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Research on national and provincial income gap from 2015 to 2019 - based on Gini coefficient

Zhang Zeyu, Li Ruixuan, Guo Xuan

Shandong University of Finance and Economics, Jinan, China

Abstract: *At present, China is in a period of rapid development, but there are still problems of unbalanced and insufficient development. How to judge the current income gap in China, so as to promote a reasonable income distribution pattern, is an urgent problem to be solved. Then this paper uses the Gini coefficient to judge the national and provincial income gap from 2015 to 2019. However, at present, China has not officially released the provincial Gini coefficient, so this paper will use the most original calculation method of the Gini coefficient, use the officially released distributable income data divided into five parts of income to calculate the Gini coefficient, and analyze the income gap based on the calculation data, so as to draw conclusions and put forward relevant suggestions.*

Keywords: *Gini coefficient; Income disparity; Disposable income*

1. Introduction

In recent years, despite the sustained and healthy development of China's economic aggregate and the continuous improvement of GDP, in 2020, the per capita disposable income in cities and towns was 43834 yuan and that in rural areas was 17131 yuan, showing a large increase over the previous years. However, the current national income gap is still large. The Gini coefficient of per capita disposable income of Chinese residents has exceeded 0.45 in the last decade. According to the indicators of Gini coefficient, the range of 0.4-0.5 is regarded as a large income gap. Through reading a large number of literatures, it is found that many scholars calculate the income gap of Chinese Residents Based on the Gini coefficient. However, China is a vast country with different levels of economic development among regions and different characteristics of urban and rural economic development. Therefore, it is necessary to explore the urban-rural income gap in the province. However, the National Bureau of statistics has not calculated the Gini coefficient of each province. The Gini coefficient of each province in China is calculated by the people, and the source of data is unknown. Therefore, after pre investigation, this paper will calculate the Gini coefficient of urban residents' income, the Gini coefficient of rural residents' income and the Gini coefficient of urban and rural residents' income in 8 representative provinces and cities from 2015 to 2019. The calculation data are all from the statistical yearbooks of each province, and the data sources are true and reliable. Analyze the calculation results of the three Gini coefficients of each province, and put forward corresponding tests based on the actual situation.

2. Theoretical basis

2.1 Measuring principle

There are many methods to measure the Gini coefficient in China, but no matter how it changes, the most classic measurement of the Gini coefficient is also initially defined as the ratio of unequal area to completely unequal area in the Lorentz curve. Through consulting a large number of literatures, it can be seen that there are two kinds of Gini coefficient calculation: equidistant grouping and heterodistant grouping. Since this paper selects the five equidistant data in the provincial statistical yearbook from low to high income, this paper selects the common formula of Gini coefficient of heterodistant grouping, as shown in formula 1[2]

$$G=\mu^{-1}\sum_{i=1}^{n}\sum_{j=1}^{i-1} p_i \left| y_i - y_j \right| p_j \tag{1}$$

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Note: where IP represents the proportion of the population of group I in the total population, is the expected value of the overall income of different groups, and iy is the average income of different groups.

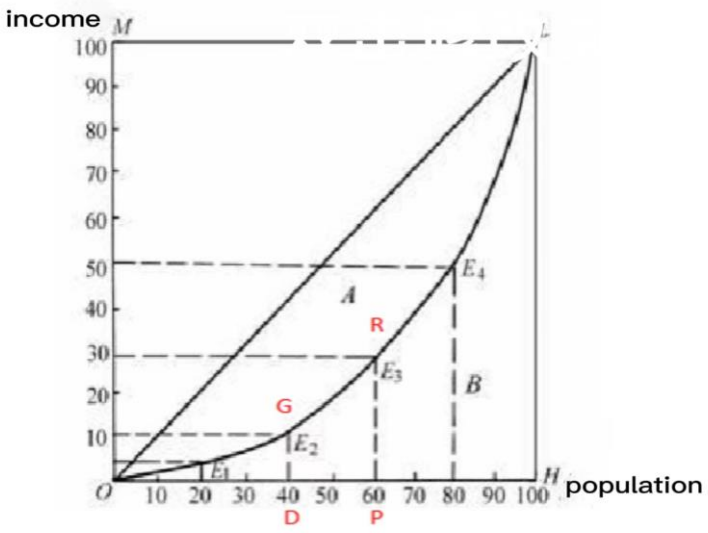

Figure 1: Gini coefficient calculation diagram.

