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Economic Implications of State-Wide COVID-19 Response Aggressiveness

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Abstract

In this paper, we evaluate how the aggressiveness of each State's response to the Covid-19 pandemic affected their respective economies from Q2, 2020 through Q2, 2021. In our study, we utilize the scale developed by McCann (2020, 2021), which ranks the least aggressive state response to the most aggressive state response at three different points of the pandemic. Using this methodology, we test the impact of the aggressiveness of each state governments' response with the resulting economic impact within that State. Namely, we examine how this level of response affected each State's unemployment rate, gross domestic product growth, and taxable sales growth of 27 various industries. In our analysis, we find that there was a significantly negative impact between each states response aggression and unemployment rates, GDP growth, and taxable sales for a sizable percentage of the analyzed industries. These results appear to remain consistent when we both analyze the instant quarterly impact of the restrictions imposed on a State, as well as when we factor in a quarter lag for each State's response.

Economic Implications of State-Wide Covid-19 Response Aggressiveness

1. Introduction

COVID-19 has had an extraordinary impact across regional, governmental, social, and economic sectors. Businesses and government policymakers are both having to respond to the COVID-19 crisis in the moment, and with little precedence as to how they should respond. COVID-19 has shown the importance of expanding crisis literature in order to identify and improve how we address the growing complexity of the modern and future crises. With new infections, deaths, and shutdowns happening in real time, the COVID-19 crisis has differentiated itself as being a complicated and ongoing crisis on a worldwide scale. Responses to the crisis have been vastly different, from very strict and widespread "shut down" measures, to more open "business-as-usual" approaches. To date, there is no precedent on how to respond to such a crisis.

In this paper, we aim to better understand how economies are affected by the severity of the elected officials COVID responses. In the United States, the onus of response to the Covid-19 pandemic has been largely shouldered by state and local officials. Thus, in our sample, we have 50 unique responses to this pandemic each quarter. In this study, we utilize the scale developed by McCann (2020, 2021), which ranks the least aggressive state response (1) to the most aggressive state response (50). These rankings are determined by 51 various factors, such as: mandatory business closures, mandated masking, large gathering restrictions, etc. (McCann, 2020). Through this methodology, we test the impact of the strength of each state governments' response (least versus most aggressive) with the resulting economic impact within that respective state. In our analysis, we examine how this level of response affected each States unemployment rate, gross domestic product growth, and taxable sales of 27 various industries. The purpose of our study is to gain a better understanding about the relationship between governmental response and economic

impact as well as which industries were the least and most impacted by the State's response aggression rating. In this paper, we find that there was a significant inverse correlation between each state's response aggression and unemployment rate throughout, and a significant negative correlation for GDP growth and taxable sales for a sizable percentage of the analyzed industries. These results appear to remain consistent when we both analyze the instant quarterly impact of the restrictions imposed on a State, and when we factor in a quarter lag for each State's response. Finally, our analysis shows that the higher percent of white population in each state helped to mitigate the effects of the crisis in most of the analyzed periods for unemployment rates, GDP growth and taxable sales.

2. Literature Review

2.1 Crises

Crises are described as unknown, sudden events that have immediate but lasting effects. Bean (2001) identified crises as either of two types: consensus or conflict. A conflict crisis is one that does not affect everyone equally; usually a conflict crisis takes the form of a riot or other civil disturbance. Matheson et al (2004) found that the Rodney King riots had a much greater effect on Los Angeles city than the whole LA County. On the other hand, a consensus crisis is one that affects everyone equally, much like that of a hurricane or other natural disaster. Smith and McCarty (1996) found that Hurricane Andrew affected all parts of the Miami population equally. Some crises, like that of Katrina, combine elements of both consensus and conflict due to the size and severity it has on a single population (Baade et al, 2007). Local disease outbreaks fit under this definition (Garrett, 2007), but not those disease outbreaks which apply to a national or global scale. These types of crises, however, are not to scale and do not encapsulate the size and complexity of the modern crisis. Scholars have expanded their perception of the modern crisis, like the COVID-

19 crisis, to fit under the category, called a transboundary crisis. Boin (2009) defined a transboundary crisis as one that jumps functional (institutional, governmental, etc.) and transcends time (start-stop) boundaries. While the consensus and conflict crisis models have certain elements of the transboundary crisis, they are not nearly to scale of the COVID-19 crisis. Moreover, the transboundary crisis is longer and causes more damage than the contemporary crisis (Boin, 2009). COVID-19 has differentiated itself because it has been ongoing for over a year and has caused sharp and sustained drops in GDP and employment.

