Black Swan

The Impact of COVID-19 on Taxi Drivers and Customers of Chicago

Chicago | June 21, 2020

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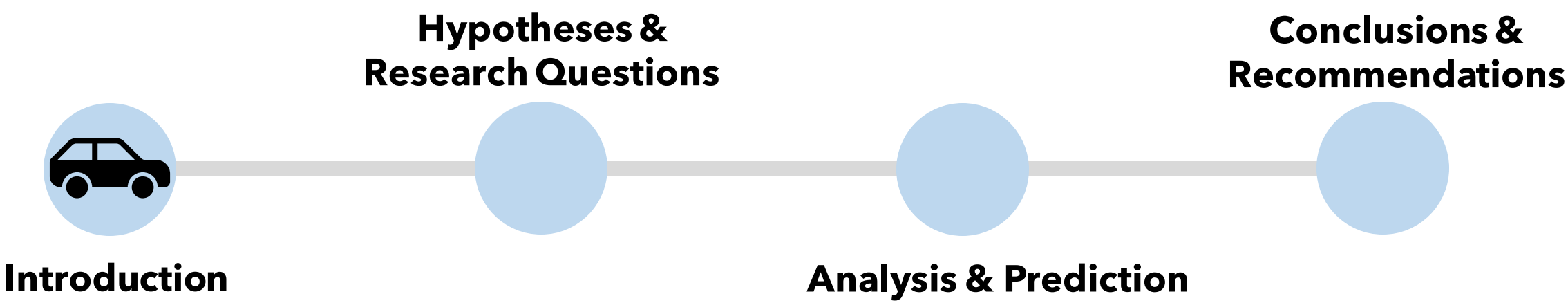
Agenda



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Executive Summary

Chicago and its communities **is facing unprecedented challenges** due to the economic fallout from COVID-19. Social distancing has necessitated a dramatically reduced taxi ridership compared to previous years. This has left the **taxi companies, drivers, and their families far below their expected revenue**, a trend which is going to continue in coming months

We have conducted a **research**, analyzing taxi rides data, which allowed us to understand the **big picture of the crisis and a dramatic decrease of revenues in the industry**, and developed recommendations to interested parties

We expect that this analysis **allow the different stakeholders to develop mitigation mechanisms and allocate financial resources**, while considering both policy objectives and the shareholder expectations

For our research we used data from Chicago Open Data Portal and conducted **the exploratory data analysis together with building predictive models** for further recommendations

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Business Case

Client: Working group of Chicago Mayor's Office, Chicago Taxi Union, taxi companies, Chicago CDO

Problem: estimate the effect of COVID-19 on Chicago taxi drivers, taxi companies, and taxi clients

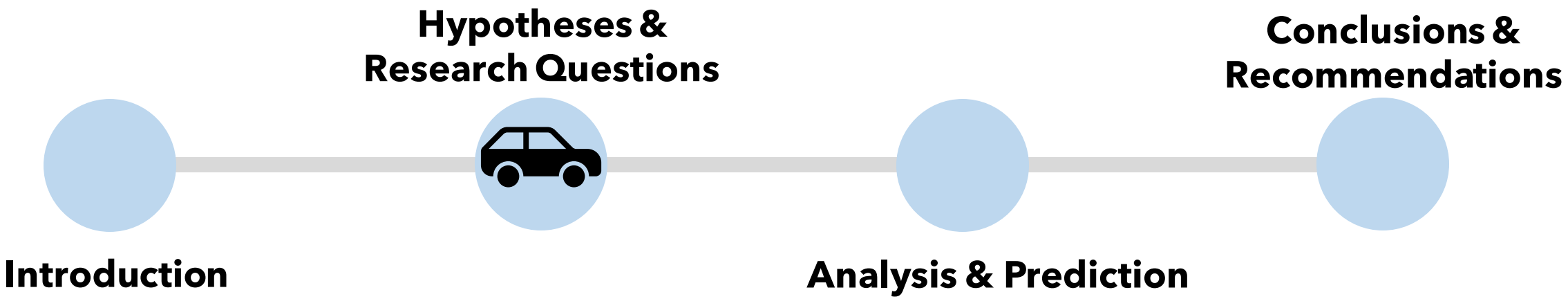
Deliverable: Research about the effect of COVID-19 on Chicago financial well-being and mobility

Data & Source

Time period: Taxi trips in Chicago (12/2019 – 06/2020)

Size: 4137294 rows * 23 columns (50 taxi companies)

Source: Chicago Open Data Portal



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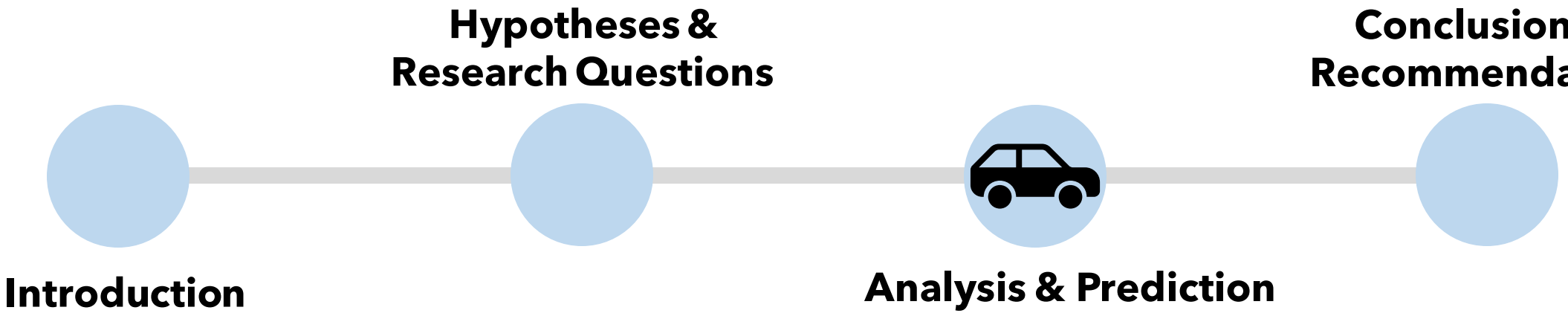
Research Hypotheses

Hypothesis 1: COVID-19 negatively affected the financial well-being of Chicago cab drivers and their families, as well as revenues of taxi companies

Hypothesis 2: COVID-19 changed the behavior of Chicago taxi clients

Research questions

- **Changes in rides frequency**
  - Total
  - by Company
- **Changes in clients' payments**
  - Payment amount (average fare & total revenue)
- **Changes in tipping behavior**
- **Changes in mobility**
  - Duration
  - Mileage
  - Hours of use
- **Changes in hotspots**



