Analysis on the effect of Partisanship on U.S. Pandemic Severity

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Abstract:

The COVID-19 pandemic has brought enormous hardship to the world since 2020. Countries suffered from economic stagnation and high casualties due to the wide-spreading virus. In the U.S, the Republican-led counties performed significantly better than the Democratic ones in terms of fewer mobility constraints, higher consumer spending, and less unemployment. Since the virus evolved and started a new pandemic wave, we aim to determine factors that contribute to higher severity. We explore the dataset on the U.S counties' COVID case and death statistics with election results from 2020 to gain more insights. Specifically, we examine the effect of partisanship on pandemic severity through four regression models and found a positive relationship, suggesting counties with a higher preference towards the Republican may experience higher casualties. Additionally, vaccination can effectively reduce the severity in a linear relationship. Therefore, we suggest the U.S government put more attention on Republican-led counties and incentivize people to get full vaccination.

1. Introduction

At the early stage of the COVID-19 pandemic, Donald Trump, the leader of the Republican party, claimed an absolute advantage within states won by him in terms of the severity level. Precisely, Republican states succeeded in controlling the situation with minimized actions like lockdowns and stabilized the economy to the most extent. With such achievement, one may argue that partisanship may affect the anti-epidemic performance. After a full year's effort, the U.S. widely promoted the vaccination and managed to lower daily cases and death. However, the virus evolves into a more potent version as the delta variant recently, ballooning the pandemic case statistics again. Exploration of aspects contributing to higher severity is increasingly becoming the focus of government and citizens' concern. With sound analysis, the government can implement targeted strategies and measures to minimize the virus strike.

This study aims to analyze the effect of partisanship as well as other demographic and behavioral factors on the pandemic severity. We will explore the relationship between vote share and death rates using four different regression models, with each adding more explanatory variables to capture the trend better. In general, this report will discuss whether partisanship is associated with pandemic severity and how factors like vaccination rate and demographics perform in the relationship.

2. The Context and Data

The data used throughout this analysis consists of a random sample of 3000 U.S. counties. It contains statistics regarding the U.S. COVID-19 case and death between June 26 and September 27, 2021. There are 53 variables included, providing information on counties' size of death and case rates, percent of votes for GOP, full-dose vaccination rate, and other demographic factors.

Since our fundamental interest is to explore the relationship between the partisanship and severity of the latest pandemic wave among the U.S counties, we split all counties into two categories by their vote share for GOP and calculated the means of other variables to check the existence of differences between parties. As exhibited in Table 1, the row with 0 stands for the party with majority voted Republican, and the other represents the reverse. To elaborate, we can see a much higher mean of death rates for the Republican group, along with a lower vaccination rate. On average, the Republican party has 13 deaths per 100000, higher. It suggests a positive relationship between the Republican partisanship and severity, where the Republican counties may suffer from higher death rates. Similarly, there is a higher prevalence of diseases and reluctance to get vaccinated in the Republican group. The group also has higher cases and deaths before the latest wave. On the other hand, the Republican tends to be more rural with higher vulnerability. All these factors can contribute to the higher death rates for the majority voted Republican group.

3. Regression analysis

3.1. Simple Linear Regression

To examine the relationship between Republican vote share and the COVID-19 death rate in the latest pandemic wave, we implement a simple linear regression (SLR) with the death rate as the response and vote share as a regressor. Since the dataset is collected by counties, the estimated coefficient is the effect of a one percent change in each county's vote share for Republicans.

As shown in the first column of Table 2, we estimate the coefficient of 0.433. The result implies a 1% increase in a county's percentage of votes for the Republican will result in an increase of 0.433 deaths per 100000. In practical means, counties with higher voting preferences for GOP have higher casualty rates. We carry out the regression under the null hypothesis that the percent Republican vote share in the U.S. 2020 presidential election has zero effect on the COVID-19 death rate in the latest wave. The results exhibit a p-value less than 0.1%, which is way below the 5% significance level. Hence, the data provides convincing evidence against the null hypothesis that Republican vote share does not affect the death rate.