2.2 Resilience and government policy

Merriam Webster's dictionary (2016) defines resilience as "the ability of something to recover from or adjust to misfortune or change." This standard definition is enough to characterize many previous social and environmental disasters because of their limited scope. With the advent of a more complex economic disruption due to an international disease outbreak, this definition is not comprehensive enough. We now have to understand this phenomena as it applies to more people and geographical areas. Ringwood (2018) found that when quantifying resilience of a certain region, there are certain geographic differences that need to be accounted for based on the industries on which that particular region is dependent on. Understanding resilience as a function of a larger region and not just one local area is important when tracking recovery at a macroeconomic level. Regional economic resilience is defined as the capacity of a regional or local economy to withstand, recover from and reorganize in the face of market, competitive, and environmental shocks to its developmental growth path (Boschma 2015; Bristow & Healy, 2014; Di Pietro 2020; Gjerde et al; 2019; Martin & Sunley; 2015; Zhang et al, 2021) Working with this definition, it is important to see economic resilience as a long term development. Regional resilience consists of 4 phases: resistance, recovery, reorientation and renewal (Di Pietro et al,

2020; Gjerde et al, 2019; Martin, 2012; Martin & Sunley; 2015). How each state/region utilizes policy beforehand can offset the timing of a recession; how they respond can accelerate the process towards reorientation and renewal. Resilience is a measurement of how quickly and efficiently a region can progress through these phases. Scholars also identify the delays in unemployment growth and GDP drops as economic hysteresis (Sutherland and Hoeler, 2013). Factors that are most inversely correlated to economic hysteresis are worth further investigation, as these things promote economic resilience.

Which factors play the biggest role in resilience are contested among scholars, and many studies have dichotomous conclusions. Martin and Sunley (2015) identified four economic subsystems that play a role in regional resiliency: industrial structure and business subsystem, labor market subsystem, financial subsystem, and the governance subsystem. Multiple studies show that diversification is most important resilience factor because any given region will not be dependent on the success of one or a couple industries (Ringwood et al, 2018; Zenka et al, 2019). Despite this, Giannakis and Bruggeman (2017) found that specialized economies and human capital (which was the most important factor in this study) are both positively correlated to regional resilience. Most pertinently, Zenka et al (2019) argued that government was not a stabilizer in the economy. We contest all of these points, postulating that government is perhaps the most important factor when tracking regional resilience and that it can have a positive (or negative) effect on regional resilience. Ezcurra and Rios (2018) reasoned that the quality of government can affect the type, frequency and intensity of economic shocks and that low quality government will have a negative impact on any given region. Certain government policies have even been shown to increase/decrease macroeconomic stability to shocks and can promote long term growth (Gjerde et al, 2019; Sutherland & Hoeller, 2013).

Considering the vast array of differences of various economies' size, structure, etc. government is the most uniform institution across geographical regions, and therefore, can be a highly reliable factor to scrutinize. Moreover, the COVID-19 crisis has prompted a government led response of non-pharmaceutical intervention, one that is not economic in nature, but with severe economic repercussions (Verschuur et al, 2021). Nevertheless, focusing on each region's variation in economic structure is important as well when measuring for resistance and recovery. Di Pietro et al (2020) classified and measured each region's baseline economic system based on factor intensity (capital/labor intensive), openness (trade), and specialization. Applying these measures to US states can help better differentiate those economic affects that are attributed to each economies' uniqueness and those that were caused by government policy. Thus, by focusing on other economic factors can help delineate effects caused by different structures and decipher a cause and effect relationship from each governments' response.

2.3 Coronavirus Overview and Economic Recovery

With an extant amount of literature covering crisis and government policy, we now turn towards evaluating the COVID-19 crisis. In the beginning of 2020, an unconfirmed virus broke out of a lab in Wuhan, China, originally identified as Pneumonia. As World Health Organization and Chinese government officials focused their efforts they came to identify an outbreak of a novel Coronavirus, now known as COVID-19. Due to the unknown nature of the virus and the interconnectedness of international economies, the COVID-19 virus spread rapidly. By February 3rd, 2020, the US had declared a public health emergency due to the Coronavirus' rapid spread. Between the months of March and May, the US government mandated shutdowns, enforced masking in public, and took other preventive measures to stop the spread.

COVID-19 can be defined as a transboundary crisis because its beginning and ending are unclear and it has impacted virtually every industry, region, etc. It is appropriate to still perceive this crisis as happening in the moment because the crisis-causing factor (COVID-19 virus) is still causing new infections (as of the end of 2021, when this analysis was conducted). While the coronavirus has had a disproportionate impact on different regions/cities, which are characteristics of a conflict crisis, it is ultimately transboundary in nature because of its ambiguous beginning and unclear end, as well as its ability to spread rapidly. Moreover, COVID-19 has had disproportionate effects among different countries and demographic areas, thus making the situation evermore complex. Özerdem & Bakarat (2002) found that the size and structure of economies are the largest factor influencing different countries impacted by disaster; larger more developed countries can better manage disaster because they are able to spread the impacts over space and time. Despite these advantages, the US economies have still been some of the most impacted by the COVID-19 pandemic. In this paper, we seek to build off this previous research to better understand economic outcomes based on level of evaluating three main economic factors: taxable sales, GDP and unemployment growth. We plan to examine these factors to the level of each state's response.