As shown in Figure 1, the area of area a is called the area of unequal income. The Gini coefficient can be expressed as the ratio of the region a between the 45 degree straight line and the Lorentz curve and the region)a+b) under the 45 degree straight line. The calculation formula of Gini coefficient can be further derived. [4]

$$G = \frac{A}{A+B} = 2A = 1-2B \tag{2}$$

According to the derivation of the above formula, the Gini coefficient is actually equal to 1 minus twice the area of area B. So when we calculate the Gini coefficient, we only need to calculate the area of area B. In addition, in the statistical yearbook of provinces in China, the income levels of cities, towns, rural areas and the whole province are divided into five equal parts according to the income level. In other words, the area of region B can be regarded as the sum of the areas of trapezoids such as quadrilateral gdfr. Therefore, formula 2 can be further derived into formula 3.

$$G = 1 - \sum_{i=1}^{n} (X_i - X_{i-1})(y_i + y_{i-1}) \tag{3}$$

So we can calculate the Gini coefficient of cities and rural areas in each province according to the data provided by the statistical yearbook of each province.

However, in the statistical yearbooks of each province, only some provinces and cities provide the per capita disposable income of the whole province according to the quintiles. Therefore, after consulting relevant literature and obtaining the urban and rural Gini coefficients respectively, we use the grouping weighting method to calculate the Gini coefficients of the whole province. See formula 4. The data of population proportion and per capita income of the whole province are from the statistical yearbooks of each province, and the data are true and valid.

$$G = P_c^2 \frac{u_c}{u} G_c + P_r^2 \frac{u_r}{u} G_r + P_c P_r \frac{u_c - u_r}{u} \tag{4}$$

Note: in formula 4, CG and RG respectively represent the Gini coefficient of urban and rural areas, CP and RP respectively represent the proportion of urban and rural population, and Cu and Ru respectively represent the per capita income of urban and rural areas. U represents the per capita disposable income of the province. [4]

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2.2 Significance of measured data

Through the calculation of the Gini coefficient, the income gap level can be reflected according to the value of the Gini coefficient. The data measured in this paper are the data divided into five equal parts of the national and provincial income. The data are all from the National Bureau of statistics or the statistical yearbooks of each province, which can ensure that the calculation results are true and effective. At the same time, the country has not released the calculation data of Gini coefficient for each province. This Gini data calculation can make up for the data gap.

3. 2015-2019 national Gini coefficient calculation

First of all, we calculate the Gini coefficient of the income gap among urban residents, rural residents and national residents. The data still select the disposable income data divided by quintiles.

Table 1: Disposable income of urban residents by quintuple.

particular year	Low Income Households	Lower Middle Income Households	Middle income household	Upper middle households	High income household
	(20%)	(20%)	(20%)	(20%)	(20%)
2015	12331	21446	29105	38572	65082
2016	13004	23055	31522	41806	70348
2017	13723	24550	33781	45163	77097
2018	14387	24857	35196	49174	84907
2019	15549	26784	37876	52907	91683

Table 2: Disposable income of rural residents by quintuple.

particular year	Low Income Household	Lower Middle Income Households	Middle income household	Upper middle households	High income household
	(20%)	(20%)	(20%)	(20%)	(20%)
2015	3086	7221	10311	14537	26014
2016	3007	7828	11159	15727	28448
2017	3302	8347	11978	16944	31299
2018	3666	8509	12530	18051	34043
2019	4263	9754	13984	19732	36049

Table 3: Disposable income of national residents divided into five parts.

particular year	Low Income Household	Lower Middle Income Households	Middle income household	Upper middle households	High income household
	(20%)	(20%)	(20%)	(20%)	(20%)
2015	5221	11894	19320	29438	54544
2016	5529	12899	20924	31990	59259
2017	5958	13843	22495	34547	64934
2018	6440	14361	23189	36471	70640
2019	7380	15777	25035	39230	76401

Based on the derived formula 3, the Gini coefficient of the obtained data is calculated by Excel, and can be compared with the officially released Gini coefficient.