According to Wooldridge, we examine five simple linear regression assumptions. Given the context, the first three assumptions hold while the last two suffer from violations. First, the linear relationship between the death rates and the vote share holds as we generate a scatterplot of the data and fit a line across all observations. Figure 1 exhibits the trend as a shape of a straight line. Second, obversions are independent identically distributed due to random sampling data. Third, the dataset contains an extensive range for the percent vote of GOP, which implies variation in the regressor. However, we may confront violations for the fourth assumption. There may be omitted variables that correlate with both the response and the independent variable, resulting in omitted variable bias. For instance, the Republican group tends to have a low vaccination rate, contributing to higher death rates. Last, the homoscedasticity of residuals fails to hold. Referring to Figure 2, the prediction errors do not have equal variances for all regressors, suggesting heteroscedasticity.

3.2. Multiple linear regression

On the basis of simple linear regression, I run three other multiple linear regression (MLR) to explore whether factors other than partisanship may influence the death rates.

First, we regress the COVID-19 death rates on the percent of votes for GOP and the percent fully vaccinated. The estimated coefficients are shown in the second column of Table 2. As exhibited, holding all else constant, a one percent increase in vote share for Republicans and full vaccination percent is associated with decreases of 0.06 and 1.25 death per 100000 on average, respectively. In other words, both Republican partisanship and vaccination reduce covid deaths, where vaccination is more influential. After adding a control variable of vaccination, the estimated coefficient for vote share turns negative and statistically insignificant. It overturns the conclusion we had from the simple linear regression. One explanation is that these two variables are correlated. Specifically, the Republican has an average lower vaccination rate, which can lead to higher death rates. As vaccination is incorporated, negative-impact factors related to the Republicans may take the majority and thus change the sign direction. In other words, we may still have omitted factors. Hence, we need to include more potential independent variables.

Theoretically speaking, vaccination rates will reduce the death rate by a decreasing rate since there will be fewer affected people when people around get vaccinated. Hence, we add an explanatory variable of squared vaccination rate to capture the potential non-linear relationship, presenting in the third column of Table 3. As shown, the estimated coefficients signify that the vaccination rate has a diminishing decreasing effect on death rates. The vaccination percentage variable has a more significant adverse effect on the death rates, while the positive coefficient of squared vaccination rate is also statistically significant at the 5% threshold. In other words, at low values of the fully vaccinated rate, an additional percentage has a negative effect on death rates. The negative influence diminishes as the vaccination rate increases. Eventually, when the vaccination rate reaches 118.63%[1], an additional percentage increase in the vaccination rate will lead to rises in the death rates. However, it is impossible to hit an over 100% vaccination rate in reality, and thus the variable would only produce negative impacts on the death rate.

Lastly, we include demographic factors to explore other factors affecting the death rates. To extend, we add each county's prevalence of diseases, social vulnerability level, vaccination hesitancy level, survival and death rate pre the latest wave, urbanity level, and race proportion. The results are recorded in the last column in Table 2. The base level of the regression is a county with very low social vulnerability, hesitancy level of probably of definitely get vaccination and urbanity level of large central metro and other race. To interpret the estimated

[1] The turning point of Fully Vaccinated Percentage = 1.872 / (2*0.00789) = 118.63%

coefficients, the data displays strong evidence that votes shares for Republican is associated with the death rates in a positive direction with a p-value less than 0.1%. An additional vote share for GOP will result in 0.454 more deaths per 100000, holding all else constant. The vaccination rate remains an adverse effect and statistical significance level under the 5% threshold. Regarding the squared vaccination variable, the positive coefficient continues to suggest a diminishing effect on the reduction. It implies that the death rate per 100000 will reduce by less than 0.675 for one additional percentage in the vaccination rate. However, the squared variable is not statistically significant, suggesting that the diminishing effect may not establish. For demographic factors, most estimated coefficients are statistically significant, except for the heart disease prevalence. To summarize, holding all else constant, higher obesity prevalence will decrease the death rate while higher diabetes prevalence will increase. Counties with vulnerability level higher than the base level of very low will have higher death rates, holding all else constant. Similar interpretations apply to the hesitancy and urbanity variables with their corresponding base level.

