Economical Impact of COVID-19 in the US: County Level

Angelica Tellez

Advisor: Huseyin Yuce

Abstract

COVID-19 pandemic triggered an unprecedented economic crisis. Many measures of restrictions (lockdowns, travel advisory, social distancing, etc.), aimed to contain the virus's spread, led to extensive disruptions across industries. COVID-19's total cost to the U.S. economy was projected to reach $14 trillion by the end of 2023 (Hlavka and Rose, 2023). This study includes a descriptive analysis of economic data along with multivariate regressions to generate various estimates. Additionally, we examine the impact of vaccination rates on economic indicators. The research explores the economic effects of COVID-19 in the U.S., supported by statistical modeling.

Intro

This study builds upon the previous article titled "Use of Populated Weighted Density Index for Coronavirus Spread in the United States." From that foundation, we posed a new question: how can the COVID-19 pandemic experience guide us in preparing for future outbreak-related economic crises? Given that outbreaks significantly impact labor-intensive sectors, disrupt supply chains, and ultimately strain national economies, we recognized the urgent need for proactive economic response strategies to mitigate future downturns.

Methods

For our economic indicator, we selected Gross Domestic Product (GDP), preferring it over alternatives like household income and unemployment rates because GDP offers a more comprehensive measure of economic activity. We employed a multivariate regression model where GDP served as the dependent variable. Our explanatory variables included COVID-19 spread, household income, weighted populated density, senior population percentage, education level, unemployment rate, and cost of living.

Results

Table 1 : Parameter Estimation of GDP Model in the US

Variable	Parameter Estimate	Standard Error	$p > \|t\|$	Confidence Limits (95%)	
Intercept	-7.9977	0.6014	<.0001	-9.1769	-6.8185
Log of spread	0.8374	0.0101	<.0001	0.8176	0.8573
Log of mean household income	0.5719	0.0587	<.0001	0.4568	0.687
Log of population-weighted density	0.0638	0.0088	<.0001	0.0466	0.0811
Log of older adults (age ≥ 65 years)	-0.3861	0.0427	<.0001	-0.4698	-0.3024
Log of education	0.3038	0.0351	<.0001	0.235	0.3726
Log of unemployment	-0.1393	0.0423	0.001	-0.2222	-0.0564
Log of cost of living	1.7715	0.1148	<.0001	1.5463	1.9967

Figure 1 : GDP Percent Change vs Vaccination (2021)

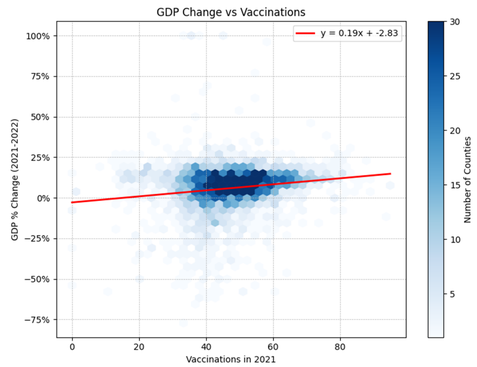


Figure 2 : GDP vs Spread for US Counties (2020-2022)

