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An Analysis of the Impact of COVID-19 Pandemic on Regional Inequality in China

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Abstract: The aim of this paper is to examine the phenomenon of regional inequality in China under the broad context of the COVID-19 pandemic and also the post-pandemic time period. To diversify the sample, nine years of raw data (2013-2021) are included in this paper. Using the annual data from this time period, a 5-year calculation of the Gini coefficient from 2017 to 2021, will be calculated. To calculate, the Cumulative Change Model, the Lorenz Curve Framework, and the Cutting Method are applied. The raw data is first applied in the cumulative change equation; by graphing the results, the Lorenz Curve can be framed, which then can be used to calculate the Gini coefficient. The conclusion is that the COVID-19 pandemic further exacerbated the situation of regional inequality, as shown by an increase in the Gini coefficient.

Keywords: COVID-19 Pandemic, Regional Inequality, Gini Coefficient

1. Introduction

By November 2022, China ended the Zero-COVID policy [1], indicating the fall of the COVID-19 pandemic in China. Even though people's life seems to revive a lot, the effects that the pandemic brought to China in the past three years still sustained some aftershock, including lots of industries in China. Moreover, even before the pandemic, there were some problems occurred in China. One specific problem is class rigidity.

China's social class has been very rigid [2] since decades ago, but recent changes in social structure, caused by both changes in lifestyle and changes in the social status of people in the 21st century, have led to an extremely big gap between the rich and the poor, since these changes may cause one's social status to increase and one's social status to decrease. As being hit by the COVID-19 pandemic, many people tended to move from place to place, leading to high social mobility. Right now, as impacted by social mobility, class rigidity can be mostly affected by the changes in different cities/provinces in China and class rigidity, in this case, can be named regional inequality.

While this problem occurred in China over decades and the COVID-19 pandemic can also lead to such kind of rigidity (or inequality), it is worth examining. As mentioned in the previous paragraph, many industries have been impacted by the pandemic. Thus, this paper will take the catering industry as the subject, using the original calculated Gini coefficient data to examine the regional inequality in China. Plus, this paper attempts to show that the COVID-19 pandemic can not only cause regional inequality but also exacerbate the issue, and there are some efforts that can be made to help alleviate this issue.

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2. Literature Review

Because of COVID-19, the catering industry and tourism industry in China, for example, have been hit hardly [3]. To be more specific, COVID policies leading to home isolation and blocking transportation [4] reduced sales for many restaurants, causing a decreasing trend in revenue and net profit. At the same time, such restaurants were confronted with a variety of increasingly high costs [5], including house rent—one of the largest shares in expenditure—that did not decrease even in the pandemic. Eventually, their income has been reduced a lot as compared to past years. The catering industry has the following characteristics: 1) short entry time for many firms, 2) shallow capital pool, and 3) lack of ability to counter risks. Because of these traits and reduction in income, many big firms could maintain their sales by using chain [6], but small firms, representing most of the practitioners, could only quit the market. Many people left first-tier cities in China, and one interpretation is the lack of ability to keep a foothold in these cities, which may reflect an increase in regional inequality.

There are mainly two ways that can cause an increase in regional inequality in China. First, there is a city-level resource misallocation in China [7]. All the best resources are found in first-tier cities, and all the citizens in the city are the biggest beneficiary by receiving considerable welfare. It lowers the possibility of social mobility. Second, due to the COVID-19 pandemic, many people seek a more stable life to develop in county territories that they belong to, leading to an outflow of population from big cities. The example of small restaurant firms in the previous paragraph matches the second way, indicating the exacerbation of regional inequality.

When talking about regional inequality, the "middle class" is typical. The term “middle class” refers to a group in the middle of a social hierarchy [8], earning approximately 60 to 500 thousand CNY annually. After the pandemic at the beginning of 2020, many micro, small, and medium-sized enterprises have been struck sharply. Since their income has been reduced by almost half, a majority of such enterprises closed down, leading to many pressures among white-collar groups in cities. Moreover, a bulk of these people are on the borderline of the middle class, meaning they might fall into the low-income group after a stronger strike under severe economic conditions or international situations.

In summary, the income growth of the upper class in China is rapid and fastest, and there is a shrinkage in the middle class, making the lower class poorer. Such things embody class rigidity and regional inequality in China, and this paper will focus on examining this inequality, specifically income inequality, by using the Gini coefficient. For most of the existing papers about the Gini coefficient, the data of the index will be directly used, which lacks originality. So, on the foundation of analyzing the regional inequality by using existing coefficients, this paper will also be focused on calculating the Gini coefficient based on data from another field and examining the situation using the data calculated. Moreover, this article makes contributions to the literature: 1) presenting an alternative way to examine regional inequality, 2) reinforcing the severe condition of regional inequality in China, 3) proposing ways to help ameliorate the problem in China.