Scholars have found that measuring taxable sales is a good indicator of industry performance in different areas, as these are measured at a county, city and statewide levels and collected either monthly, quarterly, and/or yearly (Baade et al, 2004; Matheson & Bade, 2004). Taxable sales are defined as the total sales of taxable goods and services by a particular business for a given period of time. Collecting data on taxable sales from before and during the COVID-19 crisis can be viewed as a measure of how well each industry is currently performing in each state. Unemployment rate is regularly used to track the health of the overall economy and is a byproduct of taxable sales drops (Ezcurra and Rios, 2018; Fratesi & Rodriguez-Pose, 2016; Giannakis and

Bruggeman, 2017; Ringwood et al, 2018; Zenka et al, 2019) GDP provides a high level overview of industry health; it measures all the transactions and productivity within any given industry, not just the sales from that industry. By examining taxable sales data, unemployment, and GDP, we believe we can paint a picture of how the economies of each state performed in 2020 and 2021 (up to Q2) during the pandemic. Pair this with state response rankings, we can better understand how policy has affected all 3 measures.

For the first part of the analysis, we measure the change of the unemployment rate, based on the level of aggressiveness of response. In this section, we believe that more aggressive restrictions will lead to higher (positive) year-over-year changes in unemployment over each of the four analyzed periods. In the second section, we analyze year-over-year GDP growth, based on the level of aggressiveness of response. We believe that more restrictions will lead to lower GDP growth over each of the four analyzed periods. Finally, we will analyze overall taxable sales for 27 of the main industry categories for each State and compare the year-over-year changes to the aggression level of state restrictions. Overall, we believe that more aggressive States with restrictions will lead to lower taxable sales, particularly in those industries that are influenced by the restrictions, such as service and travel industries.

For all three sections, we not only analyze the instant quarterly economic impact of the restrictions imposed on a State, but we also factor in a quarter lag for each state's response. During crises, regions typically experience a secondary shock after the initial event, which affects the overall level of economic resilience in the region (Zhang, 2021). By factoring in a lag, we can account for those impacts immediately felt from the economic shock, as well as those that are delayed.

3. Methodology

3.1 Design and Procedure

At the beginning of the COVID-19 pandemic, McCann (2020) created a framework to assess the nature of each state government's response, looking at 51 various metrics across three main dimensions: "Prevention and Containment," "Risk Factors and Infrastructure," and "Economic Impact." He then assigned a weighted average to each dimension: 75% to Prevention and Containment (such as travel and large gathering restrictions), 20% to Risk Factors and Infrastructure (for example, restrictions on drugs related to Covid-19 treatment), and 5% to Economic Impact (state who have enacted budget legislation in response to Covid-19). McCann (2020) utilized a 100-point scale to measure each state's response, 1 (100) being the least (most) aggressive response. He then ranked each state from least (1) to most (50) aggressive. These rankings were generated and published three times: April 7, 2020 (beginning of Q2), October 6, 2020 (beginning of Q3), and January 26, 2021 (beginning of Q1). (McCann, 2020; McCann, 2021; McCann, 2021).

In this analysis, we gathered economic data by state, based on overall taxable sales, taxable sales by various industries (27), unemployment rate, and GDP. All three measures of study, Unemployment and GDP growth, and taxable sales are posted each quarter, which will enable us to analyze quarterly performance throughout our sample.

To more holistically understand the landscape of each state, we included these variables into the regression analysis: Aggression rating, percentage of working age population, population with bachelor's degrees or higher, Gini index, population density, and white population. We applied these variables to the change in unemployment, taxable sales, and GDP (all with both with no lag & one quarter lag). Below is a brief description of each variable:

1. **Aggression Rating:** This variable ranks the strictness of each state response to COVID, including criteria like: mask mandates, business closures, stay at home orders, etc. Each state is ranked on a scale 1-50, 1 being the least aggressive and 50 being the most aggressive response (McCann, 2020)
2. **Working Age:** This variable measures the percent of working age population in each state, which are those individuals age 25-60 (OECD, 2022)
3. **Population with bachelors:** This variable measures the percent of population with a bachelor's or higher degree in each state. (NSF, n.d.).
4. **Gini index:** This variable measures the income inequality by each state. (World Population Review, n.d.)**.**
5. **Population Density:** This variable measures the population concentration (person/sq. mile) in each state (US Census Bureau, 2021).
6. **White:** This variable measures the percent of the population that is white in each state (US Census Bureau, 2021).

