Has COVID Worsened Income Inequality in China?

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Abstract. As COVID sweeps through the global economy, it has a negative impact on almost any country in the entire world. Although the direction of public opinion is that the impact is bad, the research intends to prove its truth through statistical methods. Is the gap between rich and poor in China really getting bigger because of COVID? Will people's income become more unequal as a result? By calculating the Gini coefficients and counting their trends, the research found that China's income equality has actually improved in the short term. This conclusion is based on a detailed analysis of income data from 31 provincial-level administrative regions across several years, allowing for a more comprehensive understanding of regional income patterns. The research not only evaluates numerical trends but also considers relevant social and economic factors that might have contributed to these changes. While most assume that crises like COVID-19 intensify inequality, this study finds that, under certain conditions, temporary improvements in income equality can emerge, possibly due to emergency policies or economic adjustments.

Keywords: Economic, Equality, Modelling, Covid-19

1. Introduction

Since the outbreak of the new crown epidemic at the end of 2019, it has had a wide-ranging impact on many fields around the world. The impact on the distribution of national income is particularly concerning to the media and the government. As the origin of the outbreak and the world's second-largest economy, changes in China's economic and social structure have far-reaching implications for the country and the world. In recent years, despite China's remarkable economic growth, the issue of income inequality has been the focus of social and policy research. The outbreak and subsequent public health response may have further impacted this issue. This article explores whether the new crown epidemic has exacerbated China's national income inequality and analyzes its possible causes and consequences to provide a reference for relevant policy formulation.

2. Literature review

The whole research focuses on whether COVID-19 positively or negatively impacts China's national per capita income, thereby reducing or increasing income inequality. The main research data comes from the National Bureau of Statistics of China. The research method summarizes the national per capita income from 2013 to 2021 (the per capita income will be subdivided into 31 provincial, autonomous regions) and uses the per capita income of the autonomous region to draw an

accumulative graph. Then, calculate the Gini coefficient of China's per capita income for each year and compare the Gini coefficients corresponding to the four years to draw a conclusion--what impact does COVID have on China's income inequality?

Different kinds of literature have their own arguments on whether COVID has positively or negatively impacted income equality in China. Zohal used macroeconomics, description analysis, and correlation analysis to study how COVID affects the development of China's economy and its potential impact [1]. The research found that foreign trade and domestic production ushered in a huge blow during the COVID period, causing a large destruction of per capita GDP. However, after the government's adjustment and rectification, China's economy has rebounded after the COVID, and the economy has recovered and its growth rate has exceeded the level before the epidemic. This also means that income equality has improved because GDP per capita rose dramatically after the epidemic. However, YUE QIAN uses the logit regression model to explore whether COVID has played an equalizer role in the Chinese economy, and it conducts a sample survey of 4715 people with different social statuses, genders, and educational backgrounds. The results show that COVID not only failed to act as an equalizer but also exacerbated the original inequality in Chinese society and had a greater blow to low-income groups, that is, socially marginalized groups [2]. The two literatures analyze COVID from the perspective of macro and micro, respectively. QUE YAN's data collation and analysis are more suitable for this study because the data are often more convincing, and the impact of COVID-19 on the entire Chinese economy is more suitable for use in the evaluation of research results.

In order to make the whole research better organized and more detailed, the research on income inequality cannot be the whole article, and other aspects of inequality affected by COVID are also essential. PENG NIE studied the inequality of COVID-19 on the mental health and physical health of low-income and high-income people in China [3]. He used multiple linear and additive regression models to conduct statistical analysis on 8448 people of different ages, genders, and jobs. Finally, he concluded that COVID has worse effects on the physical health of low-income people (unemployment, substandard health insurance, lack of money to see a doctor) and worse on the mental health of high-income people (job stress, stress of living in the city), which means that COVID has exacerbated health inequalities in China. Haoye Liao focused on the impact of COVID-19 on education inequality in China [4]. He studied whether school shutdown increases inequality in academic performance. Through a sample survey of 7202 middle school students from 98 different schools, he used the empirical model to draw the following conclusions: Parents' income and educational level determine the academic performance of children taking online classes at home; parents with higher levels of education and income are better able to educate their children during this period. Zhaohui Su explores whether women are facing greater inequality during COVID. Research shows that with more women on the front lines of protests, women being victims of domestic violence, and the sheer number of expectant mothers, COVID has caused more women to be infected, subject to domestic violence and anxiety [5]. This presents the inequalities that women face is undoubtedly exacerbated. In the discussion and analysis of the results of this study, linking income inequality with other forms of inequality will undoubtedly increase the persuasiveness of the results and make the research more comprehensive because it can make the impact of COVID-19 on the epidemic in China more apparent.