3. Methodology

There are various ways to calculate or study income inequality [9]. However, the Gini coefficient is most commonly used [10]. The Gini coefficient or index is a way to not only calculate income inequality but also help researchers and scholars to measure the gap between the rich and the poor. It ranges from 0 to 1 to combat different situations of income inequality. As the coefficient becomes larger, the gap between the rich and the poor becomes larger. Usually, 0.4 can be a boundary: if the Gini coefficient is larger than this number, there might be too much difference between the rich and the poor, indicating a probability of regional inequality.

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The data on the Gini coefficient can be obtained from The World Bank. However, only 130 countries have their coefficient data can be found. Yet, for this paper, China's data on the Gini coefficient is available. Not only China's data but other organizations also providing statistics on income inequality use The World Bank's Gini index data [11]. Thus, the reliability can be proved.

Moreover, this paper is aimed to calculate the Gini coefficient by using the number of corporate enterprises in the catering industry in different provinces/cities in China, and the data are obtained from the National Bureau of Statistics of China. After obtaining the data, an original analysis will be made.

Even though a variety of data can be utilized and analyzed, there are two limitations of the Gini coefficient. First, this coefficient does not capture samples both in urban areas and rural areas [9]. Second, it fails to capture interventions that "bridge inequality between rich and poor" [11]. The second limitation was not been solved, which can be a factor hindering making China's current income inequality index better. But the first limitation can be solved by adding weights to rural and urban samples [12].

4. Data Presentation

There are two pieces of data in this essay. There is one table comparing the Gini coefficient of various countries, including the United States, United Kingdom, Canada, and Japan. Moreover, there is one chart showing China's Gini coefficient in various years—from 2017 to 2021. The reason why for choosing data from 2017 to 2021 is that this paper aims to examine the difference in the economic situation before the pandemic and after the pandemic in China.

For the Gini coefficient, two variables are used: income and population. Such two variables can be displayed in the Lorenz curve, a framework to calculate the Gini coefficient. In the framework, the x-axis represents % of households by income distribution, and the y-axis represents the cumulative share of income earned. Just as the description said, the unit for these two variables are shown by percentage, and the range for both the x-axis and y-axis is ranged from 0% to 100%.

For the chart, the aim is to emphasize the urgency of China's regional inequality conditions by comparing it with developed countries around the world that have lower Gini coefficients. Thus, the way of representation is just to show the index directly and explicitly. For the graph, it is important to see the overall trend and the changes in the Gini coefficient year by year. Thus, the way of representation is first to calculate the coefficient and then make a line chart with dots showing specific numbers and lines showing overall trends.

Admittedly, the data collected from The World Bank is not very high quality. Since the focus of the paper is to examine post-pandemic situations in China, the data must be better focused on the time period from 2019 to 2023 (or the present). However, the most updated data that can be obtained is 2019's Gini coefficient. It poses a potential limitation to this essay. However, since the data obtained from the National Bureau of Statistics of China is for original analysis, it can be manipulated easily.

5. Analysis

The yearly data on the number of corporate enterprises in the catering industry of China are collected from the National Bureau of Statistics of China. To be more specific, 31 provinces or cities in China have been chosen as the specific data. Next, for each province or city, the data have been placed by each year—from 2013 to 2021—as shown by Table 1, for effectiveness and conciseness of showing data and later choosing the data for analysis. The Gini coefficient, in definition, is placed from households with the lowest income (poorest) to households with the highest income (richest); thus, this dataset, shown by a table, is filtered by ascending order.

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To restate the variables needed, the y-axis of the Lorenz curve is the cumulative share of income earned. So, an additional calculation to Table 1 is made. For example, for data in 2021, the number of corporate enterprises will be shown using the way of cumulative change. That is, this data will use the number of corporate enterprises in the catering industry as income earned by households, showing how much money the first one person has, the first two people have, the first three people have, all the way to how much money do first 31 people have. Figure 1 shown below is the visual representation of the cumulative change calculated, but it is also a component in the Lorenz curve (usually serves as the area B).

In order to get the rest of the Lorenz curve, the midline of the framework will be calculated. Let us denote the y value of the midline of the Lorenz curve with y_m. Since this value might change for each x value, it can be modeled in the following way:

$$y_m = \frac{t}{31} \cdot x \tag{1}$$

where t is the sum of all cumulative changes in these 31 places, and $x = 1, \dots, 31$.