4. Results:

Our study commences in January, 2020, and runs through June, 2021, using quarterly data from Q1, 2019 to Q2, 2021. This time period encapsulates key economic factors before the COVID-19 economic shock, during the shock, and the beginning of the economc recovery thereafter. The data comes from the Bureau of Economic Analysis (BEA), where there is a repository on quarterly economic data for each industry in each state. Many economic repercussions are felt after the initial shock, so this was factored in by accounting for a one (1) quarter lag.

Table 1: Descriptive Statistics – Base Models

Explanatory Variables (N=50)	Mean	Std. Dev	Min	Max
Q1 2020 Unemployment (%)	3.77	1.02	2.07	7.01
Q2 2020 Unemployment (%)	11.73	3.33	6.47	23.13
Q3 2020 Unemployment (%)	7.93	2.39	4.07	14.70
Q4 2020 Unemployment (%)	6.19	1.81	3.47	11.53
Q1 2021 Unemployment (%)	5.60	1.75	3.00	9.50
Q2 2021 Unemployment (%)	5.23	1.60	2.63	8.07
YoY Q1 2020 Unemployment change (%)	0.13	0.71	-0.87	3.97
YoY Q2 2020 Unemployment change (%)	8.22	3.20	3.47	19.20
YoY Q3 Unemployment change (%)	4.42	2.25	1.07	11.93
YoY Q4 Unemployment change (%)	2.71	1.70	0.57	9.40
YoY Q1 Unemployment change (%)	1.83	1.70	-3.30	7.43
YoY Q2 Unemployment change (%)	-6.49	2.70	-15.27	-1.97
GDP YoY Growth Q1 2020 (%)	0.05	1.45	-2.98	2.85
GDP YoY Growth Q2 2020 (%)	-9.21	1.93	-13.95	-4.61
GDP YoY Growth Q3 2020 (%)	-2.95	1.81	-8.23	1.05
GDP YoY Growth Q4 2020 (%)	-2.33	1.77	-8.36	1.78
GDP YoY Growth Q1 2021 (%)	0.54	1.59	-5.16	5.09
GDP YoY Growth Q2 2021 (%)	11.76	3.05	4.98	18.80
Age Population 19-64 years old (%)	59.40	1.36	56.80	62.10
Population 25 and older with bachelor's degree or more (%)	33.01	6.74	21.05	59.67
Percentage White Population (%)	78.84	12.31	25.60	94.60
Gini Index	46.21	1.93	41.74	51.02
Population Density (residents/square mile)	225.58	293.19	1.30	1263.00

In terms of overall unemployment across all states, as depicted in Table 1, the largest shock happened during Quarter 2 of 2020, where the year-over-year unemployment rate increased by an average of 8.22%, ranging from 3.47% up to 19.20%. This negative impact is supported by the YoY average -9.21% change in GDP growth. Year-over-year unemployment rates increased for all 50 States in Quarters 3 & 4 of 2020, and remained positive, on average, for Q1 2021. GDP growth followed the same general trend: Average negative growth in Quarters 3 (-2.95%) and 4 (-2.33%) for 2020, with some subsequent stabilization and increases for Quarters 1 (0.54%) and 2 (11.76%) in 2021.

4.1 Unemployment Changes

Table 2: Unemployment YoY Change (no lag)

Explanatory Variable (N=50)	Q2-20	P-Value	Q4-20	P-Value	Q1-21	P-Value
Aggression Rating	0.083*	(0.022)	0.061***	(0.000)	0.061***	(0.000)
Age	0.002	(0.954)	-0.021	(0.172)	-0.025	(0.077)
Population w/ bachelors	0.090	(0.251)	-0.020	(0.520)	-0.038	(0.197)
Gini index	0.266	(0.270)	0.167	(0.112)	0.223*	(0.027)
Population Density	-0.000	(0.884)	0.001	(0.430)	0.001	(0.287)
White	-0.022	(0.463)	-0.032*	(0.011)	-0.029*	(0.017)
Constant	-7.582	(0.512)	-1.931	(0.690)	-4.734	(0.305)
R-Squared	0.202		0.511		0.559	

Notes: P-Values < .05 were labeled with one star (*); P-Values < .01 were labeled with two stars (**); P-Values < .001 were labeled with three stars (***).