Table 4: calculation of Gini coefficient.

particular year	National Urban Gini coefficient	National Rural Gini coefficient	National Gini coefficient(self-test)	National Gini coefficient (official)
2015	0.295	0.348	0.386	0.462
2016	0.297	0.355	0.388	0.465
2017	0.303	0.359	0.391	0.467
2018	0.316	0.366	0.394	0.468
2019	0.317	0.352	0.394	0.465

Note: the national Gini coefficient data are from the National Bureau of Statistics

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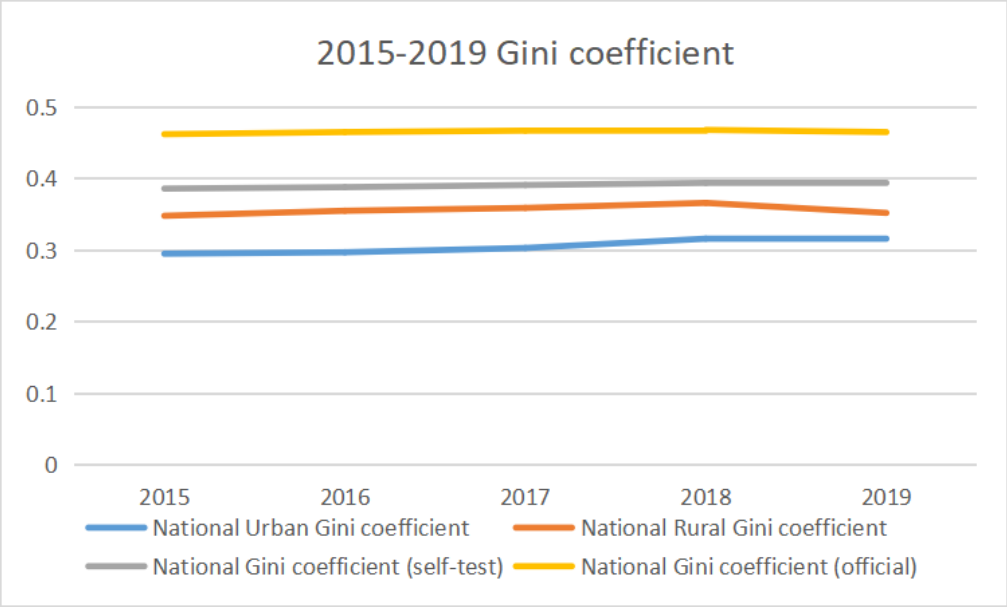

Figure 2: Line chart of Gini coefficient.

According to Figure 2, we can draw the following conclusions:

(1) The self-test national Gini coefficient is significantly lower than the national Gini coefficient. The reason is that in fact, in order to ensure the authenticity and effectiveness of the data obtained, the data used in this paper is the data distributed by the National Bureau of statistics, which is divided into five parts according to income. The gap between groups is not considered in the calculation process, so the Gini coefficient is small compared with the data on the official website. However, it can be seen that the self-test national Gini data have the same trend as the officially released Gini coefficient, which can show that the method adopted in this book is true and reliable and has reference significance.

(2) The Gini coefficient of urban and rural areas showed an upward trend from 2015 to 2018, but the Gini coefficient of rural areas showed a downward trend from 2018 to 2019. It shows that the income gap among urban residents is increasing and the income gap among rural residents is narrowing.

4. Calculation and analysis of provincial Gini coefficient

4.1 Calculation of provincial Gini coefficient

By consulting the statistical yearbooks and relevant literature of each province, this paper finally selects 8 representative provinces for calculation, and calculates the urban Gini coefficient, rural Gini coefficient and provincial Gini coefficient of 8 provinces from 2015 to 2019. Beijing and Shanghai do not publish the data of urban and rural areas respectively, so only the Gini coefficient of the whole province can be calculated, and the three Gini coefficients of the other 6 provinces can be calculated, The Gini coefficient of the whole province is calculated by using the method of calculation principle in the theoretical basis, after calculating the Gini coefficient of cities and rural areas respectively, and then using the weighted method. The calculation results are shown in the figure below.

Table 5: Gini coefficient of income of all residents in each province from 2015 to 2019.

