Factors affecting income inequality in the U.S.

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Income inequality is a social hot topic causing many negative impacts on society so that, over a very long period, many economists have been paying attention to it. As in the U.S. where there is a high level of income inequality, the top 20% of highest-earning families earned more than half of all U.S. income in 2018. Therefore, using the U.S. in 2018 as an example, firstly, we study the relationships between income inequity and the ratios of white and black people, internet accessibility, unemployment rate, educational attainment and economic development level in 50 states, and then in 27 districts of Wisconsin. We would love to figure out several questions: Which variable affects income inequality most? In which direction? Besides, what's the trend of income inequality in the past decades? How did it respond to an economic recession and a hit of a pandemic? What will the effect of COVID-19 on income inequality be?

We found that internet accessibility is almost irrelevant, while the unemployment rate affects the most, on average, every 1% increase leads to a 1.2 % and 3.5 % increase in income inequity at the state and district level respectively. Besides, roughly speaking, GDP per capita has a positive relationship with income inequity in 2018 and over decades.

Analysis

1. Data

We collected data about people between 24 and 65 years old who are the major labor force and focus on their income, race, internet accessibility, educational attainment, and data about GDP and unemployment rate. Besides, we downloaded the time series data of these factors in Wisconsin from 2004 to 2019.

Table 1 variables, descriptions and sources

Variable Names	*Description*	*Source*
income_diff	divide the difference between total incomes earned by individuals earning more than 90th quantile and total incomes of workers earning lower than 10th quantile by total incomes in an area, and then multiply it by 100 (%)	PUMS[1]
white_ratio	the ratio of white people (%)	
black_ratio	the ratio of black people (%)	PUMS
inter_ratio	the ratio of internet access (%)	PUMS
edu_ratio	the ratio of people with bachelor' degree or higher (%)	PUMS
gdp_gr	the real GDP growth rate (%)	BEA[2]
gdp_pc	real GDP per capita = real GDP/population (thousands dollars)	BEA
unemp_rate	unemployment rate (%)	BLS[3]

[1] PUMS (Public Use Microdata Sample): https://www.census.gov/programs-surveys/acs/microdata.html

[2] BEA (Bureau of Economic Analysis): https://www.bea.gov/data/gdp/gdp-county-metro-and-other-areas

[3] BLS (U.S. BUREAU OF LABOR STATISTICS): https://www.bls.gov/lau

2. Results Based on States' Data in the US

We first explored the situation of income inequality in the contiguous United States. Figure 1 presents that the states on the west and east coast have higher income inequality levels, such as California and New York. Texas and Florida also have large income inequality.