3. Methodology and data

The entire methodology in this study is based on China's per capita disposable income from 2013 to 2018. The data comes from the National Bureau of Statistics of China [6]. The National Bureau of

Statistics was chosen because it has relatively authoritative and official data (government website). Hence, a methodology based on more authoritative data is more convincing. After collecting the per capita disposable income of each of China's 31 provincial-level autonomous regions from 2013 to 2021, the research will analyze the data year by year and draw by ranking and summing the per capita disposable income of the 31 provincial-level administrative regions Into an accumulative graph. The purpose of drawing the chart is to calculate the Gini coefficient more advantageously. After getting the nationwide Gini coefficient for each year from 2013 to 2018, draw them into a line chart; the purpose is to observe the overall trend of the Gini coefficient and summarize whether there is an abnormality around 2019 to infer the impact of COVID on income equality across the country.

This is the data of per capita disposable income of China's 31 provincial-level administrative regions from 2013 to 2018 extracted from the database of the National Bureau of Statistics of China:

Table 1. Per capita disposable income of China's 31 provincial-level administrative regions

Data set: 31 provincial-level administrative regions										
Index: Per capita disposable income of all residents (Yuan)										
Time: Last 10 years										
Region	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
北京市 Beijing	77415	75002	69431	67756	62361	57230	52530	48458	44489	40830
天津市 Tianjing	48976	47449	43854	42404	39506	37022	31074	31291	28832	26359
河北省 Hebei Province	30867	29383	27136	25665	23146	21484	19725	18118	16647	15190
山西省 Shanxi Province	29178	27426	25214	23828	21990	20420	19049	17854	16538	15120
内蒙古自治区 the Nei Monggol Autonomous Region	35921	31108	31497	30555	28376	26212	24127	22310	20559	18693
辽宁省 Liaoning Province	36089	35112	32738	31820	29701	27835	26040	24576	22820	20818
吉林省 Jilin Province	27975	27770	25751	24563	22798	21368	19967	18684	17520	15998
黑龙江省 Heilongjiang Province	28316	27159	24902	24254	22726	21206	19838	18593	17404	15903
上海市 Shanghai Municipality	79610	78027	72232	69442	64183	58988	54305	49867	45966	42174
江苏省 Jiangsu Province	49862	47498	43390	41400	38096	35024	32070	29539	27173	24776
浙江省 Zhejiang Province	60302	57541	52397	49899	45840	42046	38529	35537	32658	29775
安徽省 Anhui Province	32745	30904	28103	26415	23984	21863	19998	18363	16796	15154
福建省 Fujian Province	43118	40659	37202	35616	32644	30048	27608	25404	23331	21218

Table 1. (continued)

江西省 Jiangxi Province	32419	30610	28017	26262	24080	22031	20110	18437	16731	15100
山东省 Shandong Province	37560	35705	32886	31597	29205	26930	24685	22703	20864	19008
河南省 Henan Province	28222	26811	24810	23903	21964	20170	18443	17125	15695	14204
湖北省 Hubei Province	32914	30829	27881	28319	25815	23757	21787	20026	18283	16472
湖南省 Hunan Province	31036	31993	29380	27680	25241	23103	21115	19317	17622	16005
广东省 Guangdong Province	47065	44993	41029	39014	35810	33003	30296	27859	25685	23121
广西壮族自治区 Guangxi Zhuang Autonomous Region	27981	26727	24562	23328	21485	19905	18305	16873	15557	14082
海南省 Hainan Province	30957	30457	27904	26679	24579	22553	20653	18979	17476	15733
重庆市 Chongqing Municipality	35666	33803	30824	28920	26386	24153	22031	20110	18352	16569
四川省 Sichuan Province	30679	29080	26522	24703	22461	20580	18808	17221	15749	14231
贵州省 Guizhou Xizang Autonomous Region	25508	23996	21795	20397	18430	16704	15121	13697	12371	11083
云南省 Yunnan province	26937	25666	23295	22082	20084	18318	16720	15223	13772	12578
西藏自治区 Tibet Autonomous Region	26675	24950	21744	19501	17286	15457	13639	12254	10730	9740
陕西省 Shanxi Province	30116	28568	26226	24666	22528	20635	18874	17395	15837	14372
甘肃省 Gansu Province	23273	22066	20335	19139	17488	16011	14670	13167	12185	10954
青海省 Qinghai Province	27000	25920	24037	22618	20757	19001	17302	15813	14374	12948
宁夏回族自治区 Ningxia Hui Autonomous Region	29599	27905	25735	24412	22400	20562	18832	17329	15907	14566
新疆维吾尔自治区 Xinjiang Uygur Autonomous Region	27063	26075	23845	23103	21500	19975	18355	16859	15097	13670