ID	2015	2016	2017	2018	2019
Jingxi	0.247	0.289	0.311	0.301	0.345
Jiangsu	0.328	0.324	0.326	0.349	0.354
Guizhou	0.396	0.406	0.410	0.445	0.439
Beijing	0.297	0.290	0.293	0.295	0.292
Shanghai	0.275	0.264	0.263	0.263	0.262
Guangdong	0.326	0.330	0.330	0.335	0.342
Sichuan	0.379	0.388	0.394	0.407	0.411
Gansu	0.428	0.427	0.430	0.450	0.473

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Table 6: Gini coefficient of urban residents' income from 2015 to 2019.

ID	2015	2016	2017	2018	2019
Jiangxi	0.210	0.209	0.259	0.322	0.330
Jiangsu	0.306	0.297	0.299	0.338	0.344
Guizhou	0.285	0.297	0.305	0.385	0.369
Guangdong	0.273	0.267	0.274	0.273	0.269
Sichuan	0.276	0.296	0.304	0.321	0.317
Gansu	0.264	0.267	0.273	0.325	0.343

Table 7: Gini coefficient of rural residents' income from 2015 to 2019.

ID	2015	2016	2017	2018	2019
Jiangxi	0.320	0.329	0.334	0.342	0.344
Jiangsu	0.322	0.320	0.326	0.339	0.339
Guizhou	0.310	0.347	0.349	0.367	0.361
Guangdong	0.282	0.296	0.288	0.274	0.287
Sichuan	0.323	0.342	0.365	0.415	0.407
Gansu	0.346	0.365	0.370	0.425	0.436

4.2 Trend analysis of provincial income gap from 2015 to 2019

4.2.1 Trend analysis of income gap of all residents in the province from 2015 to 2019

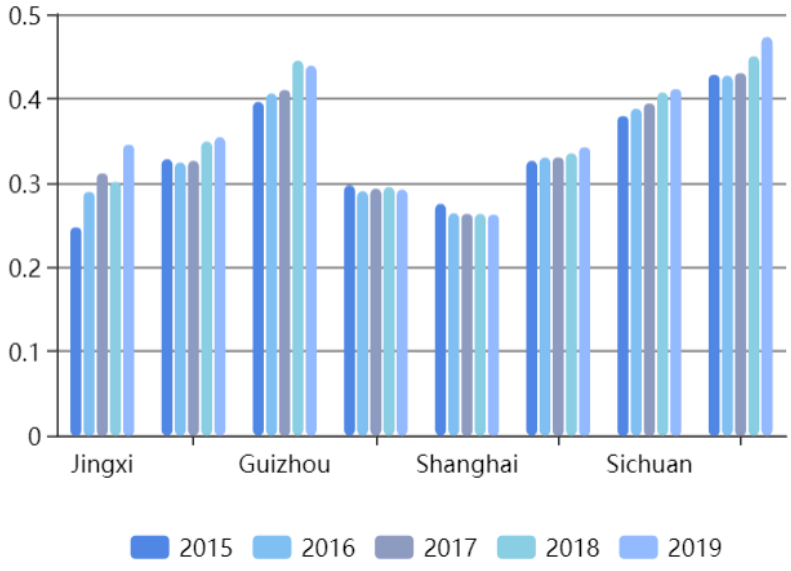

Figure 3: Histogram of Gini coefficient of all residents in the province from 2015 to 2019.

It can be seen that the Gini coefficients of Beijing, Shanghai, Guangdong and Jiangsu, the four economically developed provinces and cities, have little change, and are all between 0.26 and 0.35, no more than 0.4. However, these three regions have relatively developed economies and a high degree of urbanization. The gap between the rich and the poor has gradually stabilized with economic development and policy intervention, and the Gini coefficients of Beijing and Shanghai continue to decrease. For example, the four economically underdeveloped provinces of Jiangxi, Guizhou, Sichuan and Gansu are still in the stage of insufficient development, and the Gini coefficient is still growing. The Gini coefficient of Guizhou, Sichuan and Gansu is not only increasing year by year, but also its

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value is greater than 0.4, which can explain that their income gap is very huge. In Jiangxi, although the Gini coefficient is increasing, the Gini coefficient is not large, and the gap between the rich and the poor is small.