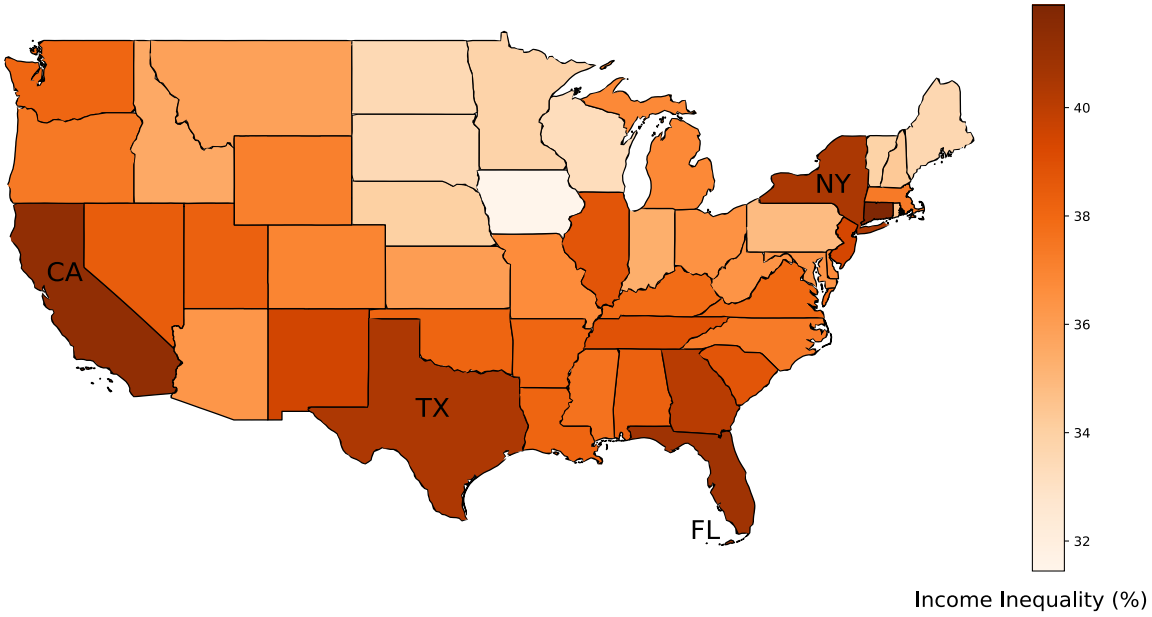

Figure 1 Income Inequality in the Contiguous United States

To further find out which factors affect income inequality, we used the scatter plot and the fitting line to show the relationship between potential influential factors and income inequality.

Figure 2 reflects the relationship between income inequality and GDP per capita. From the plot, the fitting line of GDP per capita is relatively flatter, which proves a little bit of effect on income inequality.

Regions with higher unemployment rates may have more serious income gaps since a higher proportion of the unemployed means poor people will have lower earnings while rising unemployment usually does not affect the already wealthy crowd. In figure 3, we can see that the income difference ratio increases with the unemployment rate, which is consistent with our expectations.

Next, we also study the impact of the proportion of races on income inequality. Shown as in Figures 4 and 5, states with a larger proportion of black people tend to have higher income difference levels.

We have also analyzed the impact of education level and network development level on income inequality, but since the fitting line is almost horizontal, we believe that these two factors have little effect on the nationwide data.