The MLR alleviate violations for the fourth assumption of the expected conditional mean of 0 for the residuals. As described above, there exist omitted variable biases in the SLR, making the estimated coefficient biased. Adding more relating variables into the regression, the final model reduces the biases by including the omitted variables as much as possible.

4. Limitations of results

One limitation is that there still could be omitted variables that lurk in the residual. For instance, the population age of each county should be a control variable when computing the regression. To illustrate, a county with a higher average age population may suffer from higher death rates since the elder has a weaker immune system to deal with the virus. They are also less eligible for getting fully vaccinated for the same reason. Hence, the age variable would be a confounder left to incorporate and threaten regression results' validity.

5. Conclusion

In conclusion, partisanship towards the Republicans is positively associated with the pandemic severity, while vaccination reduces the death rate. The result overturns the prediction given the pandemic performance before the delta variant, suggesting the government to focus on the Republican led counties and those with higher social vulnerability. In addition, they can implement measures to reduce people's hesitancy towards vaccination and to increase vaccination rate.

References:

1. Wooldridge, Jeffrey M. *Introductory Econometrics a Modern Approach*. South-Western, Cengage Learning, 2020.

Table 1: Descriptive statistics: Variable means for ROP-voting and non ROP-voting counties

	Deaths per 100,000 post Jun 26,	Percent fully vaccinated: VAXSd	Prevalence of Obesity: UC data	Prevalence of Heart Disease: UC	Prevalence of Diabetes: UC data	Hesitant: Definitely not: VH dat	Hesitant: Probably not: VH data	Hesitant: Unsure: VH data	Cases with documented covid-19 p	Deaths per 100,000 pre Jun 26, 2	Urban vs Rural Code: UC data	Social Vulnerability Index: Cate
0	24.45	45.91	32.61	7.3	12.47	6.93	3.67	5.5	9308.87	174.42	3.57	3.2
1	37.51	34.21	35.51	8.89	13.21	9.02	4.83	5.97	10299.28	212.19	4.85	2.95

Table 2: Regression Analysis of COVID-19 Death Rates, Republican Vote Share and Vaccination

	(1)	(2)	(3)	(4)
Percent of votes for GOP pres: ER data	0.433***	-0.0583	-0.0569	0.454***
	(0.0327)	(0.0421)	(0.0419)	(0.0591)
Percent fully vaccinated: VAXS data		-1.247***	-1.872***	-0.675*
		(0.0690)	(0.330)	(0.288)
Vaccination Rate Squared			0.00789*	0.00609
			(0.00379)	(0.00325)
Prevalence of Obesity: UC data				-1.545***
				(0.166)
Prevalence of Heart Disease: UC data				2.349
				(1.262)
Prevalence of Diabetes: UC data				1.759*
				(0.858)
Very Low Vulnerability				0
				*omitted
Low Vulnerability				6.182***
				(1.262)
Moderate Vulnerability				11.76***
				(1.535)
High Vulnerability				13.63***
				(2.000)
Very High Vulnerability				14.75***
				(2.637)
Hesitant: Definitely not: VH data				1.222***
				(0.247)
Hesitant: Probably not: VH data				1.673***
				(0.496)
Hesitant: Unsure: VH data				0.693
				(0.401)
Cases with documented covid-19 per 100,000 pre June 26th, 2021				-0.00122***
				(0.000206)
Deaths per 100,000 pre Jun 26, 2021				0.0289***
				(0.00643)
Large central metro				0
				*omitted
Large fringe metro				1.748
				(2.638)
Medium metro				-1.589
				(2.678)
Small metro				0.559
				(2.911)
Micropolitan				-4.681
				(2.788)
Noncore				-8.710**
				(2.866)
Controls	No	No	No	Yes
Adjusted R^2	0.050	0.148	0.149	0.363
Observations	2998	2998	2998	2998

Standard errors in parentheses

Notes: The dependent variable is COVID-19 Death Rates. Independent variables include Republican Vote Share, Vaccination and Demographics. Robust Standard errors are in brackets.

