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Abstract

With a total case count exceeding 45 million as of October 31, 2020, the COVID-19 pandemic has posed unprecedented challenges around the globe. In this report, we employ a narrower focus, looking at the economic effects of COVID-19 in the United States. By aggregating multiple data sources, including COVID-19 infection rates, COVID-19-related policy measures at the state level, and unemployment rates, we classify three different county-level archetypes. For each of these archetypes, we describe the current state of affairs, provide a case example, and comment on the potential path to economic recovery.

Introduction

To analyze the economic effects of COVID-19, a baseline to establish economic performance needs to be established. An intuitive and useful measure of economic performance is unemployment rates. In *Unemployment and Economic Recovery*, Lina Levine discusses the importance of looking at unemployment above GDP to analyze an economic recovery (Levine 2010). With COVID-19 it may be important to view unemployment levels at post-lockdown levels as many, but not all lockdown layoffs may have been temporary as businesses lost almost all revenue sources.

Research into past economic recoveries also shows that public perception of economic health is important for a financial rebound. (Azis 2010). A good proxy for analyzing this sentiment could be the policies that local and regional governments have adopted to deal with COVID. An area that lacks an effective government response would likely also have negative perceptions of the current safety of their area and the future of their ability to return to a normal life and economy. A recent World Economic Forum article shows that perceptions of the threat of this crisis do appear to be tied both to government response and the actual severity of the outbreak. (Oliver 2020)

Another important aspect of a pandemic recovery is sector specific effects. All industry has been affected by the pandemic, but some sectors are much quicker to recover and even grow during extended shutdowns, while others may be heavily damaged. Industries including transportation, energy and hospitality will continue to see the worst effect of COVID-19 as people are not able to and do not want to travel. (Konings 2020) Regardless of a city's response to the pandemic, if the economy of an area is centered in specifically susceptible sectors then the recovery will be much harder and there may be lasting economic impacts from this crisis.

While over 100 years ago, the 1919 H1N1 pandemic provides insight into the potential economic impact of a pandemic at the scale of COVID-19. A new study at The MIT Sloan School of Management shows that cities that implemented aggressive interventions to curb the spread of the disease saw quicker economic recovery. Cities that implemented interventions 10 days earlier to their counterparts saw a 5 percent relative increase after the pandemic ended. (Dizikes 2020)

Although the current economy is much different than it was in 1919 this gives an idea of what to expect for an economic recovery in a post COVID-19 United States. With this in mind, a comprehensive analysis of the economic recovery for a city will include the severity of infection (i.e.

how high was the case/death count) and the stringency of government policies towards curbing the spread.

Data and Methods

In an attempt to make this challenge more tractable within the allotted time frame, we chose to focus on the United States for our analyses. As a result, all data sources listed in this section pertain to the United States.

The data sets used in our analysis are USAFacts daily count deaths and cases. The USAFacts dataset gives a comprehensive look at cumulative COVID-19 infections and deaths on a county basis and is utilized by the CDC.

For unemployment rates, we utilize the Current Population Survey (CPS), provided by the Integrated Public Use Microdata Series. From this source, we are able to obtain the total size of the labor force and the number of unemployed persons at a granular level within the US (e.g., by metropolitan area, by county).

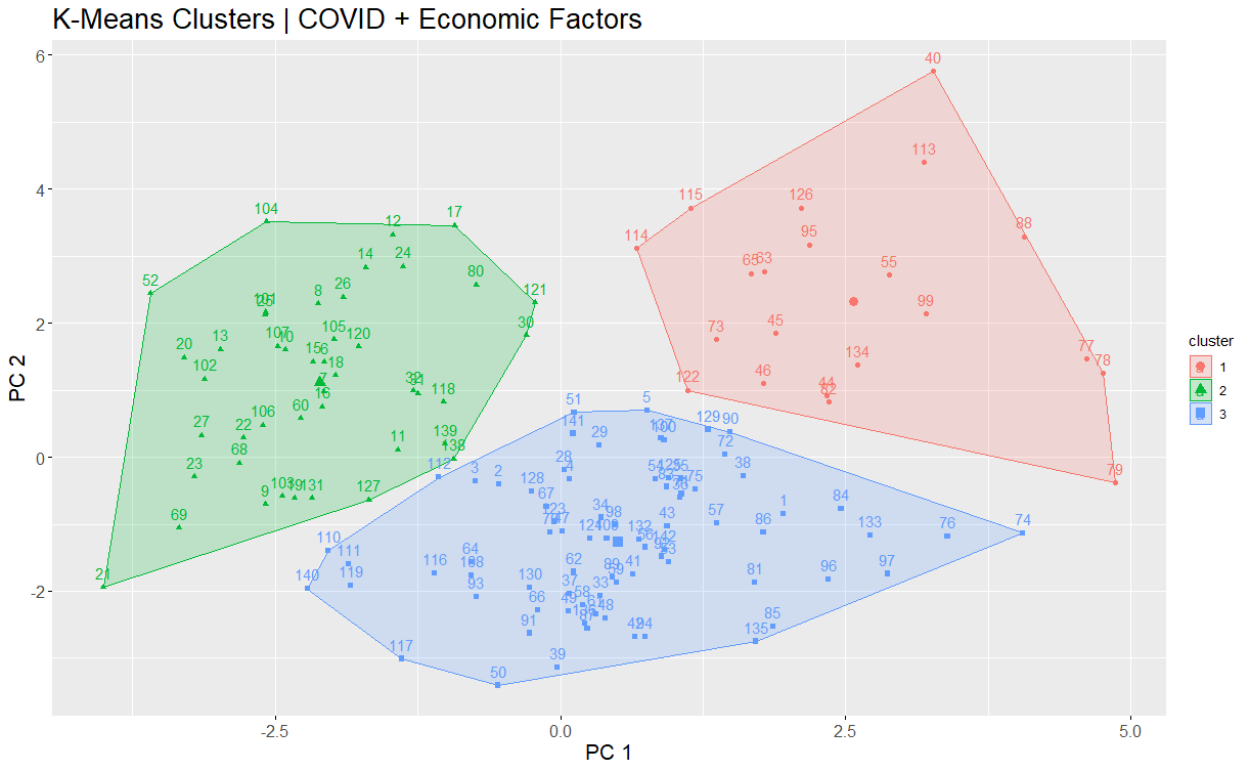
In joining three primary data sets pertaining to (1) COVID case counts and deaths, (2) unemployment rates, and (3) local COVID-19 related policies, we ultimately choose to aggregate our data to the county-level. This decision is not without consequence, as about 50% of our unemployment data did not have a county ID. However, we feel comfortable with this outcome for two primary reasons:

- We suspect that the county ID's are missing in the unemployment data at random (or completely at random). The data documentation suggests that the county IDs are omitted to make it more challenging to identify individuals who completed the CPS
- Our modeling objective is to create representative clusters of locations, not to exhaustively label each location in our dataset

Our data engineering is primarily limited to combining the data sets discussed above in high fidelity ways and creating time series related features (e.g., rolling averages of unemployment rate, changes in COVID rates). By incorporating these temporal features, we reduce the need to select a modeling algorithm that can interpret multiple observations from the same location over time. As a result, we create a final data set that only contains the last observation for each location (September 2020).

We ultimately perform K-means clustering on our data set to determine discrete archetypes of locations. It is our belief that these clusters both inform the degree to which these locations have been affected economically by COVID-19 and the trajectory that will follow toward economic recovery.

Results



Representative examples

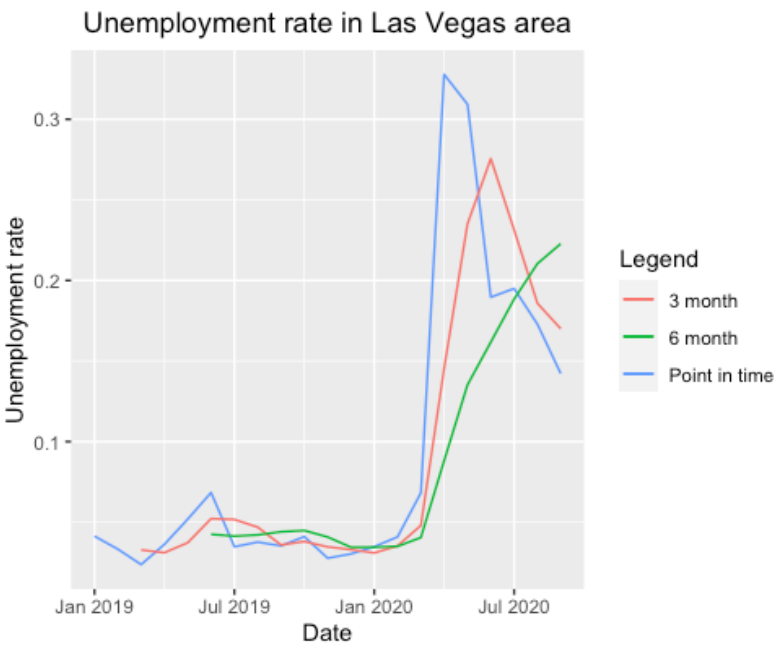
Cluster 1	Cluster 2	Cluster 3
Las Vegas, Nevada	San Mateo, California	Tampa Bay, Florida
Philadelphia, Pennsylvania	Pittsburgh, Pennsylvania	Greenville, North Carolina
Kansas City, MO-KS	Worcester, Massachusetts	Billings, Montana

Cluster descriptions

#1 - “This is the worst year ever”

Group one is categorized by high economic losses from COVID-19 and high infection rates alongside low government intervention. This group has the worst long term outlook and will likely be among the slowest cities to recover. The industries in these areas rely heavily on travel and face to

face interaction such as tourism and hospitality. A good example of this group is Las Vegas, Nevada where the Casino industry saw a 79% reduction in revenue from the pandemic. (Horwath 2020)



Group #2 - “Why isn’t everyone else taking this seriously?”

Group two is categorized by moderate economic losses from COVID-19, but low infection rates alongside high government intervention. This group has by far the best long-term outlook and will likely see recovery shortly after or even before the pandemic is completely over. These cities are economically reliant on industries that are able to be maintained remotely such as technology. An example from this group is San Mateo, California, that is home to numerous large technology companies that were able to easily adapt to remote work. This group will recover quickly as a large portion of their economic losses were from government mandated shutdowns.

Group #3 - “Business as usual”

Group three comprises locations that adopted a low-regulation approach to addressing the pandemic. Locations in this group also saw moderate economic losses while experiencing higher than average infection rates. While it seems counterintuitive that places higher in infections suffered some of the lowest observed economic losses, we reason that the lack of stringent government regulation allowed businesses to continue functioning as normal in spite of the potential risks. This group does not have as arduous a path to economic recovery as those in Group #1 since their economic activity decreased very little in the first place.

Conclusion

Our analysis clustered US cities into three groups based on the economic impacts and infection rates of COVID-19. Through our K-means clustering we were able to identify group #1 as the cities at the highest risk of a long and slow recovery that is potentially combined with more economic shock as more waves of the pandemic continue. We were also able to identify cities with reduced economic risk as our group #2. The remaining group has a large amount of potential risk from the pandemic, but thus far has not shown to be as susceptible to economic damage from the virus.

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