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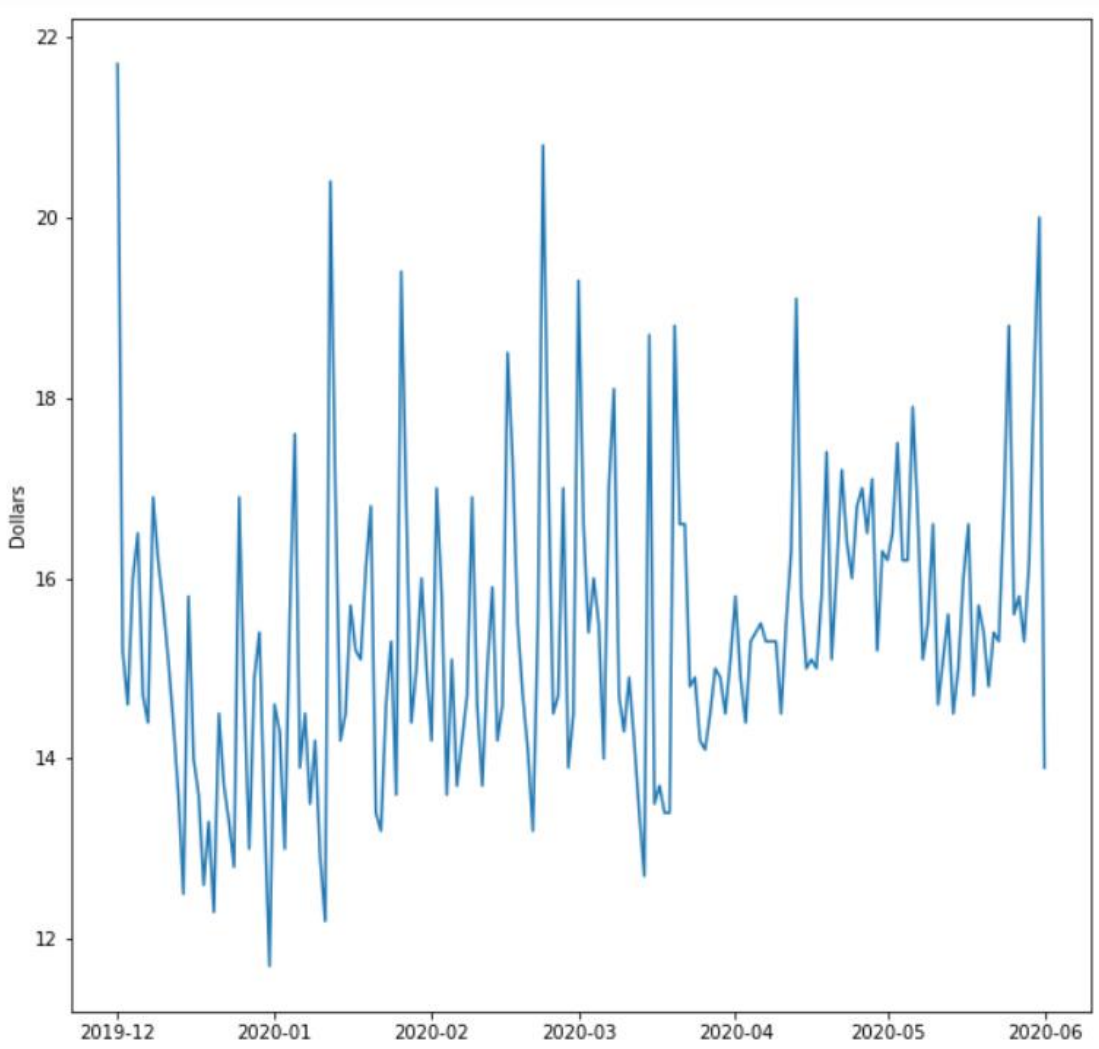
Hypothesis 1

COVID-19 **negatively affected** the financial well-being of Chicago cab drivers and their families, as well as revenues of taxi companies

Info: In Chicago, cab drivers are licensed as chauffeurs **(~12,700 licenses)**

Info: Average salary is $38,001, but the range typically falls between $31,564 and $46,379. Some **lease** cabs for **$500 per week**