4.2.2 Trend analysis of urban residents' income gap from 2015 to 2019

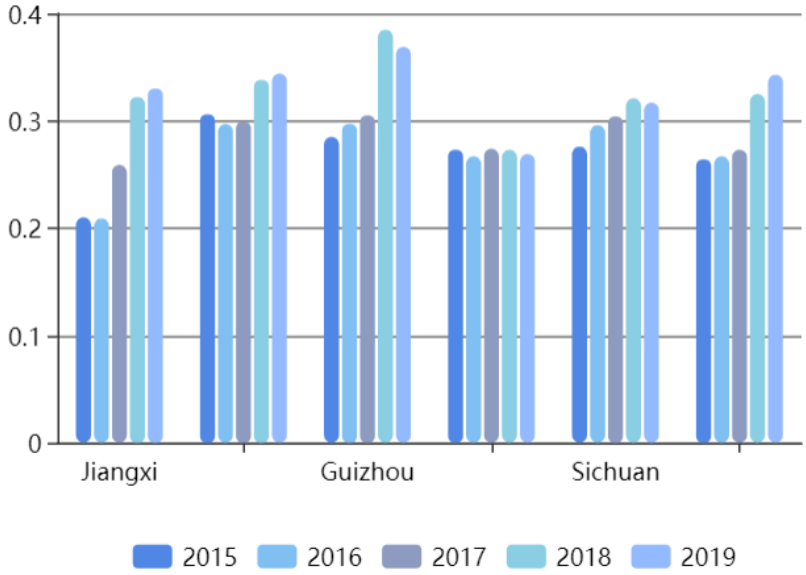

Figure 4: Histogram of Gini coefficient of provincial urban residents.

First of all, it can be seen that the Gini coefficient of cities and towns in Jiangxi has increased rapidly from 2017 to 2019. Although the Gini coefficient is still small, it can be seen that Jiangxi is promoting urbanization, and the per capita disposable income of urban residents has increased from 26500 yuan in 2015, It was raised to 36546 yuan in 2019, and the per capita income of its income group increased from 27799 yuan in 2015 to 85435.98 yuan in 2019, which is three times the original. It can be seen that the high-income group of its urban residents is expanding and the income is increasing, which may be the reason for the rapid increase of its Gini coefficient. The Gini coefficient of Jiangsu Province and Guangdong Province has little change, and its value is not high, and the income gap is small. The Gini coefficients of Guizhou, Sichuan and Gansu are still expanding.

4.2.3 Trend analysis of rural residents' income gap from 2015 to 2019

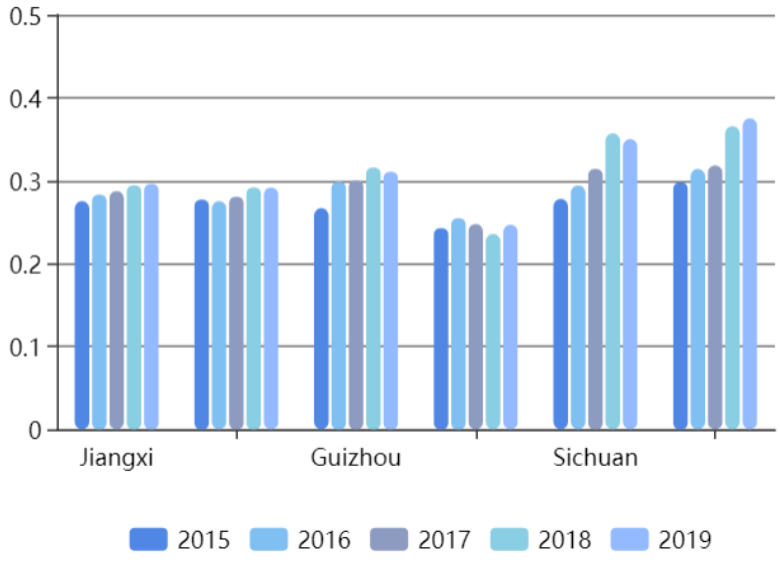

Figure 5: Histogram of Gini coefficient of rural residents in the province.

The change trend of Gini coefficient is basically the same as that of all residents and urban residents.

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Developed provinces tend to be stable, and the gap between the rich and the poor in underdeveloped provinces gradually increases. At the same time, it can be found that the Gini coefficient between urban and rural areas in low-income areas is too large, which can explain the large income gap between urban and rural areas.