In Table 2, we run three separate OLS regressions using the year-over-year changes in the unemployment rates, analyzing the economic conditions in Q2 2020, Q4 2020, and Q1 2021, based on the aggressiveness rankings posting at the beginning of the analyzed quarter. For example, rankings in Q2 2020 are matched to the Q2 2020 unemployment year-over-year changes. Here, we find that there is a statistically significant impact of each state's aggression rating as it pertains to unemployment change across all three analyzed quarters. This means that as the state's response aggression increased, the unemployment rates significantly increased as well. Table 2 also shows that a greater percentage of white population significantly decreased the overall employment rates in Q4 2020 and Q1 2021.

Table 3: Unemployment YoY Change (1 Quarter lag)

Explanatory Variable (N=50)	Q2-20	P-Value	Q4-20	P-Value	Q1-21	P-Value
Aggression Rating	0.066**	(0.004)	0.063***	(0.000)	-0.040	(0.185)
Age	-0.011	(0.617)	-0.025	(0.076)	0.007	(0.838)
Population w/ bachelors	0.009	(0.859)	-0.030	(0.293)	-0.058	(0.391)
Gini index	0.362*	(0.019)	0.215*	(0.029)	0.087	(0.698)
Population Density	0.0004	(0.731)	0.001	(0.286)	-0.002	(0.881)
White	-0.033	(0.078)	-0.031**	(0.009)	-0.013	(0.638)
Constant	-10.94	(0.132)	-4.558	(0.310)	-7.108	(0.500)
R-Squared	0.380		0.582		0.076	

Notes: P-Values < .05 were labeled with one star (*); P-Values < .01 were labeled with two stars (**); P-Values < .001 were labeled with three stars (***).

Next, we lag the economic (unemployment) results by one quarter in order to investigate if the restriction aggressiveness has any delayed impact. For example, our Q2 2020 aggressiveness ranking are analyzed against the unemployment impact of the following quarter (Q3 2020). In Table 3, we find that each state's aggression rating maintains its significance as a driver of higher unemployment. For Q1 2021 with a quarter lag, the strength of the results appear to dissipate as the economy worked to reopen in Q2, 2021.

4.2 GDP Changes

Table 4: GDP YoY Change (no lag)

Explanatory Variable (N=50)	Q2-20	P-Value	Q4-20	P-Value	Q1-21	P-Value
Aggression Rating	-0.052*	(0.015)	-0.036*	(0.023)	-0.027	(0.066)
Age	-0.027	(0.195)	-0.006	(0.727)	0.007	(0.649)
Population w/ bachelors	0.007	(0.874)	0.030	(0.397)	0.040	(0.229)
Gini index	-0.006	(0.964)	0.032	(0.787)	-0.005	(0.967)
Population Density	0.000	(0.720)	0.000	(0.984)	-0.000	(0.827)
White	0.035	(0.054)	0.063***	(0.000)	0.051***	(0.000)
Constant	-8.434	(0.216)	-8.251	(0.140)	-4.393	(0.346)
R-Squared	0.249		0.409		0.346	

Notes: P-Values < .05 were labeled with one star (*); P-Values < .01 were labeled with two stars (**); P-Values < .001 were labeled with three stars (***).

In this section, we run a similar OLS regression analysis using the year-over-year changes in GDP growth for each of the three analyzed quarters. In Table 4, we see that, once again, that the percent white population and aggression rating to have a statistically significant impact on year-over-year GDP change. Two of the three periods reported p-values of less than .001, a significant statistical correlation between percent white population and GDP. Here, we can see evidence that those states with higher percent white populations exhibited less severe unemployment shocks and less negative GDP growth during the Pandemic.

Table 5: GDP YoY Change (1 Quarter lag)

Explanatory Variable (N=50)	Q2-20	P-Value	Q4-20	P-Value	Q1-21	P-Value
Aggression Rating	-0.037*	(0.042)	-0.036*	(0.013)	-0.077*	(0.024)
Age	-0.021	(0.237)	0.007	(0.639)	0.686	(0.072)
Population w/ bachelors	0.002	(0.963)	0.036	(0.258)	0.004	(0.946)
Gini index	-0.021	(0.863)	0.015	(0.892)	0.454*	(0.043)
Population Density	0.000	(0.530)	-0.000	(0.915)	-0.002	(0.198)
White	0.063***	(0.000)	0.053***	(0.000)	0.100**	(0.003)
Constant	-4.405	(0.445)	-5.079	(0.316)	-4.863	(0.349)
R-Squared	0.377		0.388		0.325	

Notes: P-Values < .05 were labeled with one star (*); P-Values < .01 were labeled with two stars (**); P-Values < .001 were labeled with three stars (***).

Next, we again lag the economic (GDP growth) results by one quarter in order to investigate if the restriction aggressiveness has any delayed impact. Here, we see a consistently strong impact of the state's aggression rating and the negative year-over-year GDP growth. White population percentage maintains a significantly positive relationship on GDP growth, after factoring a one quarter lag.