Average fare increased by $1



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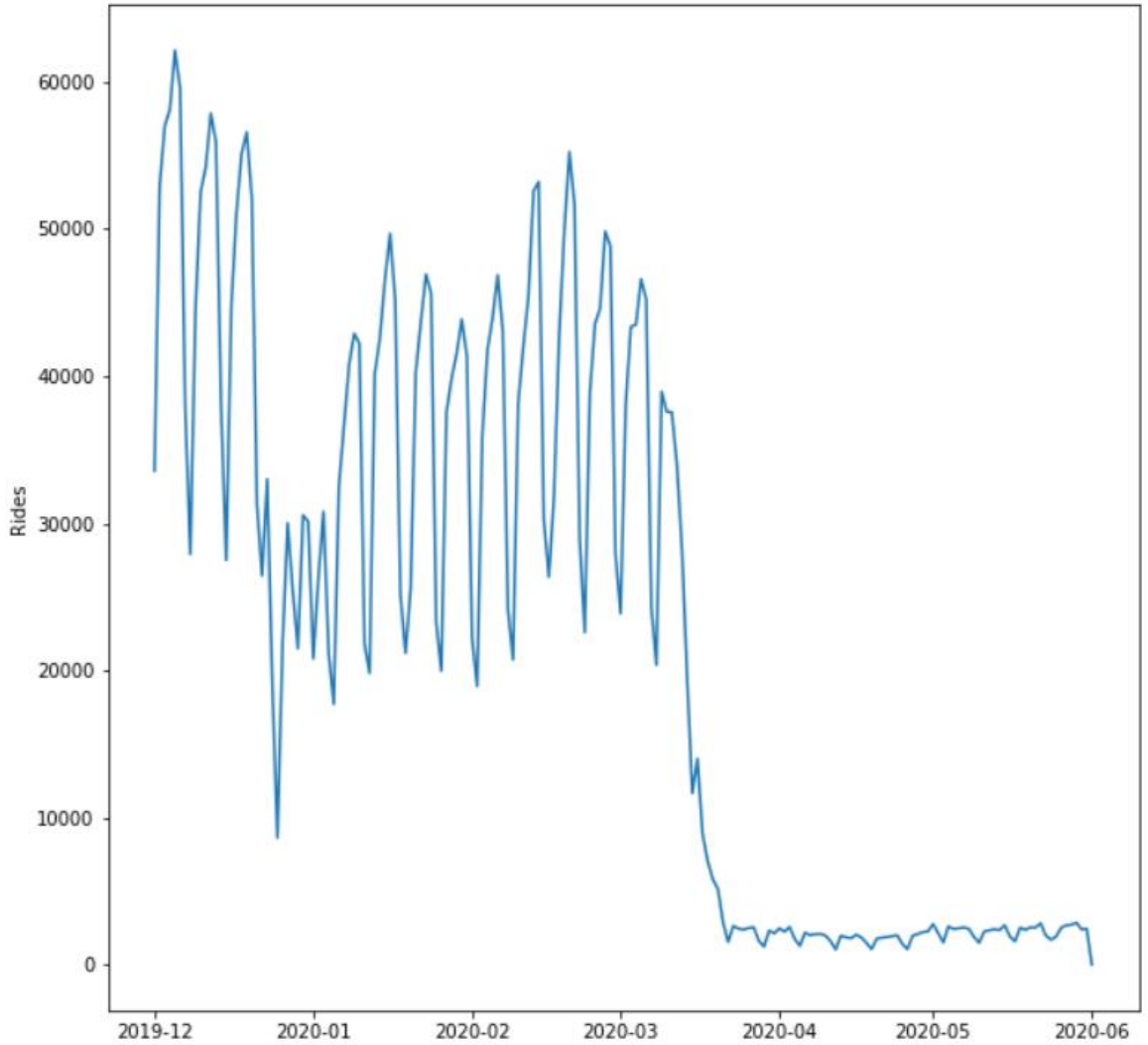
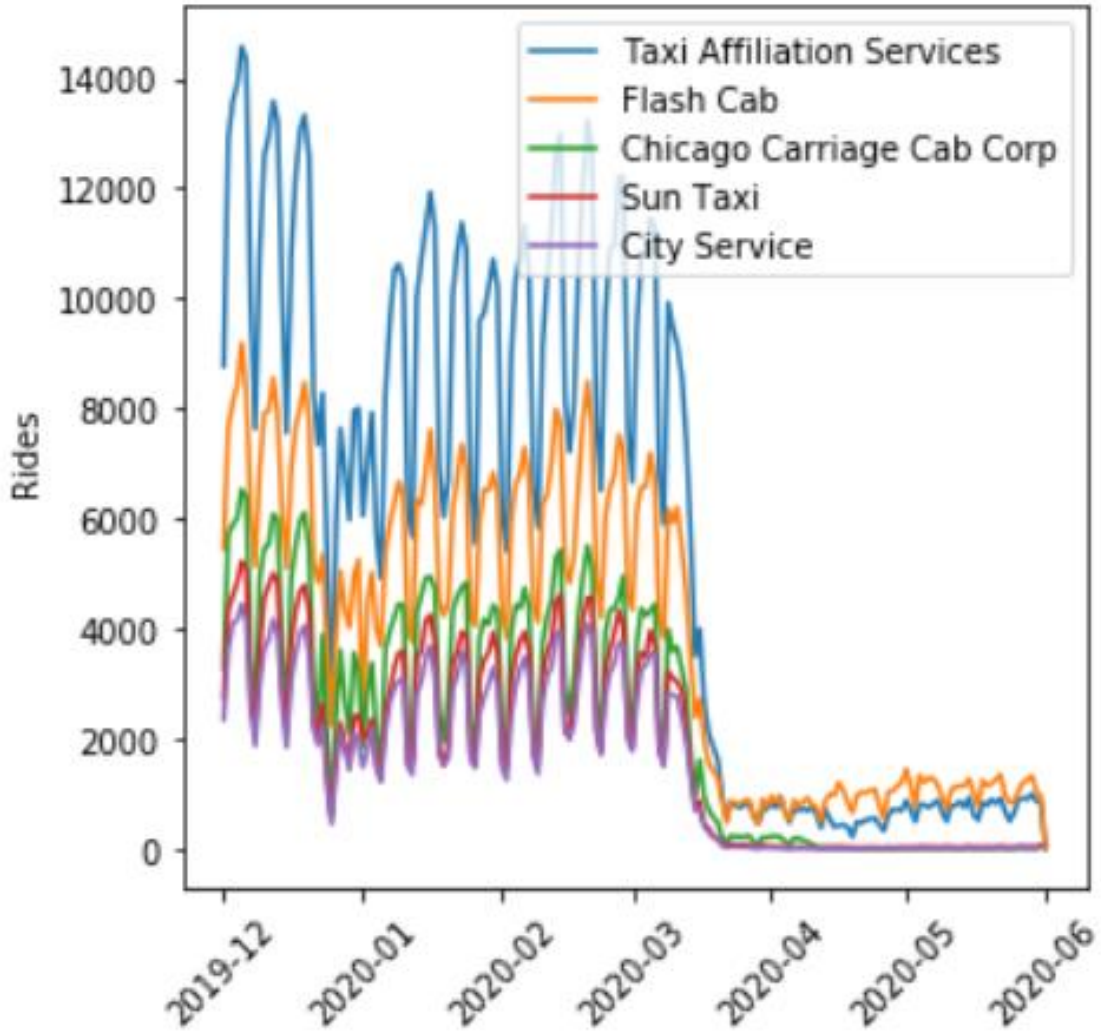
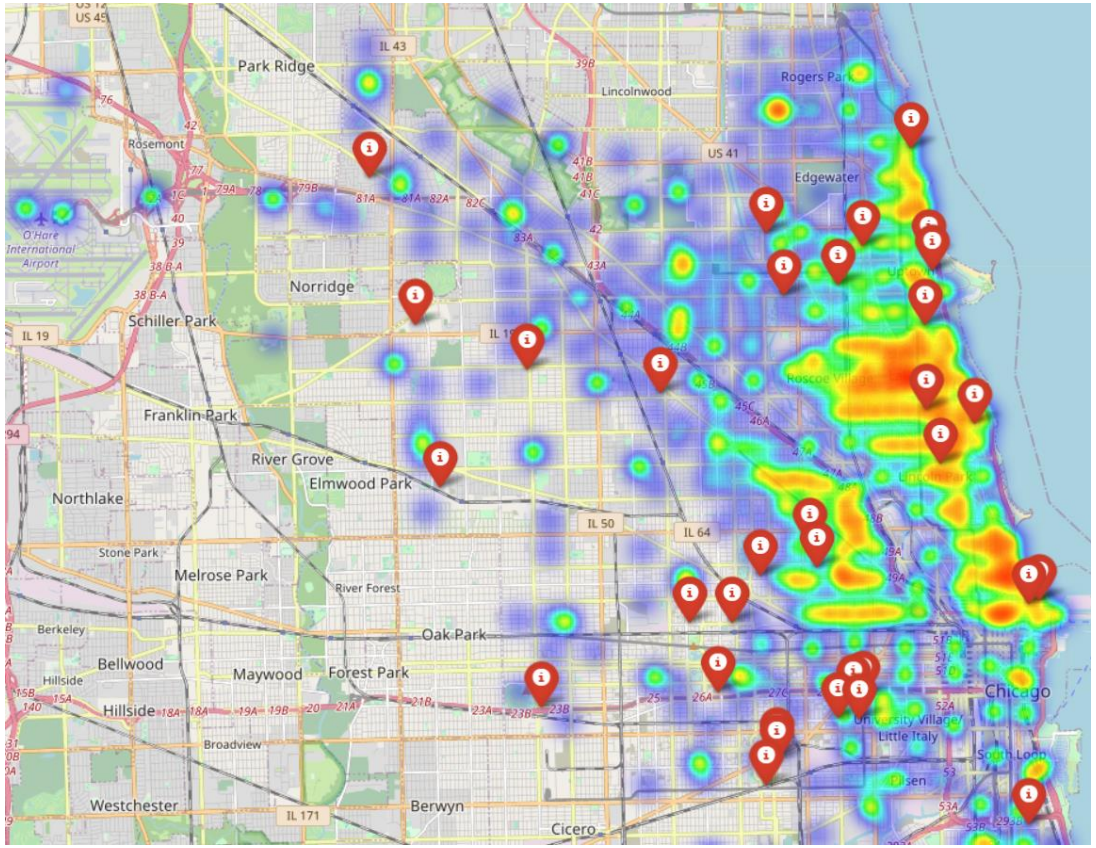
Daily taxi traffic dropped by ~95%