After calculating the midline, the difference between the values of the midline and the values of the cumulative change will be calculated. Then, as shown by Figure 2, which incorporates values from both values of cumulative changes and values of the difference, the entire Lorenz curve can be demonstrated.

Based on Figure 2, the Gini coefficient can be calculated. The general formula of the Gini coefficient based on the Lorenz curve can be shown in the following way:

$$Lorenz\ Curve = \frac{A}{A+B} \tag{2}$$

where A is the orange portion, and B is the blue portion.

By calculating the blue portion, the cutting method is applied. That is, the blue portion will be cut into several trapezoids (using values in cumulative change as the upper base or lower base), and the entire area can be calculated by summing the area of those trapezoids up, as shown in Figure 2. Moreover, the area of A+B, denoted as A_x, can be modeled in the following way:

$$A_x = t^2/2 \tag{3}$$

where t is the sum of all cumulative changes in these 31 places.

After obtaining the value from the area of the blue range and the area of the entire area, the area of the yellow range can be calculated by the area of the entire area minus the area of the blue range. Finally, the Gini coefficient can be calculated, and this method can be applied every year.

Table 1: Number of Restaurants in China's 31 Provinces, 2013-2021

Region	2021	2020	2019	2018	2017	2016	2015	2014	2013
Beijing	2043	2009	2076	1259	1299	1324	1408	1873	1822
Tianjin	607	515	483	345	351	388	378	400	423
Hebei	600	499	468	442	429	423	440	467	467
Shanxi	739	603	471	442	397	450	469	506	568
Inner Mongolia	228	227	239	281	326	369	377	387	427
Liaoning	366	347	340	304	343	387	533	637	715
Jilin	193	155	166	174	223	226	184	162	162
Heilongjiang	121	86	87	80	101	145	152	176	210
Shanghai	2587	2508	2231	1626	1655	1672	1770	1892	1638
Jiangsu	3300	2510	2030	1848	1853	2030	2065	2122	2402
Zhejiang	2490	2163	1957	1659	1579	1526	1554	1544	1506
Anhui	1449	1359	1271	1252	1213	1214	1183	1097	1032

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Table 1: (continued)

Fujian	1599	1411	1272	1092	1021	957	921	864	797
Jiangxi	1093	796	635	540	447	346	294	236	241
Shandong	2072	1627	1377	1609	1767	2057	2122	2268	2430
Henan	1333	1184	1133	983	1235	1416	1324	1311	1374
Hubei	1572	1421	1494	1479	1363	1630	1667	1883	1861
Hunan	1634	1493	1250	1101	930	800	707	598	587
Guangdong	5735	4868	4393	3491	3143	2958	2893	2914	2883
Guangxi	745	531	415	362	344	320	318	305	303
Hainan	114	98	71	55	52	51	53	62	84
Chongqing	1214	1181	1159	1224	1372	1412	1273	1120	1015
Sichuan	2150	1795	1672	1544	1474	1538	1510	1547	1611
Guizhou	721	645	607	611	598	511	385	385	304
Yunnan	878	770	633	611	536	493	380	361	360
Tibet	18	17	13	10	13	12	9	10	13
Shanxi	1526	1419	1372	1282	1241	1128	1022	968	958
Gansu	408	368	347	348	362	358	340	339	346
Qinghai	53	56	58	48	53	53	43	40	37
Ningxia	55	59	72	62	67	70	80	79	90
Xinjiang	257	181	126	94	97	95	93	81	