4.3 Taxable Sales Growth, by Industry

In the third section of the analysis, we analyze the quarterly taxable sales year-over-year growth for 27 various industries, retrieved from the Bureau of Economic Analysis (bea.gov, 2021). For the average year-over-year sales growth calculation, we take an equally-weighted average of the yearly change for all 50 States in each of the 27 industries each quarter.

Table 6: Descriptive Statistics (equally-weighted YoY Taxable Sales in %)

Line code (all industries)	Q22020	Q32020	Q42020	Q12021	Q22021
1: All Industry Totals	-2.83	-1.29	2.29	2.79	17.66
2: Private Industries	-3.35	-1.48	2.60	3.19	19.71
3: Agriculture, forestry, fishing, & hunting	-8.17	4.23	7.72	8.20	115.36
6: Mining, quarrying, oil, & gas extraction	-38.78	-28.81	8.60	13.78	208.17
10: Utilities	2.84	0.44	9.94	11.38	6.51
11: Construction	0.65	2.93	3.55	3.44	10.83
12: Manufacturing	-0.29	4.00	4.74	22.31	
13: Durable Goods manufacturing	-1.01	1.79	4.50	5.03	20.29
25: Nondurable goods manufacturing	-3.11	-2.19	3.68	4.71	25.88
34: Wholesale trade	-2.68	-0.95	2.87	3.39	23.43
35: Retail Trade	6.32	7.40	11.44	11.96	26.18
36: Transportation and warehousing	-18.91	-16.22	-10.67	-9.95	22.77
45: Information	-0.74	0.82	4.46	4.68	12.18
51: Finance and Insurance	5.22	6.12	8.92	9.21	14.40

56: Real estate, rental, & leasing	1.39	1.54	1.77	1.82	5.97
60: Professional, Scientific, and technical services	-2.35	-0.99	2.24	2.53	10.98
64: Management of companies and enterprises	-0.53	0.10	2.47	2.98	9.06
65: Admin, support, waste mgmt., & remediation services	-2.95	0.77	5.98	6.57	26.69
69: Educational services	-6.36	-9.44	-7.99	-7.78	2.54
70. Health Care & Social Assistance	-1.69	0.56	2.31	2.51	19.08
76. Arts, Entertainment, and Recreation	-37.75	-32.35	-24.33	-23.77	84.72
79. Accommodation & Food Service	-19.49	-17.84	-8.93	-7.95	72.88
82. Other services (except gov. & gov. enterprises)	-9.28	-8.28	-7.05	-6.91	19.41
83. Government & Government Enterprises	0.05	-0.55	-0.08	-0.07	5.41
84. Federal Civilian	6.09	4.85	3.10	2.86	2.87
85. Military	2.65	3.23	6.85	6.87	8.17
86. State & Local	-1.81	-2.41	-1.71	-1.64	6.44

Notes: This table displays the equally-weighted average year-over-year taxable sales growth (as a %) for 27 of the analyzed industries for all 50 States.

In Table 6, total industry taxable sales revenue were net negative YoY for both Q2 and Q3 of 2020 until Q42020, which reported a 2.3% positive YoY differential. The hardest hit industries during Q2 2020 were: 1. (3) Mining, quarrying, oil and gas extraction, 22. (76) Arts and Entertainment, and 3. (76)Accommodation and Food Service. While the mining industry bounced back in Q4 2020, posting positive growth in Q4 2020 to Q2, 2021, Arts, Entertainment, and Recreation as well as Accommodation and Food Services remained negative until Q2, 2021. Industries with more modest changes in taxable sales YoY signals their resilience to changing circumstances as they still have similar sales/revenues despite adverse events. These include line codes: 10 (utilities), 45 (Information), 51 (Finance and Insurance), 56 (Real Estate), 84 (Federal Civilian), and 85 (Military). These industries can be described as having more immediate economic resistance to change (McCann, 2020).

The next three tables run similar OLS regressions to the previous two sections (unemployment and GDP growth), and use taxable sales growth for each industry as the dependent variable. To improve the clarity of the below tables, we only post coefficients with a “p-value” less than 0.10.