Figure 1: Scatterplot of Percent of votes for GOP v.s. Death Rates per 100000 post Jun26, 2021

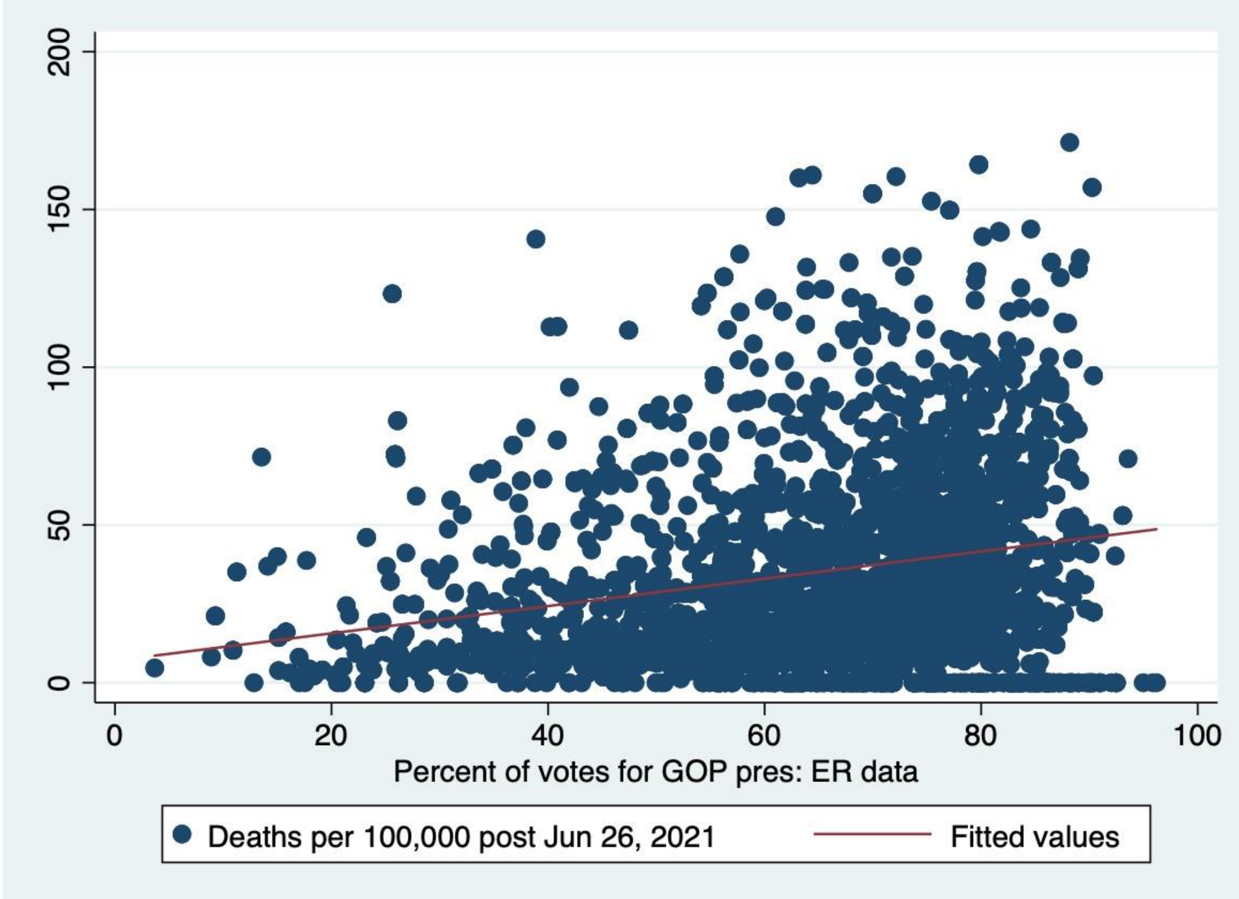

Figure 2: Residual Plot