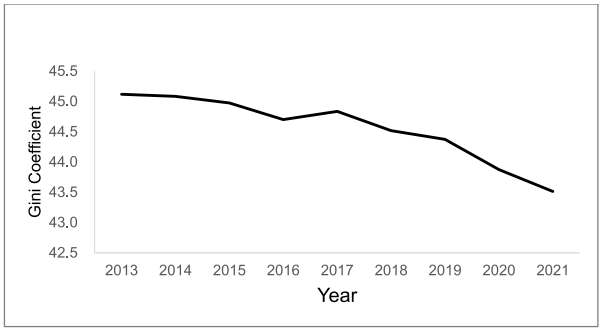

Fig. 1. Gini Coefficient of the Postgraduate Student (2013-2021) [Owner-draw].

Table 2. Gini Coefficient of the Number of Postgraduate Students in Higher Education Institutions (Graduates)[Owner-draw].

Year	Gini Coefficient
2013	45.12
2014	45.08
2015	44.97
2016	44.70
2017	44.84
2018	44.52
2019	44.37
2020	43.87
2021	43.51

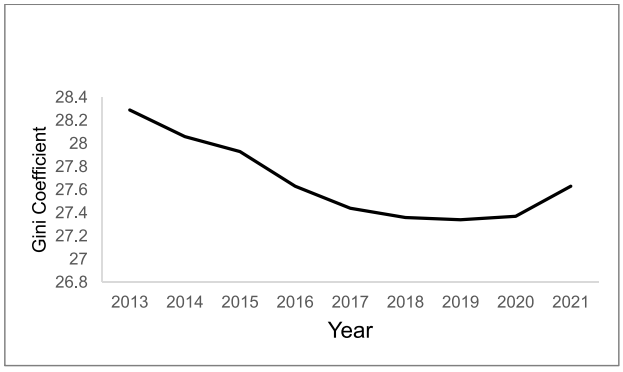

Fig. 2. Gini Coefficient of the Institutions of Higher Learning(2013-2021)[Owner-draw].

Table 3. Gini Coefficient of the Number of Institutions of Higher Learning [Owner-draw].

Year	Gini Coefficient
2013	28.29
2014	28.06
2015	27.93
2016	27.63
2017	27.44
2018	27.36
2019	27.34
2020	27.37
2021	27.63

According to Figures 3 and 4 and Tables 4 and 5, the educational resources are more unequal in different provinces from 2013 to 2021 because the Gini coefficient increased gradually. The stratification phenomenon of high and middle schools is mainly manifested in the different academic qualifications and teachers in high and middle schools. High and middle schools vary according to the economic development of each region.

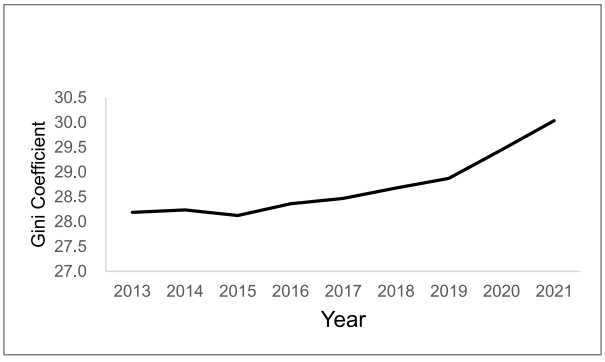

Fig. 3. Gini Coefficient of the High Schools (2013-2021) [Owner-draw].

Table 4. Gini Coefficient of the Number of High Schools [Owner-draw].

Year	Gini Coefficient
2013	28.19
2014	28.24
2015	28.13
2016	28.36
2017	28.47
2018	28.68
2019	28.87
2020	29.45
2021	30.04

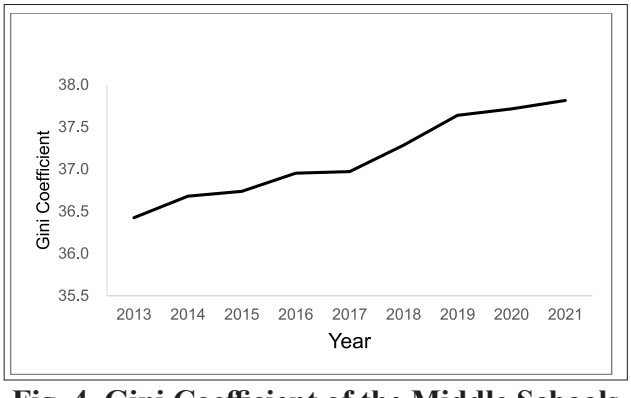

Fig. 4. Gini Coefficient of the Middle Schools (2013-2021) [Owner-draw].