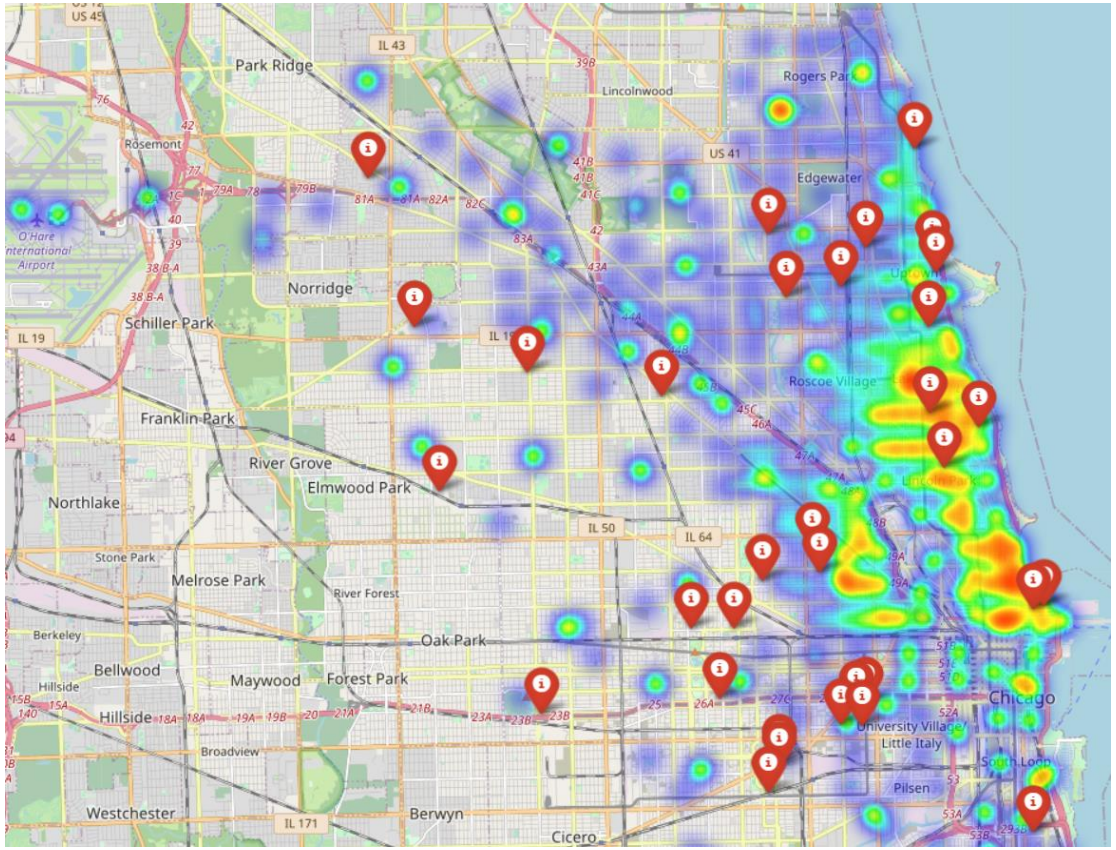


Major companies have the same trend



The intensity of rides decreased





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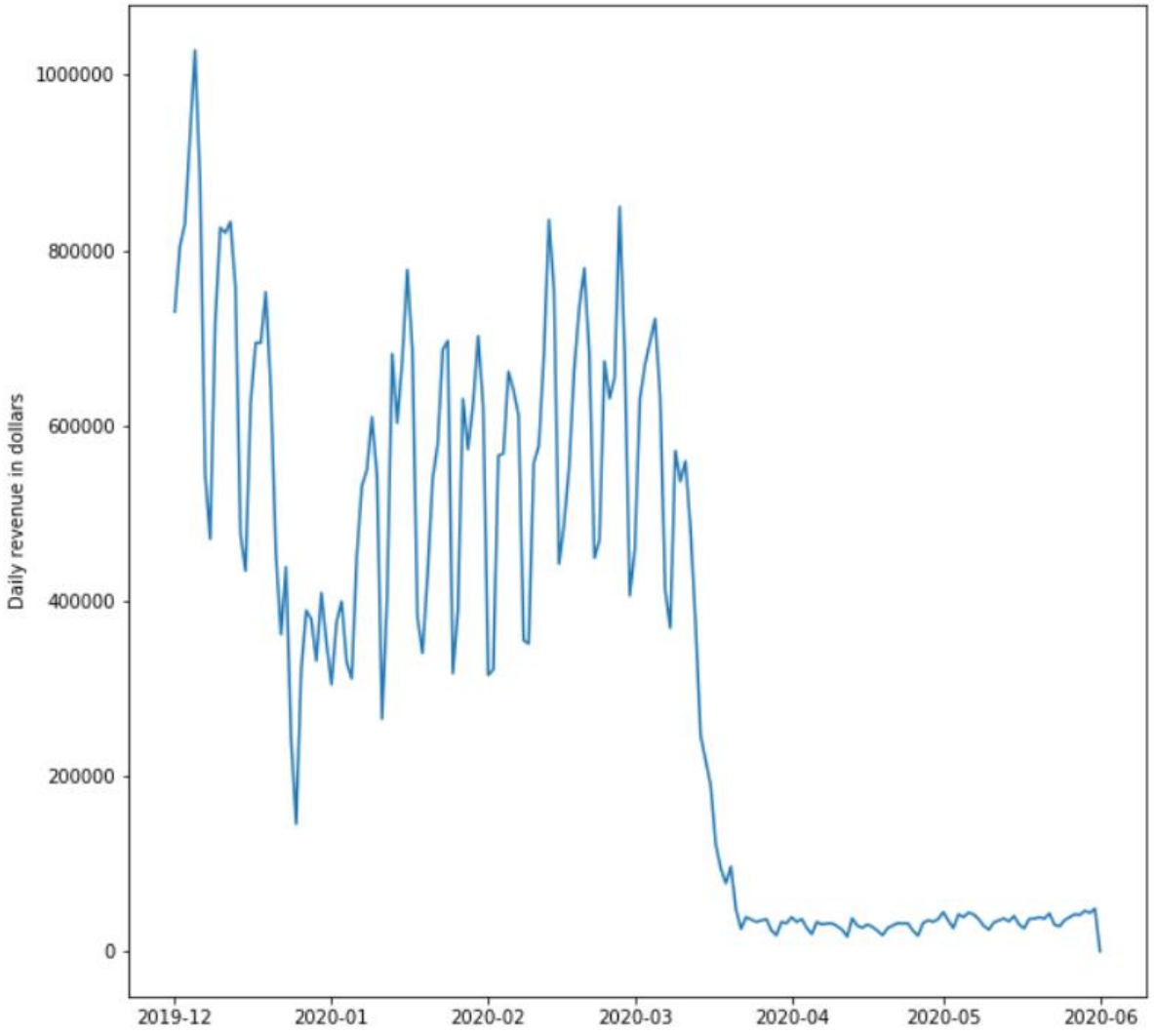
Total daily revenue down by ~95%

