Economic Impact of COVID-19 Pandemic on US Metros

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COVID-19 pandemic has adversely affected cities worldwide and dramatically changed the way in which we conduct our lives. The pandemic has shown us that there are start disparity and differences in society as it has left behind a wreckage of human casualties and exposed weaknesses in healthcare infrastructure. While we have been able to counter some of the socio-economic impacts through the help of government aid, there are other economic effects that still affect millions globally, and will continue to do so in the foreseeable future unless innovative and effective policy measures are not put in place. Our team's analysis aimed to address the question of how the COVID-19 pandemic affected US metropolitan cities through studying economic indicators and examining other parameters.

For this analysis, we collected and processed data from various sources in 7 different categories which help us define a COVID-19 economic impact index. All our datasets in .csv format can be found at https://github.com/microgel/datathon-duke. Our sources of data were:

1. Consumer spending - Affinity Solutions: www.affinity.solutions/dataforgood
2. Small Businesses - Womply: https://www.womply.com/
3. Job Postings - Burning Glass Technologies: https://www.burning-glass.com/
4. Employment - Paychex, Intuit, Earnin, Kronos
5. Unemployment Claims - U.S. Department of Labor
6. Online School Participation - Zearn
7. GPS Mobility Data - https://www.google.com/covid19/mobility/

With the data we collected, we first cleaned it as there was a lot of data for non-metropolitan cities and removed null values. We had to map geographic keys for cities for the 53 metropolitan cities we collected using a python script utilizing the pandas library. We then processed data for the top and bottom quartile of income distribution for the employment data. For the low-income workers, we used Paychex and Earnin data, and for high income workers we evaluated the change in employment suning Paychex and Intuit data. For the small business revenue and open data, we seasonally adjusted it by dividing it year-over-year. For the job postings data, we

removed duplicates to ensure that we only account for those job postings that have not had a duplicate posting for at least 60 days prior. For the online school participation data, we used the average level of student engagement using the online Zearn math curriculum among schools that used the platform for course instruction prior to the pandemic. For the mobility trends from the Google GPS mobility data, we fit a polynomial trend curve to examine how time spent at residential and work places has changed over the pandemic and how we project it to be. For the credit/debit card spending, we calculated a 7 day moving average for all merchant category codes in all 53 US metro cities. Finally, we visualized the data using Tableau and published the dashboard on Tableau Public for the reader to visit and interact with the dataset.

Analysis (Visualizations are hyperlinked):

Category 1 — Employment

- Employment for all workers
- Employment for workers in top quartile of income distribution
- Employment for workers in bottom quartile of income distribution

Category 2 — Unemployment

- Unemployment insurance claims, count
- Unemployment insurance claims, rate

Category 3 — Job Postings

- Average level of job postings

Category 4 — GPS Mobility Data

- Time spent (residential, workplace)
- Time spent (residential, workplace), polynomial trend line

Category 5 — Public Administration Indicators

- Credit/debit card spending

Category 6 — Small Businesses

- Percent change in net revenue for small businesses
- Percent change in number of small businesses open

Category 7 — Education

- Online math participation in schools

While the combined employment level for all workers has declined due to COVID-19, it is very interesting to notice how the difference in recovery is so vast for workers in the top and bottom quartile of the income distribution. The top quartile is >$60,000 and bottom quartile is <$27,000 per year. Our visualizations suggest that the COVID-19 sparked recession has almost ended for high wage workers, but job losses persist for low wage workers. Although employment rates have rebounded to nearly pre-COVID-19 levels for high wage workers, they remain significantly lower for low wage workers. Combined with the unemployment data and job postings, this analysis indicates how COVID-19 has adversely affected cities where there is a significant population under low wage employment and we can expect it to have continued economic effects in the next 1, 2, to 5 years: San Francisco, New York City, New Orleans, Los Angeles, etc.

The GPS mobility data indicates that there has been a rise in time spent at home and there is almost an inverse relation to time spent at the workplace, as suggested intuitively. Our polynomial trend curves adequately predict and fit to the data and have p values < 0.001 and R-Squared values of 0.426272. The mobility trends can prove to be an important economic indicator for retail activity and should be kept in mind when evaluating economic impact on cities in the future.

The small businesses data indicates that there has been slow recovery in small businesses revenue and reopening and many have closed permanently. We can see that the small businesses in San Francisco, San Jose, New Orleans, and Washington have opened in drastically lower numbers than pre-COVID-19 numbers. We also see that San Francisco, Boston, New Orleans, and Washington small businesses have had the least revenue since the onset of COVID-19 pandemic. It may be interesting to note that a lot of these cities have been tech/startup oriented

and due to the pandemic as those businesses have gone under, people have moved away to places where they pay less rent and taxes.

A clear theme that emerges from our data is that low income, low wage, and small businesses have been adversely affected economically due to the pandemic. Our analysis suggests that cities with higher share of such demographic populations will have more severe economic impacts in the next 1, 2, to 5 years.

We have also incorporated the online school participation data as it indicates how online school participation has greatly fallen since the pandemic in schools that used an online platform prior to the onset of COVID-19. It is interesting to see how break-engagement levels are almost the same, but during school session engagement has fallen a lot compared to 2019 levels. Per our analysis, we feel that the data suggests adverse economic effects for cities where school engagement is dropping as studies suggest that less school engagement leads to lower median income in the coming years, hence, affecting the job-market and unemployment levels for that city in the coming 1, 2, to 5 years.