Resource: National Bureau of Statistics of China

In order to make the methodology more understandable, research need to take a random year for a more detailed description. What follows is the step-by-step analysis of the per capita disposable income of China's 31 provincial-level administrative regions in 2018:

Table 2. Analysis of the data step-by-step

Line 1	Line 2	Line 3	Line 4
17286	17286	8643	28166.1

Table 2. (continued)

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17488	31774	26030	56332.3
18430	53204	43989	84498.4
20084	73288	63246	112664.5
20757	94045	83666.5	140830.6
21485	115530	104787.5	168996.8
21500	137030	126280	197162.9
21964	158994	148012	225329.0
21990	180984	169989	253195.2
22400	203384	192184	281661.3
22461	225845	214614.5	309827.4
22528	248373	237109	337993.5
22726	271099	259736	366159.7
22798	293897	282498	394325.8
23146	317313	305620	422491.9
23984	311327	329335	450658.1
24080	365407	353367	478824.2
24579	389986	377696.5	506990.3
25241	415227	402606.5	535156.5
25815	441042	428131.5	563322.6
26386	467428	454235	591488.7
28376	495804	481616	619654.8
29205	525009	510406.5	647821.0
29701	554710	539859.5	675987.1
32644	587354	571032	704153.2
35810	623164	605259	732319.4
38096	661260	642212	760485.5
39506	700766	681013	788651.6
45840	746606	723686	816817.7
62361	808967	777786.5	844983.9
64183	873150	841058.5	873150.0
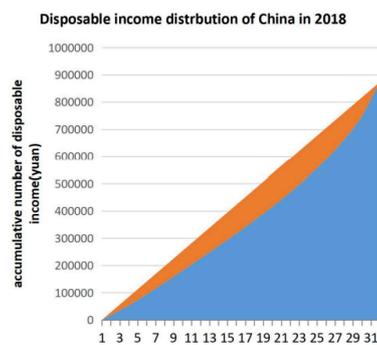
Figure 1. Disposable income distribution of China in 2018

First, the per capita disposable income of 31 provincial-level autonomous regions in Table 1 in 2018 was extracted, and the 31 values were arranged from low to high (Line 1 in Figure 2) in order to calculate the cumulative value (add up sequentially). The research used Excel's base calculation tools and got Line 2 through the basic conversion method. The research also got the total per capita disposable income of 31 provincial, autonomous regions in 2018 as 873,150 yuan. Then, the research used the Excel drawing tool to draw a trend graph with the horizontal axis variable being the number of provincial, autonomous regions and the vertical axis variable being accumulative disposable income (unit is yuan) based on the Line 2 data (the area covered is Blue), the purpose is to more intuitively reflect the distribution of per capita disposable income in China. The trend graph is a curve because China's income distribution is unequal. Due to the difference in per capita disposable income between regions, the drawn line is irregular.

The next step is to create a graph line with perfect equality of Chinese per capita disposable income under ideal conditions. First, divide the known sum of per capita disposable income into 31 equal parts and then calculate each added value in sequence to get Line 4. Then, the researcher used Excel to make the data of Line 4 into a line and add it to 1. Figure 1 shows the difference between the ideal line of perfect income equality and the actual irregular curve (the area between them is orange).

Next, the Gini coefficient is calculated, which calculates the value of dividing the area of the orange part in Figure 1 by the area of the orange plus the blue part. The area of the orange part cannot be directly calculated, so the area of the blue part needs to be calculated. The area of the blue part is the sum of the areas of 31 trapezoids (the upper and lower bases of the trapezoid correspond to the accumulative value in Line 2, and the height of the trapezoid is the unit of the abscissa of the image (that is, 1)). Through the programming method, get Line 3, which is the area of the trapezoid corresponding to each abscissa. Then, sum the areas of all the trapezoids to get the area of the blue part (10985708 yuan). The area formed by the blue and orange areas is the area of a right triangle surrounded by the line of utterly equal per capita disposable income under ideal conditions (the base and height of the triangle correspond to the abscissa 31 and the total accumulative income 873150 yuan). Through simple calculation, the area of the triangle is 13533825 yuan, then the area of the orange part is 13533825-10985708=2548117 yuan, so the Gini coefficient is equal to 2548117/13533825=0.18827.