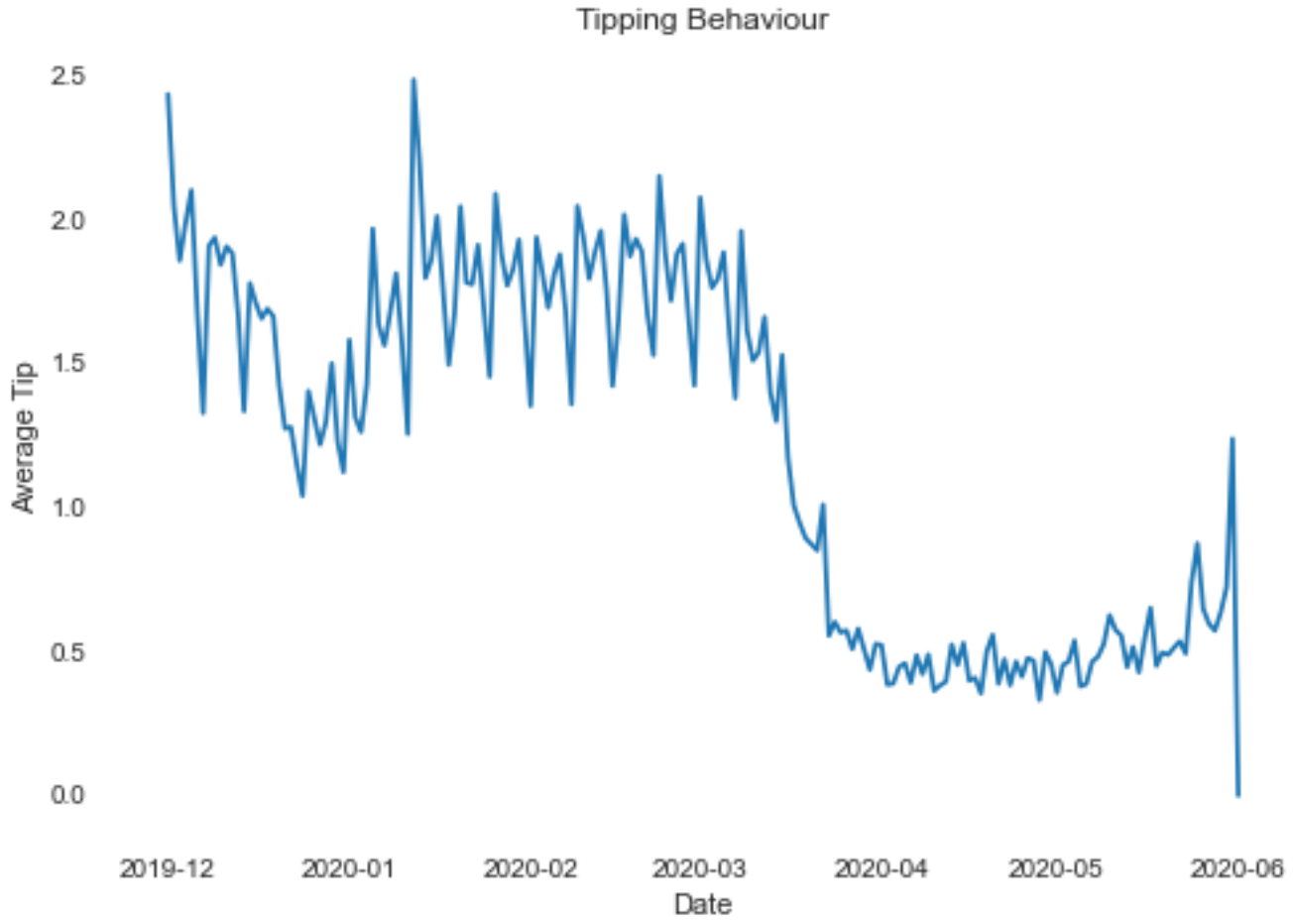


Hypothesis 2

COVID-19 **changed** the behavior of taxi clients

Average **tipping** amount **went down**

Average tip decreased from $2 to $0.5