5. Inter provincial income gap and division of provincial types -- Taking 2019 as an example

5.1 Income gap between provinces

5.1.1 Regional distribution characteristics of income difference

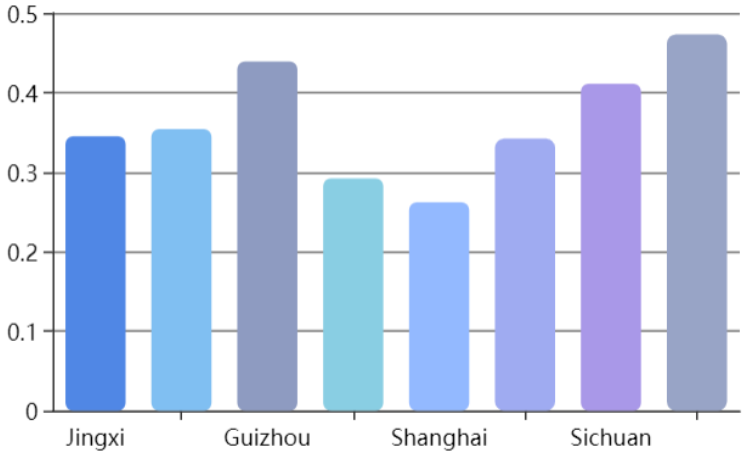

Figure 6: Distribution of Gini coefficient of income of all residents in different provinces in 2019.

As shown in Figure 6, from the perspective of geographical distribution, the income gap in the eastern region is small. In the central and western regions, the level of economic development is low, but the income gap is different.

First, for the eastern region, the Gini coefficient of each province in 2019: Jiangsu Province)0.345), Shanghai)0.262), Beijing)0.292) and Guangdong Province)0.342). Both are lower than the national Gini coefficient of 0.394. It can be seen that in these developed eastern provinces, the income gap is relatively small.

For the central and western regions, there are both provinces with large income gap and provinces with low income gap in the provinces with low economic development level. In 2019, the Gini coefficient of Guizhou, Gansu and Sichuan provinces was greater than the national income Gini coefficient measured by self, while that of Jiangxi Province was lower than the national income Gini coefficient measured by self, which indicates that there are also provinces with small income gap in the provinces with insufficient economic development.

5.1.2 Distribution characteristics of income difference between urban and rural areas

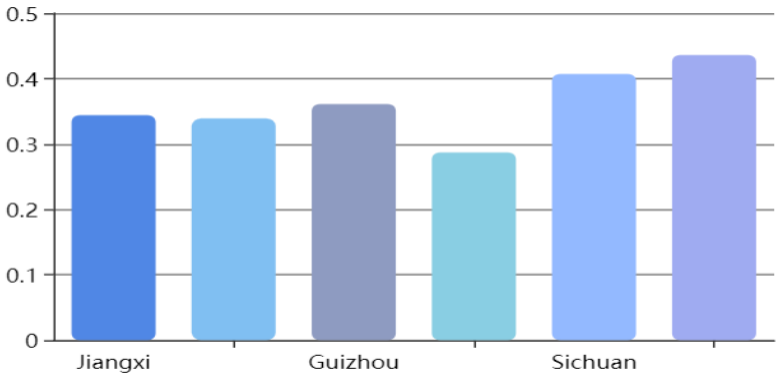

Figure 7: Distribution of Gini coefficient of rural residents' income by province in 2019.

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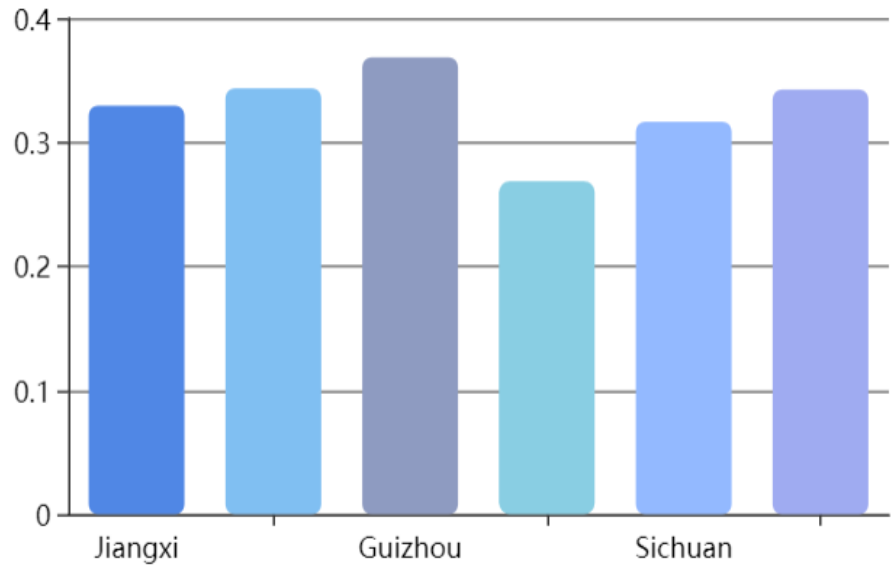