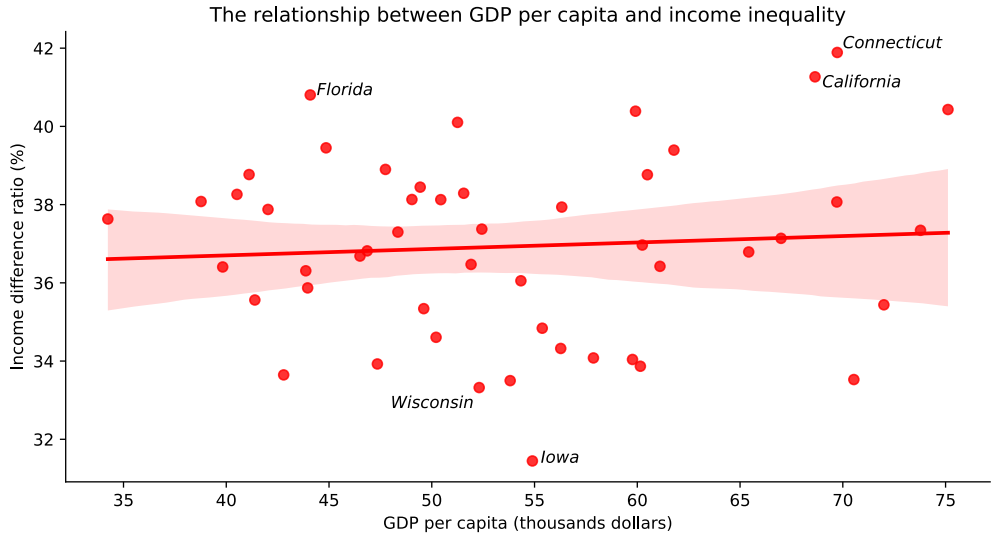

Figure 2 GDP per capita and Income Inequality

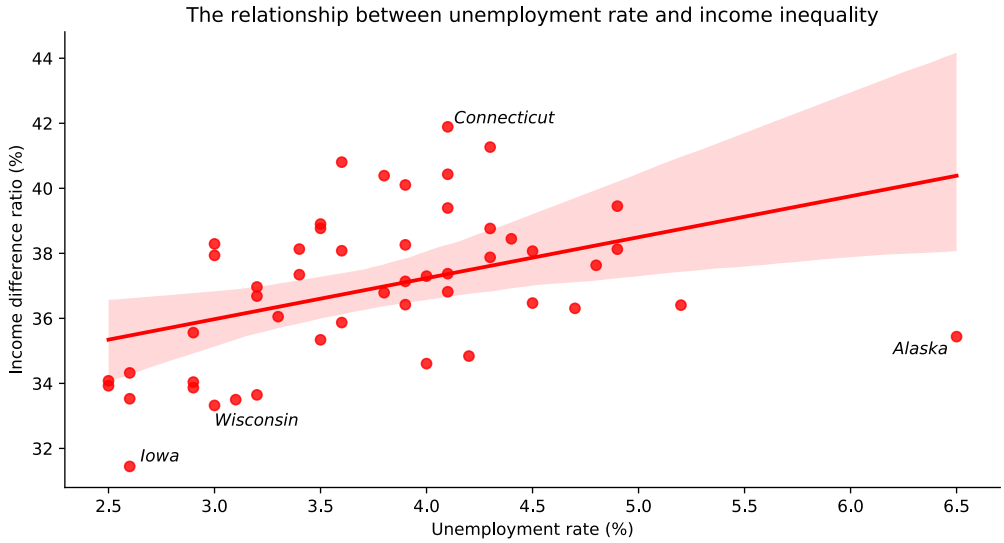

Figure 3 Unemployment Rate and Income Inequality

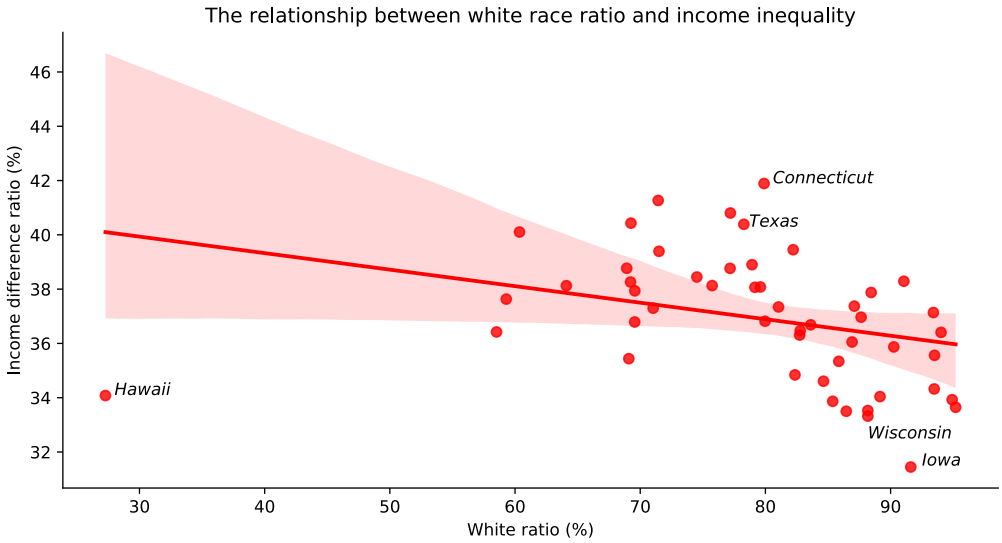

Figure 4 White Ratio and Income Inequality

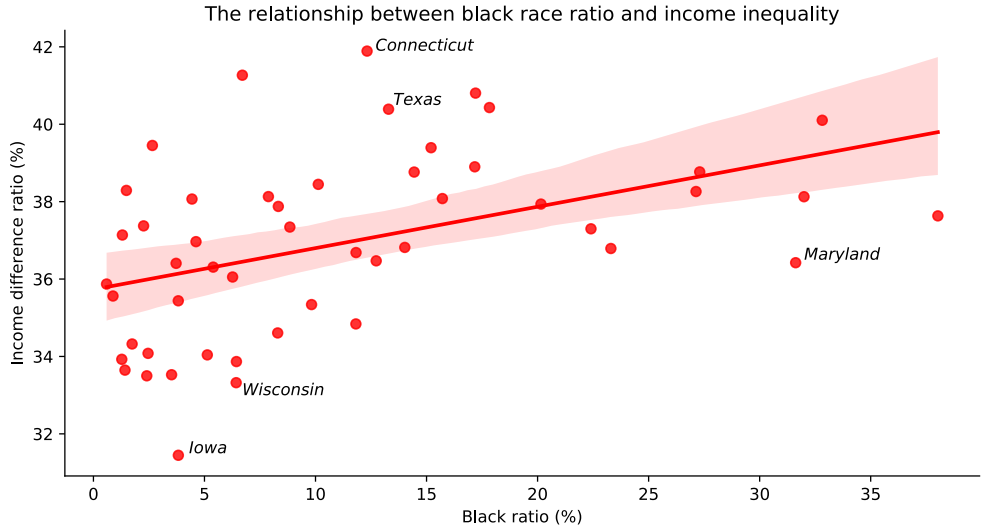

Figure 5 Black Ratio and Income Inequality

Based on the above situation, we did a regression analysis of the above factors. It can be seen from the regression results (Table 2) that the coefficients of black population ratio, GDP growth rate, and unemployment rate are significant at the 5% level, proving that these three factors have a positive stimulus on income inequality.

Table 2 Regression Result on 50 States data

	INCOME DIFFERENCE RATIO
INTERCEPT	29.89**
	(11.58)
WHITE_RATIO	-0.01
	(0.03)
BLACK_RATIO	0.09**
	(0.04)
INTER_RATIO	-0.02
	(0.14)