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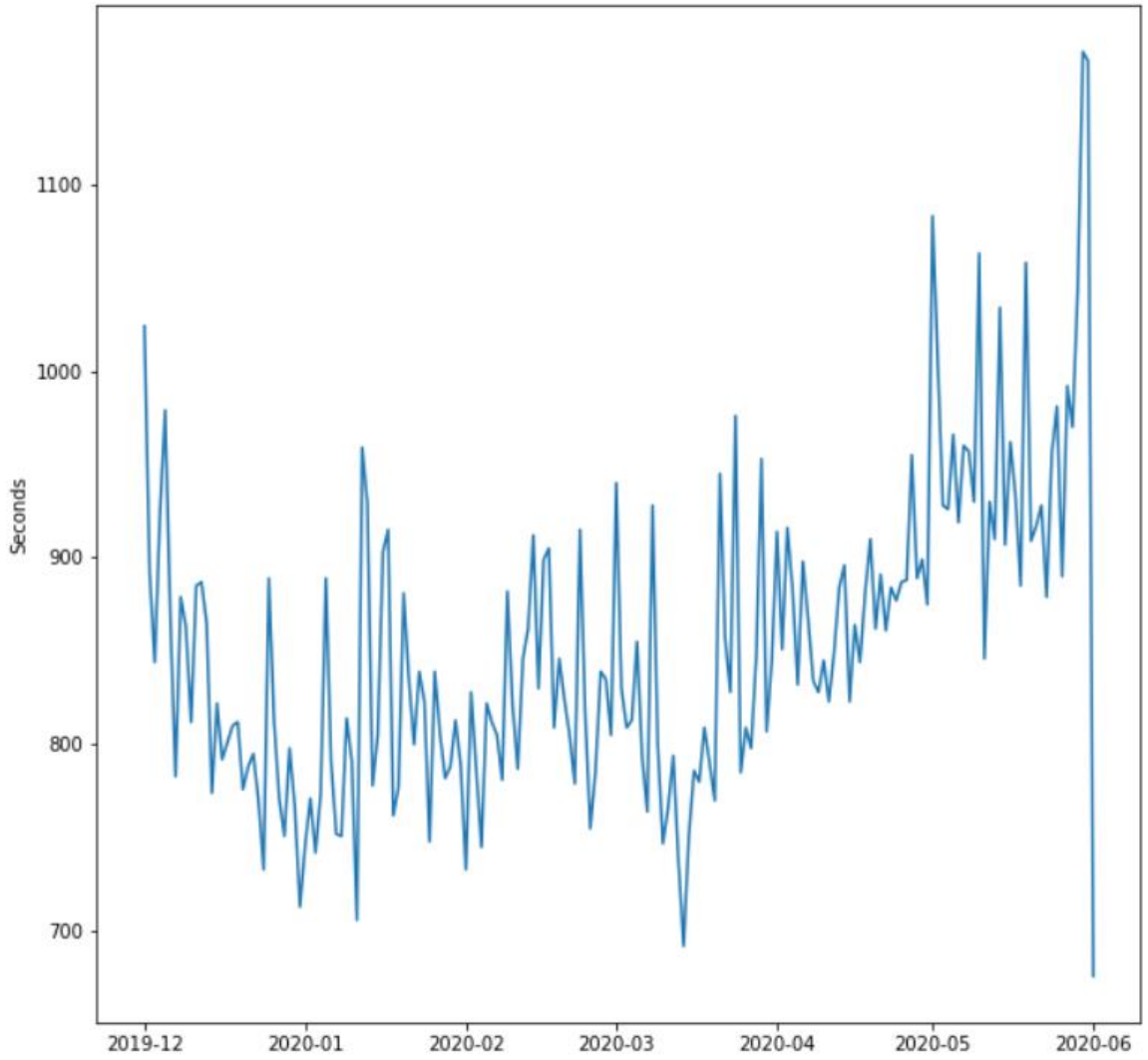
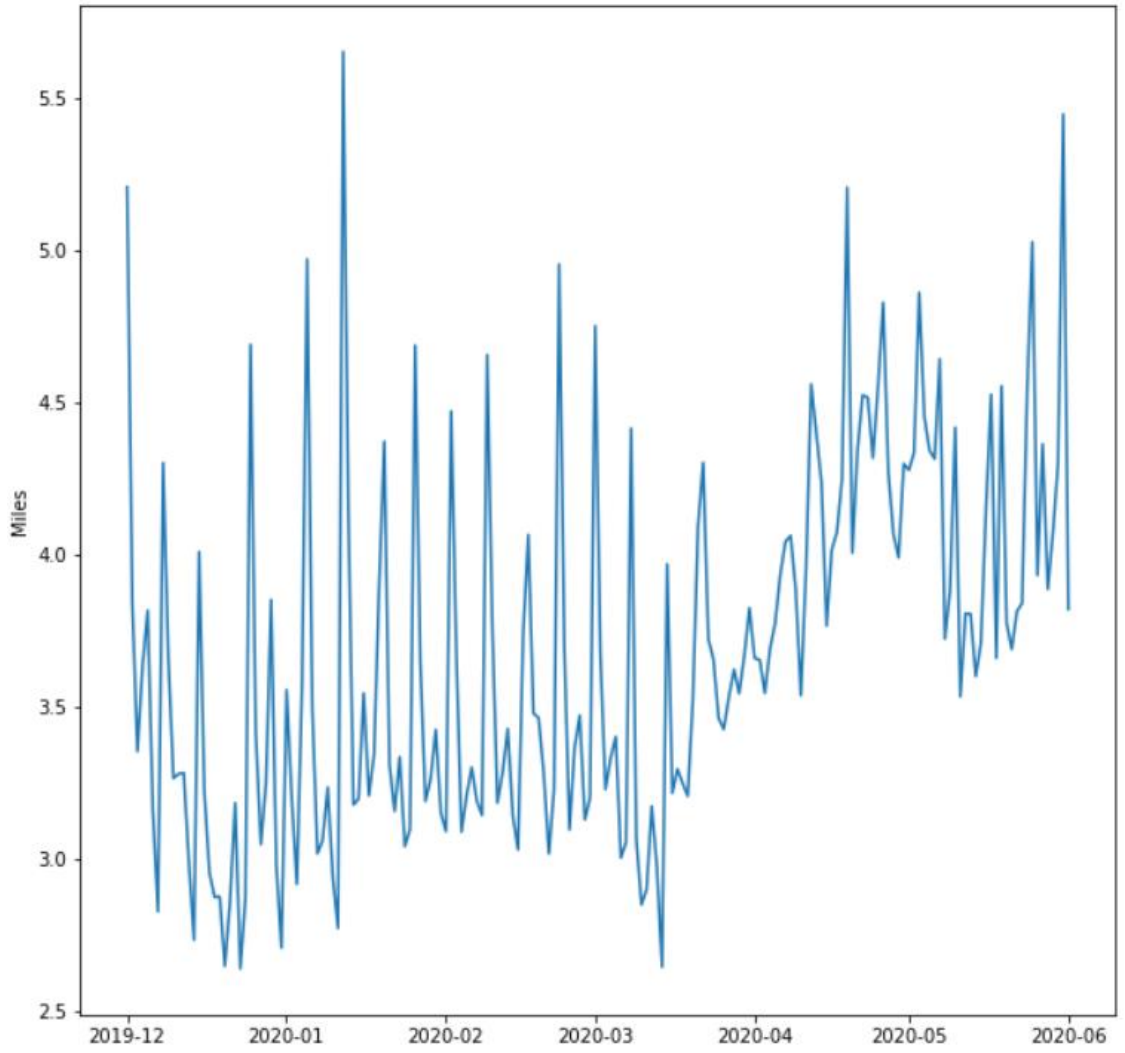
Average duration went up by 100 sec