Table 7: Taxable sales Q2, 2020 (no lag| 1 Quarter lag)

Line Code	Rank	Age	Density	Bachelors	Gini	Rank	Age	Density	Bachelors	Gini
1: All industry totals										
2: Private industries										
3: Agriculture, etc.	-.309									
6: Mining, oil, etc.					.-1.39*				.288	-1.316*
10: Utilities		-.007**					-.06	.004*		
11:Construction					-.861**					.855**
12: Manufacturing						.084*				
13: Durable Goods					.215					
25: Non-durables	-.103*					-.138***		.003		
34: Wholesale Trade						-.079*				
35: Retail Trade					-.619	-.098***				-.336*
36: Transport., etc.				.188						
45: Information										
51: Finance & Ins.										
56: Real est/rental/etc.					.034**		-.14			
60: Prof. services										
64: Company mgmt.										
65: Admin, support, etc.										
69: Education services						-.113*				
70: HC & SS					.002**	-.058*				
76: Arts, Rec., etc.	-.449**					-.524***				
79: Accommodation:	.-.197*					-.261***				
82: Other services:						-.066*		-.003*		
83: Government:	-.040*					-.034				
84: Fed. Civilian					-.300*					
85: Military:	-.125**									
86: State & Local	-.048*					-.045*				

Notes: P-Values < .05 were labeled with one star (*); P-Values < .01 were labeled with two stars (**); P-Values < .001 were labeled with three stars (***). Numbers posted without an asterisk denote a p-value < .10.

From Table 7, we see that the aggression of each states response had a significant immediate and delayed impact on the taxable sales for many industries in Q2 and Q3, 2020. Those industries who showed immediate impact are the following industry line codes: Non-durables, Arts & Rec., Accommodations, Government, Military, and State & Local. When we evaluate the one quarter lag, we see that there was also a significantly negative delayed impact on 10 of the 27 analyzed industries of the State aggressiveness response on taxable sales growth.

Table 8: Taxable sales Q4, 2020 (no lag| 1 Quarter lag)

Line Code	Rank	Age	Density	Bachelors	Gini	Rank	Age	Density	Bachelors	Gini
1: All industry totals	-.052**			.087		-.045**		-.002*		
2: Private industries	-.057*			.099		-.048**				
3: Agriculture, etc.	-.466*					-.499*				
6: Mining, oil, etc.										
10: Utilities										
11:Construction					-.423*					22.35*
12: Manufacturing	-.074*					-.061*				
13: Durable Goods										
25: Non-durables	-.128**					-.087**				
34: Wholesale Trade										
35: Retail Trade	-.073**					-.063**				
36: Transport., etc.										
45: Information										
51: Finance & Ins.										
56: Real est/rental/etc.		-.012			-.086.	.009	-.013*			-.082
60: Prof. services										-.256
64: Company mgmt.				.131					.103	-.321
65: Admin, support, etc.			-.004					-.005*		
69: Education services						-.113*				
70: HC & SS					-.273.	-.058*				-.271*
76: Arts, Rec., etc.	-.519***					-.500***				
79: Accommodation	-.170*			.328		-.163*				
82: Other services:	-.035*		-.004*			-.060*		-.004**		
83: Government:	-.035*					-.036*				
84: Fed. Civilian			-.002					-.002		
85: Military:	-.125**			.354*					.358*	
86: State & Local	-.056**					-.057***				

Notes: P-Values < .05 were labeled with one star (*); P-Values < .01 were labeled with two stars (**); P-Values < .001 were labeled with three stars (***). Numbers posted without an asterisk denote a p-value < .10.

In Table 8, we again detect a strong negative impact between each states aggression response rating and taxable sales changes for Q4 2020 (and Q1 2021 when factoring in a one quarter lag). Here, 12 industries out of 27 post a significant immediate impact between response aggression rating and taxable sales declines. Nearly half of the industries (13 out of 27) were significantly negatively affected by the aggressiveness ranking when factoring a quarter lag.

Table 9: Taxable sales Q1 2021 (no lag| 1 Quarter lag)

Line Code	Rank	Age	Density	Bachelors	Gini	Rank	Age	Density	Bachelors	Gini
1: All industry totals	-.041**		-.002*			-.116**				
2: Private industries	-.043*		-.002*			-.129**				
3: Agriculture, etc.	-.401				-1.12		3.99*			
6: Mining, oil, etc.							-8.08***			
10: Utilities										1472.11*
11:Construction							.283			
12: Manufacturing	-.057*									
13: Durable Goods							.224	.009		
25: Non-durables	-.073*									
34: Wholesale Trade						.08		.016		
35: Retail Trade	-.05*						-.092			.685
36: Transport., etc.						-.292				
45: Information										
51: Finance & Ins.										
56: Real est/rental/etc.	.13*	-.013*			-.087*	-.285*				
60: Prof. services					-.256					
64: Company mgmt.				.104	-.338					

65: Admin, support, etc.		-.005*				.146*				
69: Education services						-.134		-.289		
70: HC & SS				-.283*						1.443**
76: Arts, Rec., etc.	-.518***				.899*					
79: Accommodation	-.149*									
82: Other services:	-.062*	-.004*								
83: Government:	-.035*							-.172*		
84: Fed. Civilian		-.002					.003			
85: Military:			.339*							
86: State & Local	-.060***									

Notes: P-Values < .05 were labeled with one star (*); P-Values < .01 were labeled with two stars (**); P-Values < .001 were labeled with three stars (***). Numbers posted without an asterisk denote a p-value < .10.