Source: National Bureau of Statistics of China

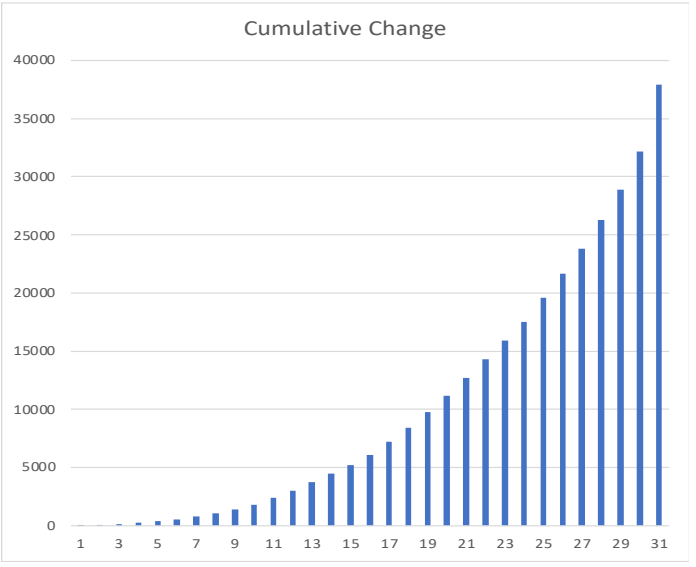

Figure 1: Cumulative Change of the Restaurants

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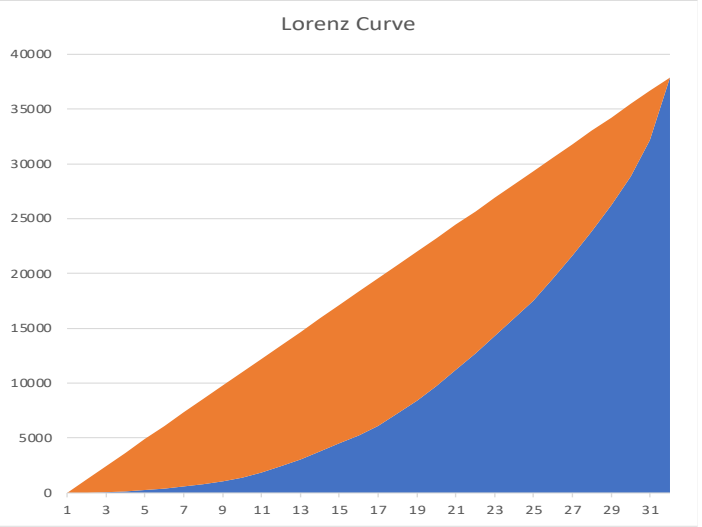

Figure 2: Lorenz Curve of the Gini Coefficient

6. Results

The results of the data manipulation, showing the calculated regional inequality Gini coefficient from 2017 to 2021, are presented in Figure 3. What we can see is that the results differ each year, depending on the different number of corporate enterprises in the catering industry as a fundamental factor. When we compare the results obtained for each year, we can conclude that there is an ascending trend of the regional inequality Gini coefficient within these years, especially a sharp increase between 2018 and 2019. Moreover, for all years, the regional inequality Gini coefficient was greater than 0.4, a "warning line" of income inequality and regional inequality. Thus, it indicates that regional inequality occurred even before the pandemic, maybe existing for decades.

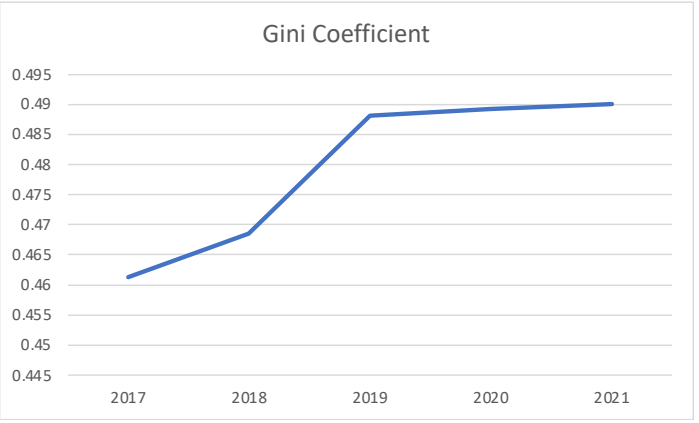

Figure 3: Calculated Gini Coefficient

In fact, there has been high growth and increasing income inequality in China over the past three decades [13]. Even in recent years, China's Gini coefficient is stable between 0.43 to 0.47 and exceeds United States 0.40, Canada's 0.33, and Japan's 0.34, as shown in Table 2. By recognizing this problem, the results of the catering industry chosen in this paper are more typical. Since there is a rigid demand in the catering industry in China [14], it serves as a main force in China's consumer market and economy. Thus, there might be a strong correlation between the industry's income inequality and the inequality at a national level: the calculated Gini coefficient in 2019, shown in

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Figure 3, approaches approximately 0.489, which poses a very significant problem after the nation has been crushed by the COVID-19.

Table 2: Gini Coefficient for 4 Countries

Country	Gini Coefficient
China	0.43
United States	0.4
Japan	0.33
Canada	0.34

Source: The World Bank

Indeed, the Gini coefficient is very high, which can be directly proportional to the market's allocation of resources. Take one simple example: there is a high level of inequality of resource distribution in China's medical health market, so the Gini coefficient for this market is about 0.6 [15], even worse than the catering industry. For most of the markets in China, the idea of "fierce competition" and "survival of the fittest" is very common. However, China has a huge population with many households, and one way to make everyone wealthy is to protect micro, small, and medium-sized enterprises and safeguard the economic interest of those enterprises/households. With COVID-19 as an external factor, many enterprises cannot afford the costs, plus there is a lack of supply of skilled workers. The phenomenon of decreasing the number of enterprises, for example, in the catering industry, and lack of workers ulteriorly increase the gap between the income of different groups of people, which increases the Gini coefficient and regional inequality in China at the same time.