Average mileage went up by 0.7 mile



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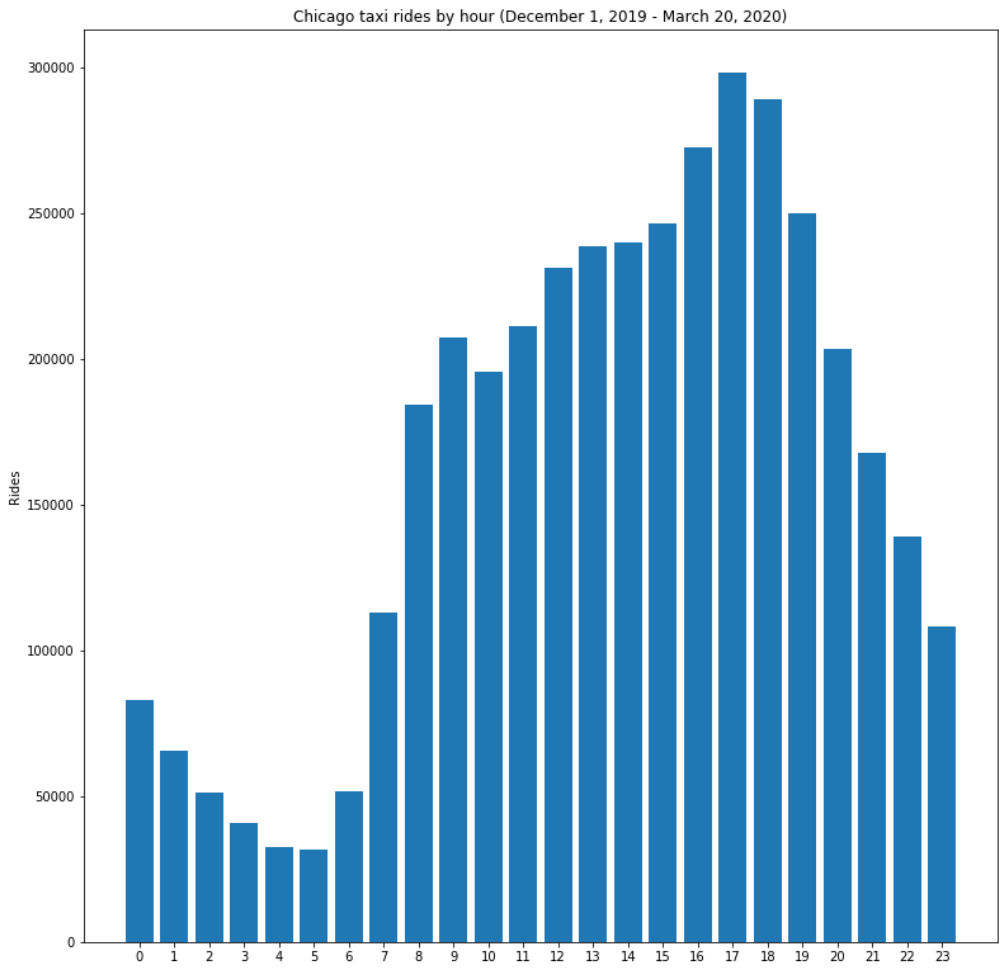
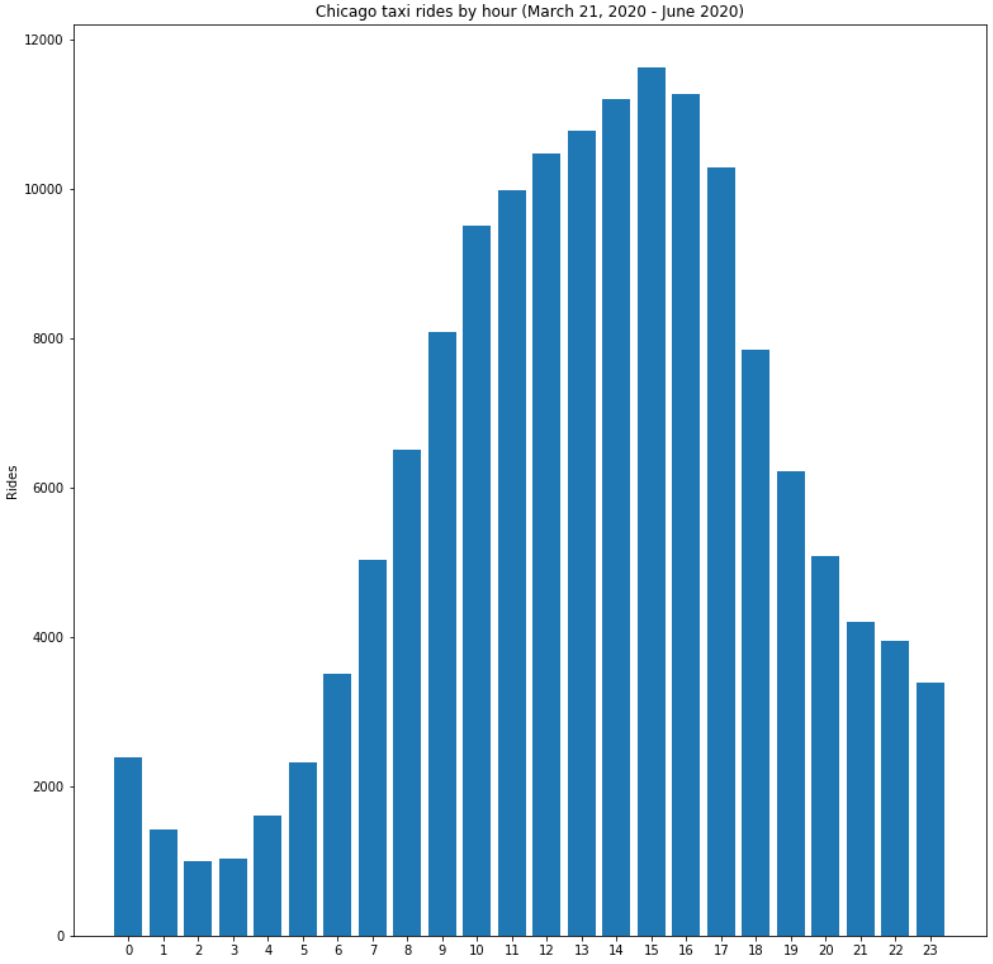
Clients change their hour preferences





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Predicting tips (Logistic regression)

Taxi drivers in Chicago make between $31K and $46K

Tip is essential part of drivers' income (up to 40%)

Tips are frequently paid by cash and are not tracked

Model justification

Classification problem: Tip/No Tip

Boolean Values: 1 for Tips and 0 for No Tips

Solution: Multinomial Logistic Regression

Feature Engineering

Omit NAs (~0.03% of the whole dataset)

Dropped and added certain columns (location as long/lat & time)

Final dataset: 4135918 * 8

Model Engineering

Separate dataset: train (70%) & test (30%)

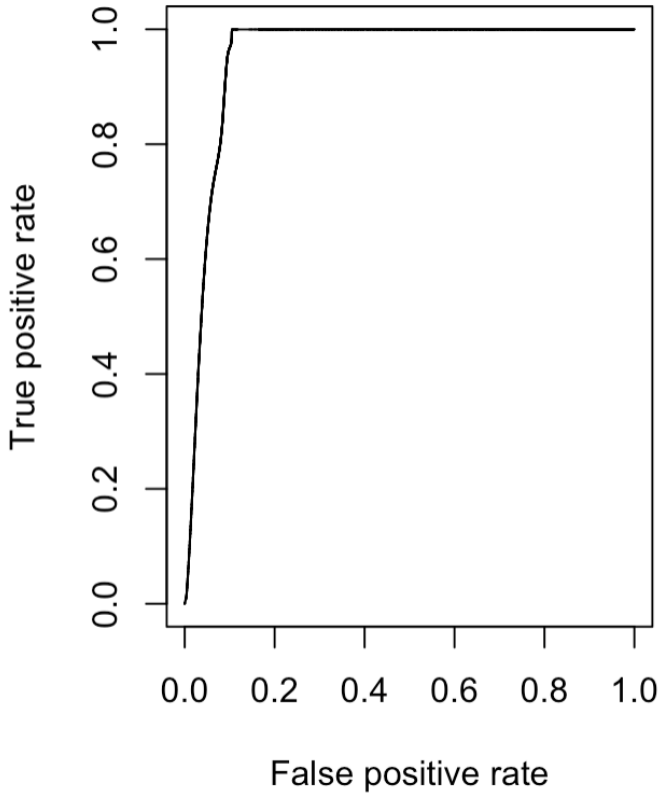
Variables : Seconds, Miles, Tolls, Fare & **Payment Flag (bool)**

Excluded from model: Tolls (based on low AIC values)

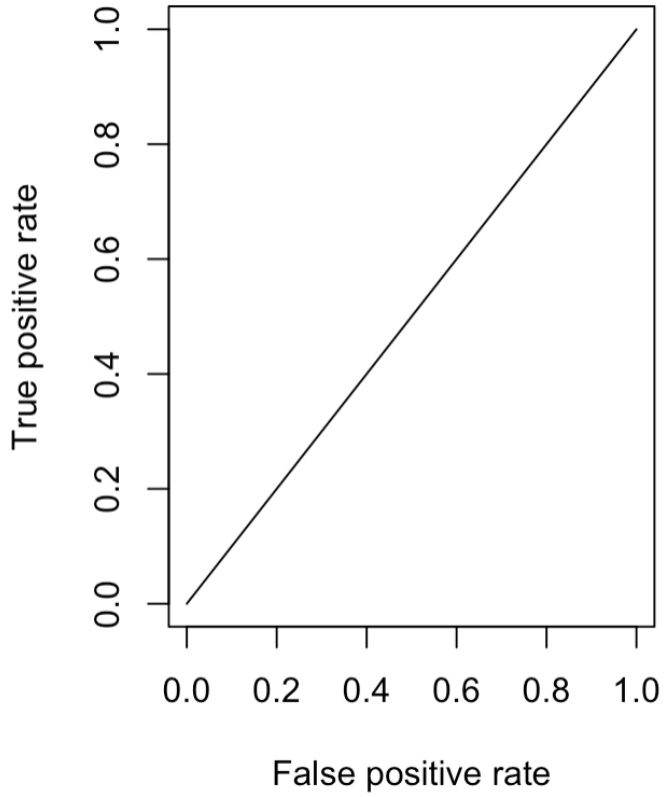
Confusion Matrix

	0	1
FALSE	608369	222
TRUE	72038	560147

Model Validation – Comparing Models



AUC VALUE : 0.9554293



AUC VALUE : 0.5

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Time Series: Ideas and Challenges