EDU_RATIO	0.10
	(0.09)
GDP_GR	0.52**
	(0.22)
GDP_PC	-0.00
	(0.04)
UNEMP_RATE	1.21***
	(0.44)
STANDARD ERRORS IN PARENTHESES. * P<.1, ** P<.05, ***P<.01	

3. Results Based on 27 Districts' Data in Wisconsin

After studying the situation in the United States, we still hope to analyze the situation in Wisconsin and explore whether the influential factors are consistent with those in the previous case.

Generally, the regions with higher GDP per capita will have greater income inequality. Figure 6 presents that Dane and Waukesha, the two districts with the highest GDP per capita, also have the highest income inequality level.

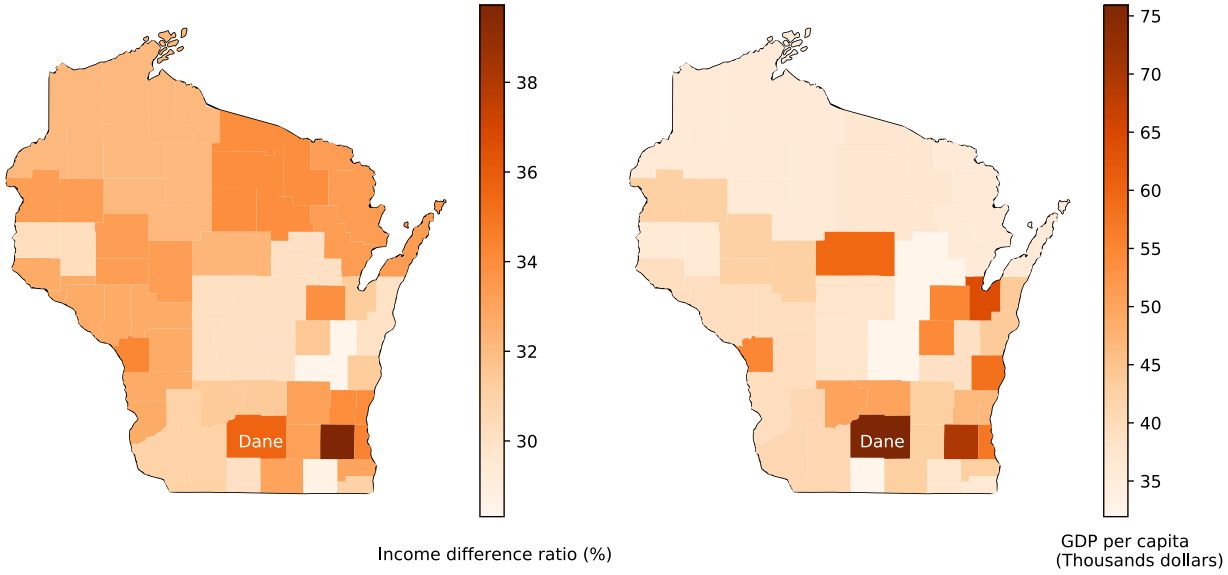

Figure 6 Income Inequality and GDP per capita in WI

Figure 7 better reflects the impact of GDP per capita on income inequality, from which we can see that there is a positive correlation between them.