In Table 9, we yet again see the negative impact between each states response aggression and taxable sales for immediately thereafter and delayed for Q1, 2021. Consistent with the previous results sections, the strength of the results begin to dissipate in Q2 2021, as the most of the economies attempted to reopen.

5. Conclusion and Discussion

In this paper, we analyze the impact of the COVID-19 pandemic on each state's respective unemployment, GDP, and taxable sales. In order to encapsulate all those variables that might affect each industry in each state's bottom line, we incorporated these variables: aggression rating, percent of population that is working age, percent of population holding a bachelor's degree, income inequality, population density, and percent population in each state that is white. In doing so, we have captured an overview of all those variables that might have an impact on the severity of the COVID-19 crisis on each state.

5.1 Unemployment

First, we find that similar unemployment trends occur across the board regarding the immediate and delayed impact of each states aggression rating. Government mandates on business closures, masking policies, etc. clearly had the most unanimous impact in regards to the unemployment levels of those respective industries. These findings confirm our previous argument, that government policies do have a strong impact on the unemployment level of all industries. Specifically, this goes into further detail on Ezcurra and Rios' (2018) argument that the

government is the most important institution in regards to economic recovery. Not only does government response have a strong immediate impact on unemployment, but has a mild impact on delayed unemployment as well.

There was also a mild delayed impact between income inequality and unemployment, specifically for Q1, 2021. We believe that a deeper investigation of income inequality among states could be beneficial to better understand the relationship between income inequality and effects of government policies.

5.2 GDP

For this variable, we found a significant immediate and delayed impact between percentage of white population and GDP change. This means that all other factors aside, the higher percent white population meant less immediate and delayed GDP changes; communities with more white people were essentially less affected over the course of the crisis. This helps to further explain the effects and nature of a transboundary crisis. While COVID-19 had an impact across geographic and industry boundaries, racial status of each state determined the severity of GDP drops. This coincides with Matheson et al (2004) findings, that crisis had a more severe impact on minority racial communities. Despite its nature, this crisis still managed to have disproportionate impact on certain groups. It is worth further investigation into which specific racial groups might have been more/less affected how far these GDP drops extend .

5.3 Taxable Sales

For taxable sales, we primarily found a very strong impact between immediate and delayed taxable sales drop and response aggression. For Q2 and Q4, 2020, we found a strong immediate and lagged negative impact between these two variables. For about half of the 27 analyzed industries, state aggressiveness maintained a negative impact into Q1, 2021. These affected

industries mentioned could have some form of economic hysteresis, which are delays in economic shocks (Sutherland & Hoeller, 2013).

5.4 Policy making implications

While each new transboundary crisis is of different nature, like the 2008 financial crisis compared to the COVID-19 crisis, the determining factors of these remains events seems to remain consistent. According to these most recent results, COVID-19 was heavily influenced through government intervention, however, there were other demographic factors at play that also had an impact of the overall economic health of each local society. By combining previous COVID-19 and crisis methodologies, this study quantifies the impact of an overall response from government on each respective business industry. These findings can perhaps serve as a gauge for how future crisis policies might affect the overall health of each respective industry it has influence over. If there is strong response aggressiveness in the next crisis we might encounter, there will likely be an immediate unemployment spike tied to those policies. In addition, many industries will face immediate and delayed taxable sales drops from government response aggression, especially many B2C industries (accommodation, entertainment, retail, etc.) Government decision-makers and policy-makers need to carefully weigh the negative economic consequences when considering health mandates.

5.5 Weaknesses and future recommendations

One of the main weaknesses is the span of time over which our study takes place. Crises might take place within a short window of time, but their effects span years after their initial start (Boin; 2009; Collins & Margo, 2007; Pelling and Barakat, 2002). With our study analyzing data year over year from 2019 to Q2 2021, we might not be able to capture the full post-crisis recovery.

Future research in later years can build off of the absence of data that we do not have access to at this moment. Economic researchers, like McCann (2020), have continued to track each states aggression rating into 2021; this data can continued to be applied in the same manner as this study to measure this economic impact of COVID-19 over extended period's time.

Another future direction to add onto the crisis literature could be to combine the overall economic effect with the overall public health effect of the pandemic. In turn, these two frameworks could produce a net benefit/harm of the pandemic for each state based on the economic benefits/harms and public health benefits/harms of each respective response aggression.

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