Prophet is an open source science tool developed by the Data science team at Facebook for time series forecasting

Uses **Generalized additive models** which can be represented by

$$y(t) = g(t) + s(t) + h(t) + \epsilon$$

Where

$g(t)$= models trend

$s(t)$ = models seasonality

h(t)= models the effects of holidays

ϵ = error term

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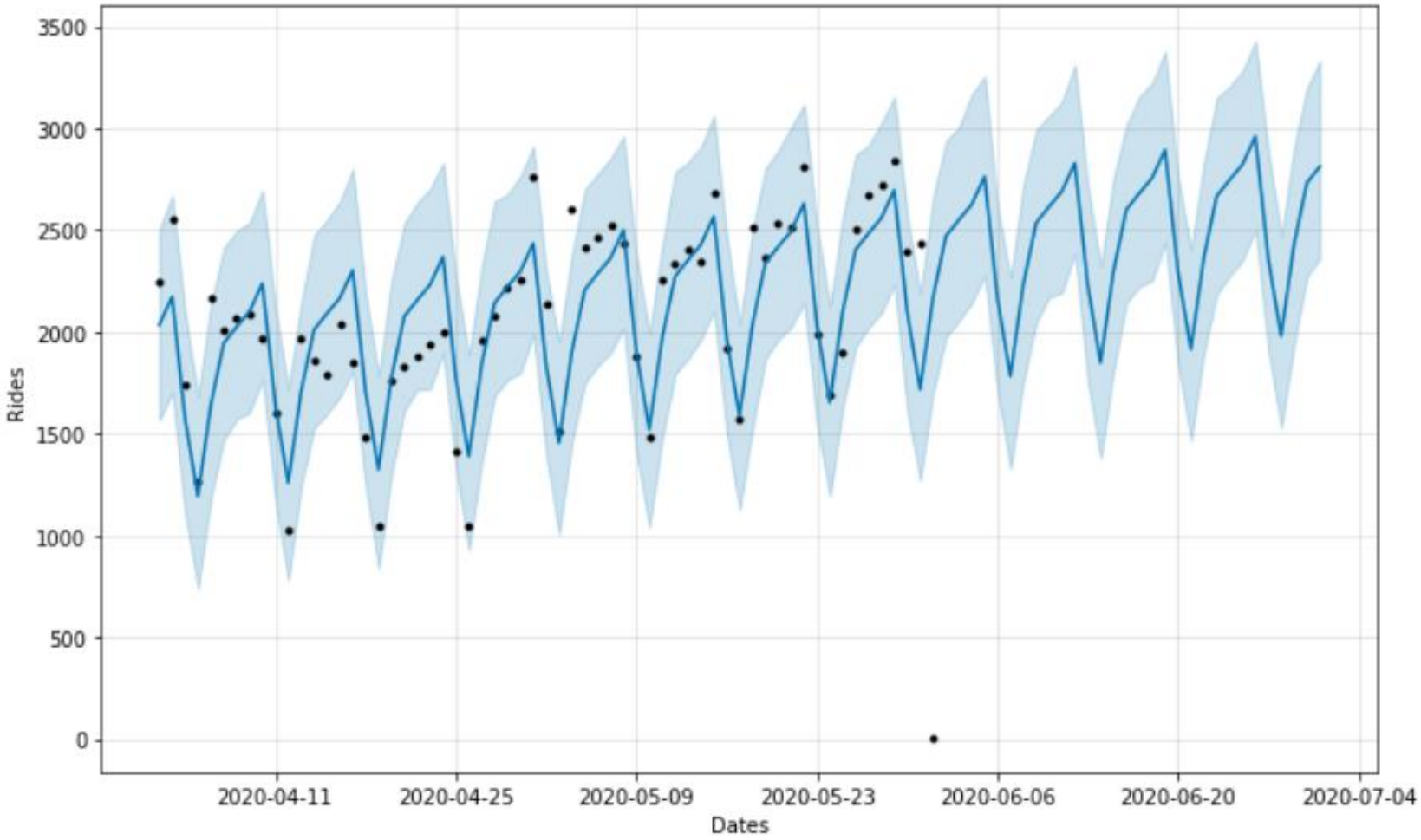
Slow 'New Normal' recovery during COVID



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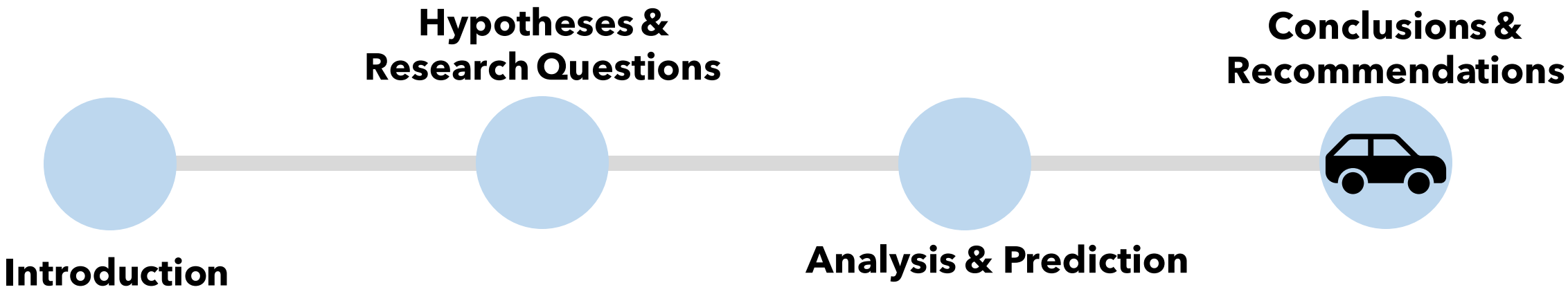

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Summary

- **COVID-19 ruined the financial well-being** of Chicago taxi drivers, their families and taxi companies' operations
- **Industry lost 95%** of its previous traffic and revenues
- **Chicago taxi clients changed their behavioral** during the crisis (mileage, hours, and tipping behavior)
- Under current conditions **the recovery will be slow**

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Policy Recommendations

Chicago authorities should reconsider the tax and fees burden on taxi drivers and companies

Drivers should be reimbursed for purchasing protective equipment

Companies should develop more flexible pricing and operations policies

Banks should offer drivers flexible payment mechanisms for car/other loan payments

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Co-Founder

Spring 2020 Cohort

THE UNIVERSITY OF CHICAGO

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References

- GitHub Repository
  - https://github.com/OleksiyAnokhin/UChicago-COVID-Hackathon
  - **https://github.com/thisisdevanshi/MSCA-Hackathon**
- YouTube Recording
  - www.bit.ly/uchicago-covid-hackathon-video
- Chicago Open Data Portal
  - https://data.cityofchicago.org/Transportation/Taxi-Trips/wrvz-psew

Thank you for your time

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