As for the unemployment rate, Figure 8 presents a situation opposite to our expectation, where the unemployment rate and income inequality have a slight negative correlation. This might be attributed to the insufficient individual sample size and selection bias.

In terms of the ethnic demographic structure, figures 9 and 10 show that the higher the white population and the lower the black population leads to a more balanced income level.

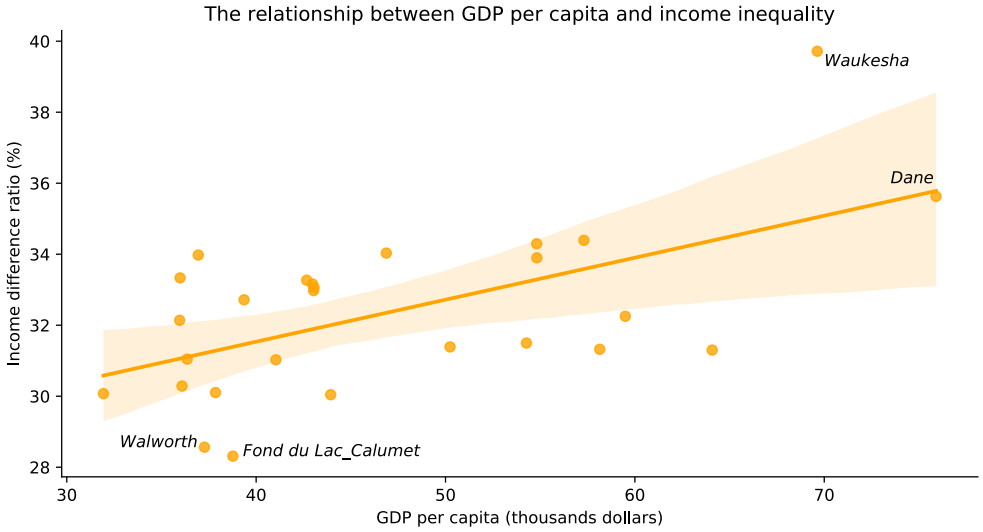

Figure 7 GDP per capita and Income Inequality in WI

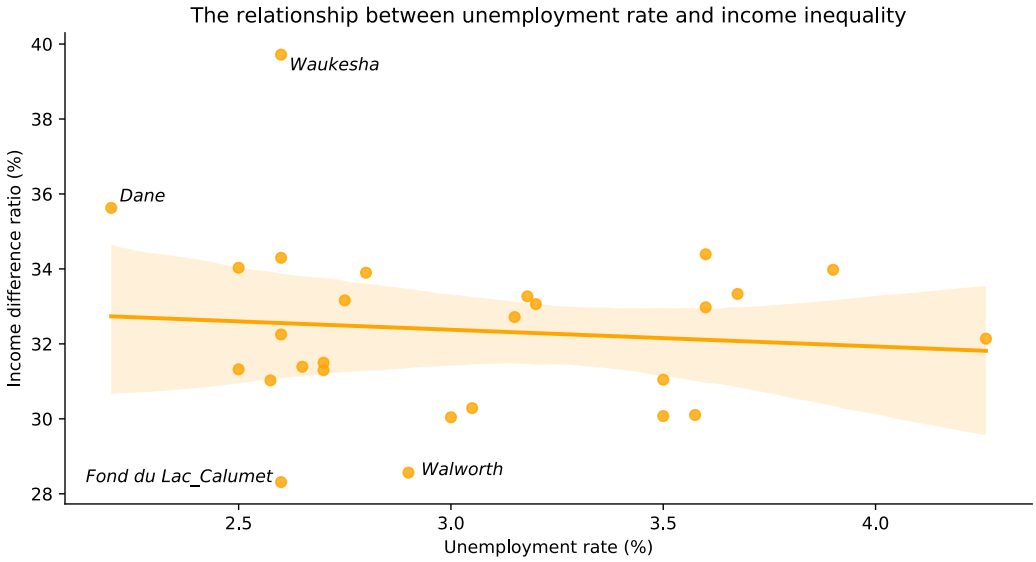