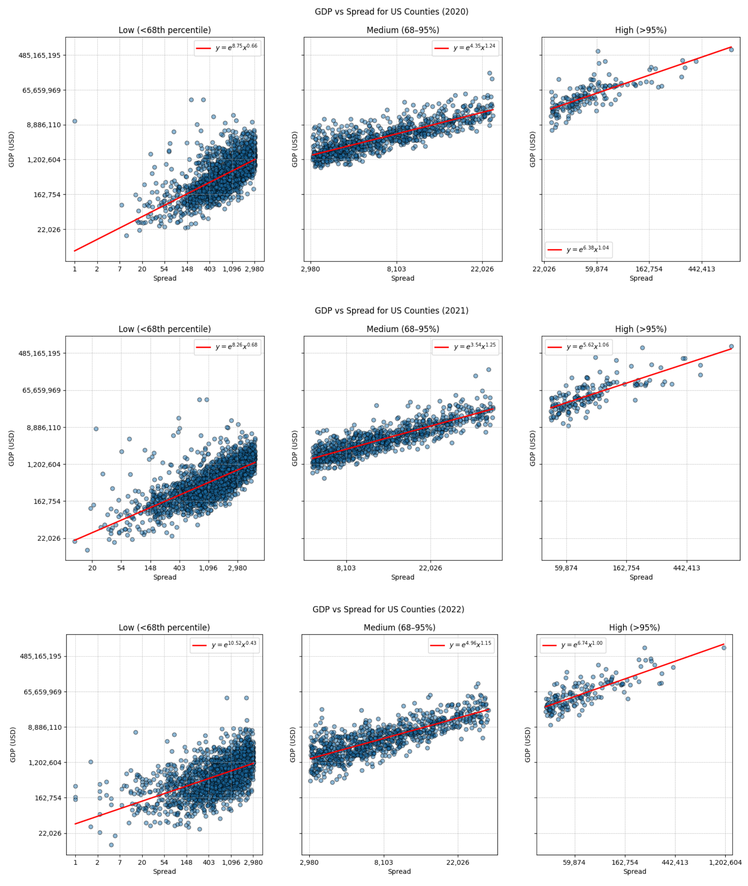
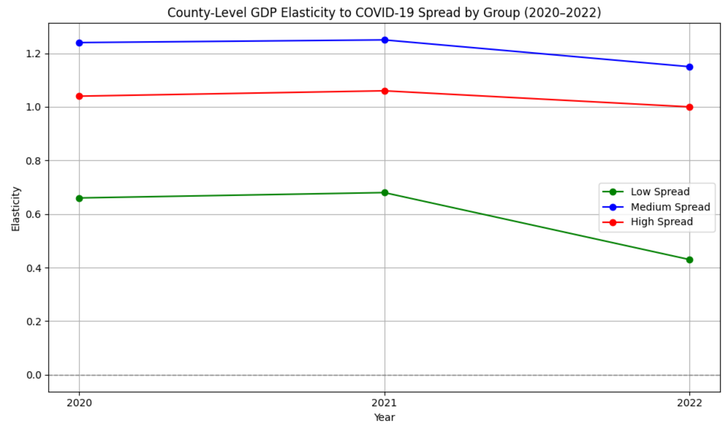


Figure 3 : GDP Elasticity to Spread by Group (2020-2022)



Conclusion

Our findings highlight the importance of early intervention during pandemics to support economic stability. Early vaccination was linked to slight but meaningful GDP recovery in 2021, while economic impacts largely reflected 2020's COVID-19 disruptions. A 10% increase in virus spread correlated with an 8.4% rise in GDP due to higher population density in economically strong areas, not because spread boosted growth. In contrast, increases in senior population and unemployment led to GDP declines. Counties with low COVID spread faced the least economic disruption and recovered faster by 2022, while medium-spread areas remained the most sensitive, showing the need for region-specific strategies in future crises.

Bibliography

1. U.S. Census Bureau. U.S. Census Bureau. https://www.census.gov.
2. Johns Hopkins University. COVID-19 Resource Center. https://coronavirus.jhu.edu.
3. USA Facts. USA Facts. https://usafacts.org.
4. U.S. Department of Labor, Bureau of Labor Statistics. U.S. Bureau of Labor Statistics. https://www.bls.gov.
5. U.S. Bureau of Economic Analysis. U.S. Bureau of Economic Analysis. https://www.bea.gov.
6. Council for Community and Economic Research. Council for Community and Economic Research. https://www.coli.org.
7. Centers for Disease Control and Prevention (CDC). Vaccination Coverage and Vaccine Confidence. https://www.cdc.gov/respvaxview/about/index.html.
8. Yuce, et al. "Use of Population Weighted Density Index for Coronavirus Spread in the United States." Journal of Health Economics and Outcomes Research, 2024; 11(2).