The data from 2013 to 2021 used the same method to obtain 9 Gini coefficients. Then, aggregated the nine Gini coefficients and made a line chart (Figure 2) with the year on the abscissa and the value of the Gini coefficient on the ordinate in order to observe the changing trend of the Gini coefficient in the past nine years and whether COVID-19 has changed the changing trend of the Gini coefficient and thus affected China's per capita disposable income equality.
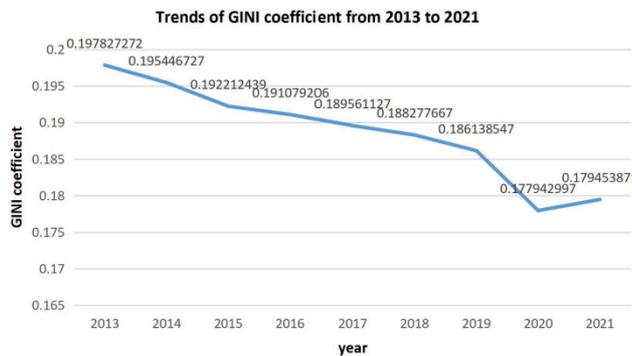

Figure 2. Trends of GINI coefficient from 2013 to 2021

4. Results and discussion

Figure 2 shows that the Gini coefficient of per capita disposable income has declined slowly from 2013 to 2019. Because the Gini coefficient is an indicator to measure the economic equality of a country or region, a decline in the Gini coefficient usually means that the distribution of per capita disposable income in China has become more balanced, which means that China's per capita income has become more equal from 2013 to 2019. It is worth noting that the decline in the Gini coefficient between 2019 and 2020 is more significant than in previous years. This represents a clear impact of COVID-19 on China's economy and per capita disposable income—a temporary and substantial increase in China's income equality. The Gini coefficient slightly increased between 2020 and 2021, meaning China's income distribution is more unequal this year. However, it also means that the Gini coefficient has returned to the original routine (the routine from 2013 to 2019).

The substantial increase in per capita disposable income equality from 2019 to 2020 means that COVID-19 benefits China's short-term income equality and economic development. This result fully confirms Zohal's research point of view. Zohal believes that COVID has a positive impact on China's economy. Potential benefits: Although COVID caused a severe blow to China's export status and per capita GDP in the first few months of 2019, due to the timely intervention of the Chinese government and preventive measures (such as quarantine or nucleic acid testing) for people across the country. The negative impact of COVID is minimized, and the economic recovery and development speed increase extremely fast, even stronger than before COVID.

However, after research and data analysis, the conclusion is that COVID has a short-term beneficial impact on China's income equality. However, the research method still has some deficiencies and flaws that will affect the research results; firstly, the scope of the research is too broad. The study researched China's income equality by analyzing provincial autonomous regions' per capita disposable income. However, the research ignored that the equal income distribution in China does not mean that the income distribution in all regions or cities has become more balanced. The conclusions drawn can only be a broad generalization of a broad range. Secondly, many people face unemployment during the COVID period (due to the company's closure, the company layoffs to reduce costs). The unemployed have no income, but the increase in the number of unemployed people will lead to more poor people, increasing the gap between rich and poor; this study did not consider unemployment.

In order to make China's income equality a long-term improvement, the government should also take relevant measures to promote income equality. Increasing subsidies and tax reductions for large enterprises can effectively reduce enterprises' cost problems after COVID-19. It also prevents enterprises from reducing wages for employees in order to reduce costs. However, government revenue will suffer due to subsidies and tax cuts. The government can also promote corporate borrowing and investment by lowering interest rates. Lowering interest rates means lower borrowing costs and lighter borrowing burdens for companies and individuals. This helps businesses reduce financial stress and make it easier to service debt and stay afloat. It is easier for individuals to repay the loan, reducing the risk of bad debt. However, there are risks associated with lowering interest rates. A low-interest rate environment may reduce the attractiveness of saving, because the returns on savings accounts are relatively low, which may affect the long-term financial planning of individuals and families. Excessive lowering of interest rates may lead to the depreciation of the domestic currency and increase the risk of inflation, thereby affecting price stability.

5. Conclusion

The results of this study suggest that COVID has a favorable impact on income equality in China. The study has calculated the nine corresponding Gini coefficients from 2013 to 2021 through the statistics and calculation of the per capita disposable income of 31 provinces and autonomous regions in China. Observing the changing trend of the Gini coefficient can prove whether COVID has an impact on income equality. This study is significant for China's economic development after experiencing COVID-19. In order to make the whole research better organized and more detailed, the research on income inequality cannot be the whole article, and other aspects of inequality affected by COVID are also essential; in the future, the study will link income equality in China with other types of equality together (gender equality, health equality, education equality), in order to explore the causal relationship between them and think about their connection to China's future economic development.

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