Figure 3 Unemployment Rate and Income Inequality in WI

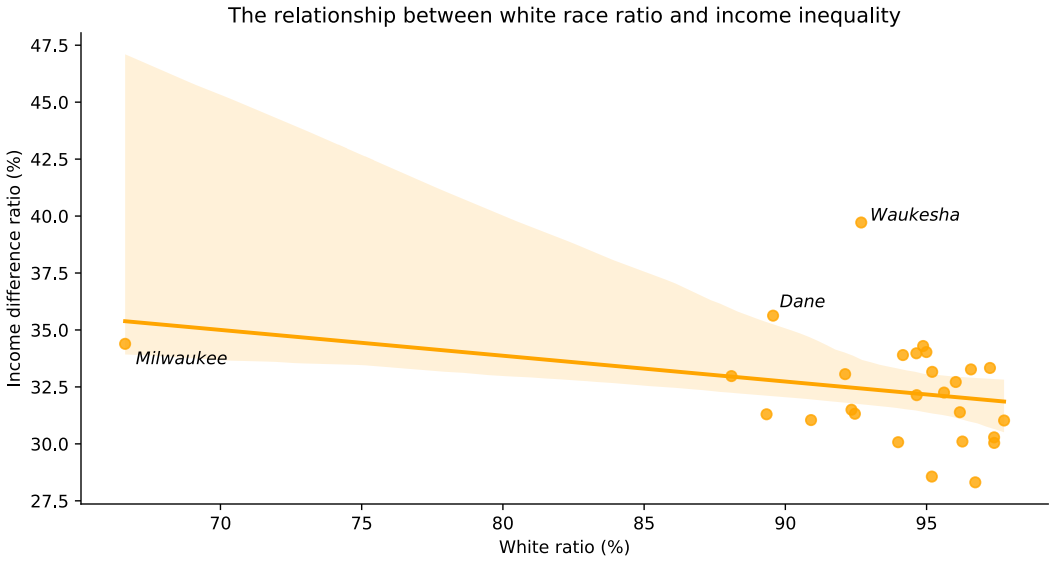

Figure 4 White Ratio and Income Inequality in WI

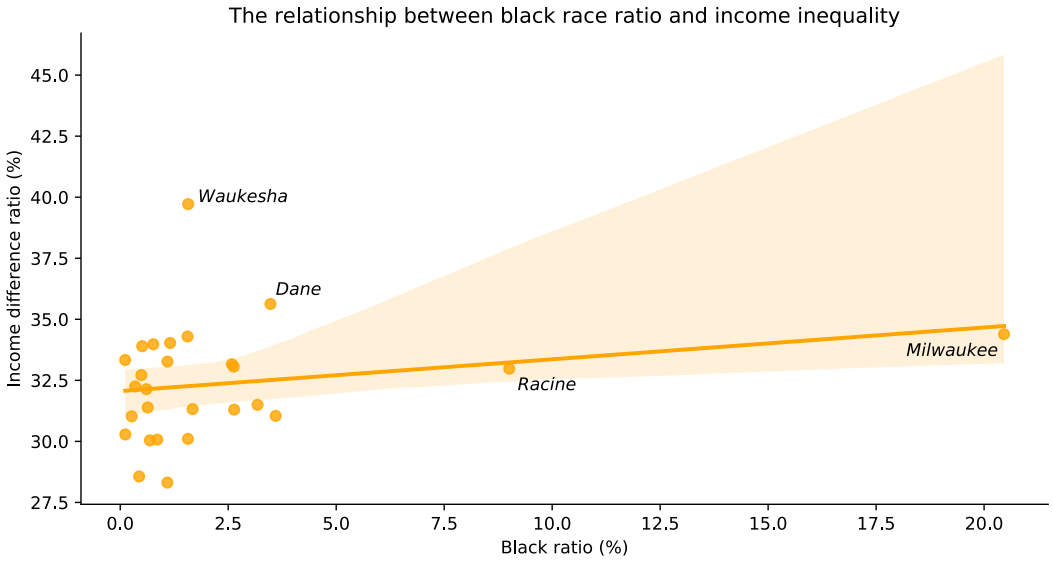

Figure 5 Black Ratio and Income Inequality in WI

Regions with a larger proportion of highly educated people may have more serious income inequality since people who received college education or above are more likely to engage in high-paying occupations and accumulate wealth, which enlarges the income inequality. Figure 11 confirms the positive correlation between education level and income inequality.