Figure 8: Distribution of Gini coefficient of urban residents' income by province in 2019.

First of all, according to the estimated Gini coefficient of all residents in each province and the Gini coefficient of towns and villages, in general, the Gini coefficient of rural areas is greater than that of cities and towns, that is, the income gap within rural areas is greater than that of cities and towns. In 2019, except for Jiangsu and Guizhou, the rural Gini coefficient of other provinces is greater than the urban Gini coefficient. Among them, the rural Gini coefficient of Gansu Province is 0.093 larger than the urban Gini coefficient, which shows that the income gap in rural areas is much larger than that in urban areas.

5.2 Division of provincial types based on income and income gap

The income of provincial residents is divided based on per capita GDP, and the income gap is judged based on the Gini coefficient previously calculated. By comparing with the national per capita GDP and the national Gini coefficient, we get our conclusion. [3]

5.2.1 High income and high equilibrium provinces

Table 8: Relevant data of high income and high equilibrium provinces in 2019.

	GDP(hundred million RMB)	Per capita GDP (yuan)	Provincial city Gini coefficient
Beijing	35371.3	164200	0.292
Shanghai	38155.32	157100	0.262
Jiangsu	99631.5	123600	0.354
Guangdong	107671.07	94200	0.342

In 2019, China's per capita GDP was 70892 yuan, while that of Beijing, Shanghai, Guangdong and Jiangsu the per capita GDP is higher than the national average GDP, so it is judged as a high-income province. In addition, the Gini coefficient of these four provinces is lower than the national Gini coefficient of 0.394, which is self measured. The income gap is small and the development is balanced. Therefore, this paper defines the above four cities as high-income balanced provinces.

5.2.2 Low income balanced provinces

In fact, the particularity of Jiangxi Province has been put forward many times in the previous article. It is a representative of low-income but balanced development. In 2019, the per capita GDP of Jiangxi Province was 57552.73 yuan, lower than the national average level. It is a typical low-income province. However, its Gini coefficient is only 0.345, far lower than the national average Gini coefficient in 2019. Therefore, Jiangxi Province is listed as a low-income balanced province.

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5.2.3 Low income unbalanced provinces

Table 9: Relevant data of low income unbalanced provinces in 2019.

	GDP(hundred million RMB)	Per capita GDP (yuan)	Provincial city Gini coefficient
Gansu	2837.36	33200	0.473
Guizhou	16769.34	29938.54	0.439
Sichuan	46615.82	55888	0.411

From table 9, it can be seen that the per capita GDP of the above three provinces is lower than the national average, and the provincial Gini coefficient is much higher than the self-rated national Gini coefficient. Therefore, the above three provinces are transformed into low-income unbalanced provinces.

6. Conclusions

This paper calculates the national Gini coefficient and provincial Gini coefficient from 2015 to 2019, analyzes the change trend of China's overall income gap from 2015 to 2019, and analyzes the income gap between regions and between urban and rural areas through horizontal and vertical comparison. The eight representative cities are divided into high-income and high balanced provinces, low-income balanced provinces and low-income unbalanced provinces according to the per capita GDP and Gini coefficient.

Through the analysis of this article, although China has achieved a well-off society in an all-round way, according to the analysis of this article, there is still insufficient and unbalanced development in the central and western provinces of China. In the less developed provinces, the gap between urban and rural areas is still large. This requires us to further strengthen the implementation of the primary and secondary distribution policies, promote the economic development of various regions, narrow the gap between the rich and the poor, and create a better future. [1]

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