Table 5. Gini Coefficient of the Number of Middle Schools [Owner-draw].

Year	Gini Coefficient
2013	36.42
2014	36.68
2015	36.74
2016	36.95
2017	36.97
2018	37.28
2019	37.64
2020	37.71
2021	37.81

The above-stratified phenomena are intertwined in China's education system, which has synthesized more complex educational stratification phenomena, constantly causing the unfair distribution of educational resources.

The result of this problem is that the central government regulates the number of institutions of higher learning, and college students consider the status of schools more than the local economy. Therefore, the number of graduate students and the Gini coefficient of the number of colleges and universities are on a downward trend, so the educational resources turned out to be more equal. On the contrary, the number of junior high and senior high schools is affected by the degree of regional economic development. The developed areas attract more talent, resulting in more middle and high school students and many schools. In underdeveloped areas, the number of talents is out-flowing, and the number of junior high and senior high schools has increased little or even decreased. Therefore, the Gini coefficient of the number of senior high and junior high schools is rising, so educational resources are more unequal. Although China's education stratification and inequality have been widely recognized and worked hard by the government, solving this problem is not easy. Many problems still require more attention and effort. For example, the government should not ignore the fairness of the allocation of educational resources but should actively promote supporting measures for the balance of educational resources in different cities; appropriate education allocations should be made in underdeveloped areas to benefit more students. In

addition, from a broader perspective, policy planning and the development of education departments should improve the participation of education in various cities and increase opportunities for social advancement so that the educational resources of all regions are more equal.

Regional education inequality is a complex and long-term problem that has become a worrying phenomenon in China's education system. It will be a major challenge to popularize high-quality education in all regions. But as long as we grasp every detail and create a fairer educational ecology, this dilemma will be alleviated. And educational institutions and individuals need more active attention from the government.

6 Conclusions

This research aims to analyze the current situation of Chinese education by calculating the Gini coefficient of educational resources. This paper calculated the trend of the Gini coefficient (number of graduate graduates, colleges and universities, high schools, junior high schools) in 2013-2021. The result trends are different, depending on the allocation of resources in different regions at different levels of education.

The results show that according to the analysis of different levels of educational resources, there are inequalities in China's education in different provinces. For example, junior and senior high school resources are more unequal. The resources of postgraduates and institutions of higher learning tend to be more equal in these years; the educational resources of developed regions, such as Beijing and Shanghai, far exceed those of economically underdeveloped regions, such as Xinjiang.

The uneven distribution of educational resources shows that there are deficiencies in school facilities, teachers, and other aspects in some areas, and the government needs to increase investment to improve the quality of basic education. At the same time, society should also strengthen support and investment in education, provide more educational resources and opportunities, and create a good environment for the all-round development of students.

References

1. Tesfeye, Kebede. (2002), "The Economics of Education: Conceptual Framework," Journal of African Economies, 26: 357-74.

2. Digdowiseiso, K. (2010). Measuring Gini coefficient of education: the Indonesian cases.

3. Galor, O. and Moav, O. (2004), "From Physical to Human Capital Accumulation: Inequality and The Process of Development," Review of Economic Studies, 60: 35-52.

4. Gruber, L., & Kosack, S. (2014). The tertiary tilt: Education and inequality in the developing world.World Development , 54, 253–272.

5. V. Soltes, K. Repkova Stofkova (2019) The Impact of Education Funding on the Socioeconomic Development of Regions , ICERI2019 Proceedings, pp. 10950-10955.

6. Thomas, V. Y. Wang, and X. Fan. (2001), "Measuring Education Inequality: Gini Coefficient of Education," Policy Research Working Paper, No. 2525, World Bank Institute.

7. López, R. Vinod Thomas, Yan Wang. (1998), "Addressing the Education Puzzle: The Distribution of Education and Economic Reform," Policy Research Working Paper, No. 2031, The World Bank, Washington D. C.