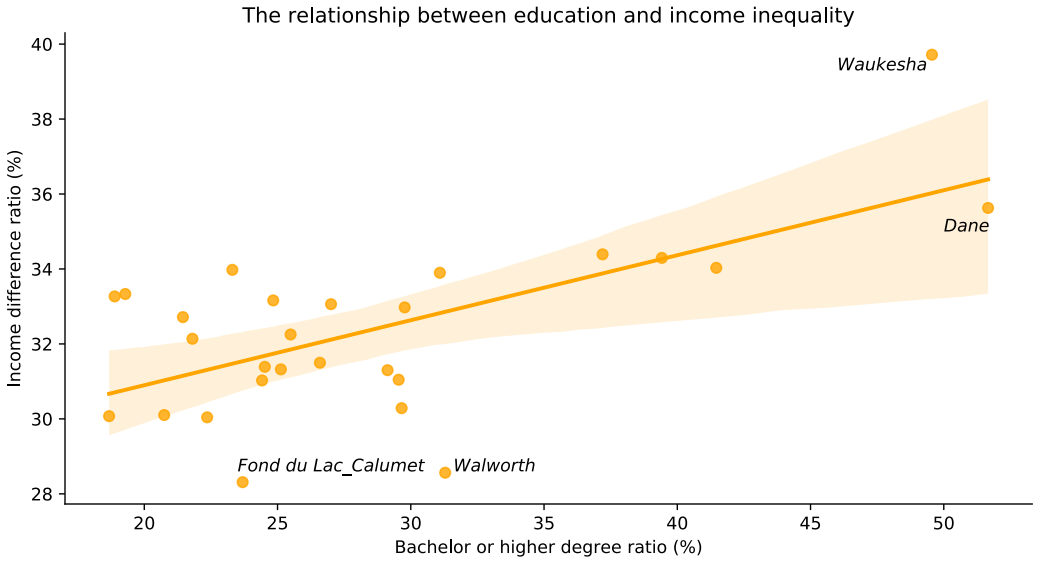

Figure 6 Education Ratio and Income Inequality in WI

From the regression result (Table 3), the estimated coefficient of GDP per capita and the unemployment rate is significant at 1% level, and the estimated coefficient of education attainment is significant at 10% level, while other variables don't affect income inequality in a statistically important level.

Table 3 Regression Result on data in WI

	INCOME DIFFERENCE RATIO
INTERCEPT	-33.44
	(32.77)
WHITE_RATIO	0.38
	(0.23)
BLACK_RATIO	0.38
	(0.33)
INTER_RATIO	0.07
	(0.20)
EDU_RATIO	0.13*
	(0.07)
GDP_GR	0.18
	(0.15)
GDP_PC	0.18***
	(0.06)
UNEMP_RATE	3.52***
	(1.01)
STANDARD ERRORS IN PARENTHESES. * P<.1, ** P<.05, ***P<.01	

4. The trend of two economic indexes from 2004 to 2019 and the prediction in 2020

Figure 12 shows the tendency of income inequality and GDP per capita in Wisconsin from 2004 to 2019. Although each economic index is highly turbulent from year to year, the figure overall shows they increase over time, which proves a positive relationship between them as a whole. In an economic sense, along with the improved life quality of people in Wisconsin, GDP per capita increases over time. But it's also a world where the rich can earn more easily, and the poor is hard to escape the dilemma of poverty. In this case, income inequality expands yearly.