7. Conclusion

The goal of this paper was to examine regional inequality in China, using the catering industry as a representative to analyze income inequality using the regional inequality Gini coefficient. Since regional inequality is an entrenched problem, the focus of the paper was what caused this and how the data matches the real situation of China. One comparison between China and other countries was made in order to emphasize China's severe problem of regional inequality. But, the bulk of the paper utilized the concept of the Gini coefficient to analyze the internal problems of China, including the market's allocation of resources and social mobility (people leaving from first-tier cities).

The main factor behind the increase in the Gini coefficient in China's catering industry is the impact of the COVID-19 pandemic. The problems of decreasing customers, utilizing lower fixed costs, boosting the company's operation capacity, and focusing more on "costs and efficiency", seem to be some possible solutions for restaurants in the long term.

From a broader perspective, to alleviate regional inequality in China, market regulation is very important. Specifically, the government should reduce the monopoly of certain industries such as education, the internet, and realty industries. Moreover, the government should also utilize progressive taxes and transfer payments to help close the gap between the rich and the poor.

Reducing regional inequality and income inequality is never an easy thing. Moreover, this paper has some limitations. For example, the difference in population between each city/province was not considered, which doesn't match the concept of the Gini coefficient strictly. Such two aspects indicate that scholars and researchers still have a lot to examine this issue, and policymakers still need to refine policies to contrive for a better social environment and economic development.

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Appendix

1) Calculations of the Regional Inequality Gini Coefficient (by year)

2021	# of Corporate Enterprise in Catering Industry	0		0	Mid-Line	x-axis
Tibet	18	18	11003.22581	1204.58065	1222.58065	1
Qinghai	53	71	54404.83871	2374.16129	2445.16129	2
Ningxia	55	126	120424.1935	3541.74194	3667.74194	3
Hainan	114	240	223732.2581	4650.32258	4890.32258	4
Heilongjiang	121	361	367385.4839	5751.90323	6112.90323	5
Jilin	193	554	559330.6452	6781.48387	7335.48387	6
Inner Mongolia	228	782	816683.871	7776.06452	8558.06452	7
Xinjiang	257	1039	1113159.677	8741.64516	9780.64516	8
Liaoning	366	1405	1493993.548	9598.22581	11003.2258	9
Gansu	408	1813	1967132.258	10412.8065	12225.8065	10
Hebei	600	2413	2583312.903	11035.3871	13448.3871	11
Tianjin	607	3020	3321140.323	11650.9677	14670.9677	12

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Guizhou	721	3741	4132933.871	12152.5484	15893.5484	13
Shanxi	739	4480	5025417.742	12636.129	17116.129	14
Guangxi	745	5225	5932572.581	13113.7097	18338.7097	15
Yunnan	878	6103	6924696.774	13458.2903	19561.2903	16
Jiangxi	1093	7196	8129550	13587.871	20783.871	17
Chongqing	1214	8410	9539796.774	13596.4516	22006.4516	18
Henan	1333	9743	11096753.23	13486.0323	23229.0323	19
Anhui	1449	11192	12797362.9	13259.6129	24451.6129	20
Shanxi	1526	12718	14615951.61	12956.1935	25674.1935	21
Hubei	1572	14290	16509729.03	12606.7742	26896.7742	22
Fujian	1599	15889	18448130.65	12230.3548	28119.3548	23
Hunan	1634	17523	20424432.26	11818.9355	29341.9355	24
Beijing	2043	19566	22672146.77	10998.5161	30564.5161	25
Shandong	2072	21638	25187606.45	10149.0968	31787.0968	26
Sichuan	2150	23788	27768474.19	9221.67742	33009.6774	27
Zhejiang	2490	26278	30604861.29	7954.25806	34232.2581	28
Shanghai	2587	28865	33708382.26	6589.83871	35454.8387	29
Jiangsu	3300	32165	37307048.39	4512.41935	36677.4194	30
Guangdong	5735	37900	42830056.45	0	37900	31
Area of Blue Range: 366287606.5						
Area of Entire Lorenz: 718205000						
Area of Yellow Range: 351917393.5						
Gini Coefficient: 0.489995744						

2) Values of the Calculated Regional Inequality Gini Coefficient (2017-2021)

Year	Gini Coefficient
2017	0.461348647
2018	0.468485181
2019	0.488093261
2020	0.489191916
2021	0.489995744