GDP and COVID-19 Cases & Deaths

SC212 Statistics/Colby College, Waterville, ME

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Introduction

Research Question

Is there an association between US states GDP and COVID-19 deaths (from January 2020 to April 2022)?

Background

- Study in Europe: Positive association between GDP & total COVID cases (January to May 2020) for 28 European countries (regression coefficient = 0.7156, p < 0.001) (Aycock)
- Study in China's 30 provinces: GDP is positively associated with COVID-19 cases (r = 0.69, p < 0.01) (Mo, et al.)

Motivation

Studies suggest economic growth and urbanization create many more opportunities to facilitate the spread of COVID (Mo, et al.)

- If the association exists, government could better target and provide the appropriate resources for each state based on their specific needs

Methods

Data: Our data is a combined dataset collected from a multitude of online sources including Worldometer, Ballotpedia, US Bureau of Economic Analysis (BEA), US Energy Information Administration (EIA) and the New York Times.

Cases: 50 states and Washington DC

Explanatory variables

- State's GDP (in billions)
- US states by regions (W=West, M=Midwest, N=Northeast, S=South)
- Governor's political party

Response variables

- Total COVID cases categorically (per 100,000 people)
  - 4 levels: A: < 20%, B: btwn 20% & 25%, C: btwn 25% & 33.33%, D: > 33.33% cases
- Total COVID cases numerically (per 1 million people)
- Total COVID deaths categorically (per 100,000 people)
  - 4 levels: A: < 0.15%, B: btwn 0.15% & 0.25%, C: btwn 0.25% & 0.37%, D: > 0.37%
- Total COVID cases numerically (per 1 million people)

	n	Mean	SD	Min	Q1	Median	Q3	Max
GDP	51	377.70	500.5453	29.65	88.47	220.69	482.98	2871.42
COVID cases	51	247,756	39,097.51	167,036	230,251	250,809	270,153	341,251
COVID deaths	51	2873	808.1615	974	2256	3031	3476	4166

Table 1. Descriptive statistics of US states and DC's GDP, Covid cases (per 1 million people), and COVID deaths (per 1 million people).

Figures

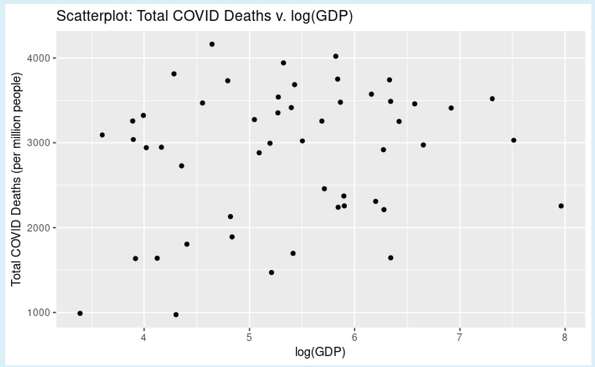

Figure 1. Scatterplot of total COVID deaths (per 1 million people) vs log(GDP) (in billions).

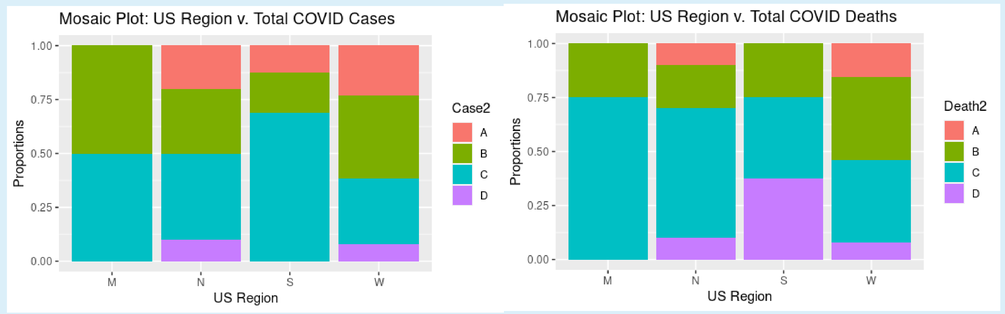

Figure 2. Left: Mosaic plot for an association between total COVID cases (per 100,000) and US region. Right: Mosaic plot for an association between total COVID deaths (per 100,000) and US region.

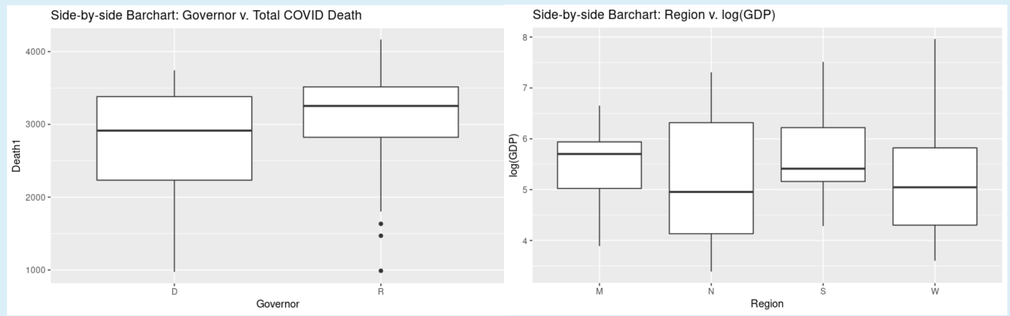

Figure 3. Left: Side-by-side boxplot of total COVID deaths (per 1 million people) by the state's governor political party. Right: Side-by-side boxplot of log(GDP) (in billions) by US regions.

Results

GDP and COVID deaths

Using a linear regression test for correlation, we have no evidence of a correlation between COVID deaths and log(GDP) (r = 0.195, n = 51, p-value = 0.172) (Figure 1).

US Regions and COVID cases

Using a chi-square test for association, we found no evidence for an association between US regions and total COVID cases (n= 51, $\chi 2$ = 9.770, p-value = 0.375) (Figure 2).

Governor's Political Party and COVID deaths

Using an ANOVA test for difference in means, we found no evidence for a difference in means in total COVID deaths depending on the governor's political affiliation (n = 51, F = 2.098, p-value = 0.150) (Figure 3).

Discussion

Interpretation

- We have no evidence of an association between a state's GDP and the total COVID deaths.
- Overall, we found no evidence that the federal and state governments' decision on public heath are influence by outside factors that we examined in this study (state's GDP, Governor's party, US regions).

Limitation

Contradicts initial findings from the two studies possibly because:

- Urbanized regions were hit first by COVID
- The studies were based on data early in the pandemic

Our study is limited to data from the start of the pandemic until April 3, 2022 and is confined to only US states (and DC)

→ Only representative of a snapshot in COVID pandemic history

Future Study

We would like to look at other relationships such as duration of mask mandate, percent vaccinations and percent boosters compared with total COVID cases and deaths.

References

Aycock, Lauren, and Xinguang Chen. "Levels of Economic Developement and the Spread of Coronavirus Disease 2019 (COVID-19) in 50 U.S. States and Territories and 28 European Countries: An Association Analysis of Aggregated Data." *Global Health Journal*, vol. 5, no. 1, Mar. 2021, pp. 24–30., https://doi.org/10.1016/j.glohj.2021.02.006.

Mo, Qiqing, et al. "Levels of Economic Growth and Cross-Province Spread of the Covid-19 in China." *Journal of Epidemiology and Community Health*, vol. 75, no. 9, 2021, pp. 824–828., https://doi.org/10.1136/jech-2020-214169.