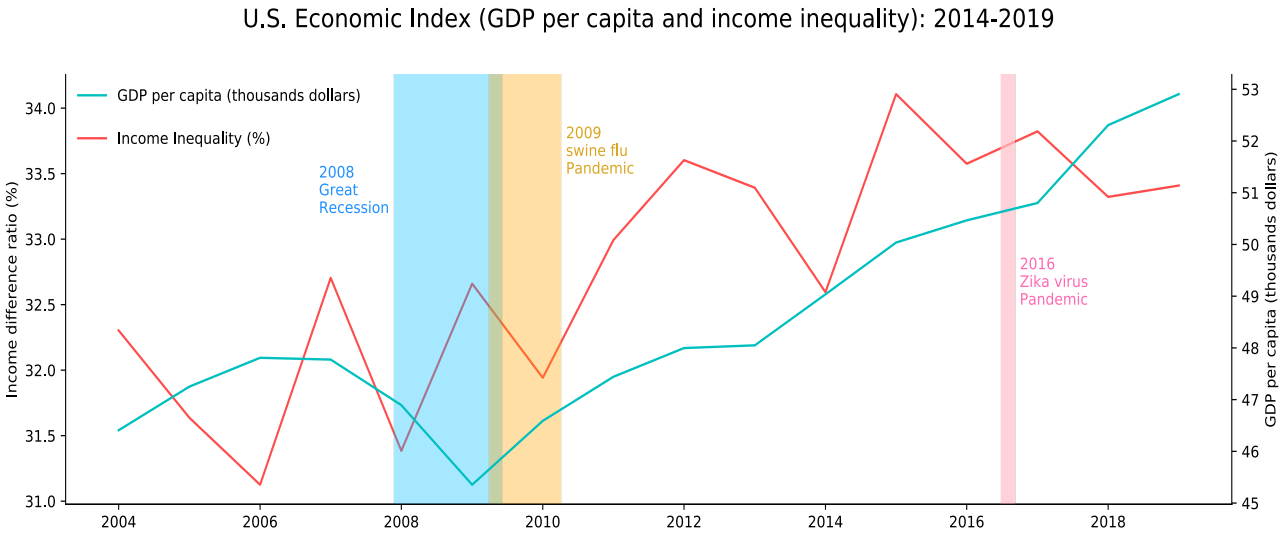

Figure 12 US GDP per capita and Income Inequality

To add more dimensions to the figure, we add the timelines of some events, such as economic recessions and pandemics, into it to analyze how GDP per capita and income inequality react to them before, during and after the events. Considering the 2018 Great Depression, GDP per capita decreased and income inequality increased dramatically, which is economically resulted from the increasing unemployment rate especially among the poor. As for other events, like a pandemic, the effect on both economic indexes depends on the severity and spread of the disease. Considering the nature of the events, the 2009 Swine flu Pandemic and 2016 Zika virus Pandemic have little effects on the economy because it shows no dramatic change in the GDP per capita.

Based on the analysis before, we can make a rough projection of the trend of economic indexes for 2020 and later. What's happening in 2020 is pretty unusual because the COVID-19 pandemic has caused the COVID-19 recession with a very high unemployment rate and a terrific decline in GDP in the U.S. Therefore, it's likely that the income inequality will be enlarged further and GDP per capita will decline further. But after 2 or 3 years, they will be back to their normal levels and increase over future decades.

Conclusions and directions for future research

Digging into the analysis of finding influential factors on income inequality, we found the unemployment rate affects income inequality the most in a positive way, and the level of income difference increases along with the increase of GDP per capita over the past 16 years. But during some special events, like an economic recession, the income inequality increased and GDP per capita decreased, which shows a temporary negative relationship between them. Overall, we predict the COVID-19 recession will have a

similar effect on income inequality and GDP per capita as the 2018 Great Recession, but the economic indexes will return to normal levels more quickly. For further research, we will try to collect more panel data to quantitatively analyze the relationship between these factors and income inequality.

References

[1] PUMS (Public Use Microdata Sample): https://www.census.gov/programs-surveys/acs/microdata.html
[2] BEA (Bureau of Economic Analysis): https://www.bea.gov/data/gdp/gdp-county-metro-and-other-areas
[3] BLS (U.S. BUREAU OF LABOR STATISTICS): https://www.bls.gov/lau/#tables

[4] States' FIPS: United States Census Bureau: https://www.census.gov/geographies/mapping-files/time-series/geo/carto-boundary-file.html

[5] Map information: USDA(United States Department of Agriculture): https://www.ers.usda.gov/data-products/county-level-data-sets/download-data

[6] USDA (United States Department of Agriculture: https://www.ers.usda.gov/data-products/county-level-data-sets/download-data