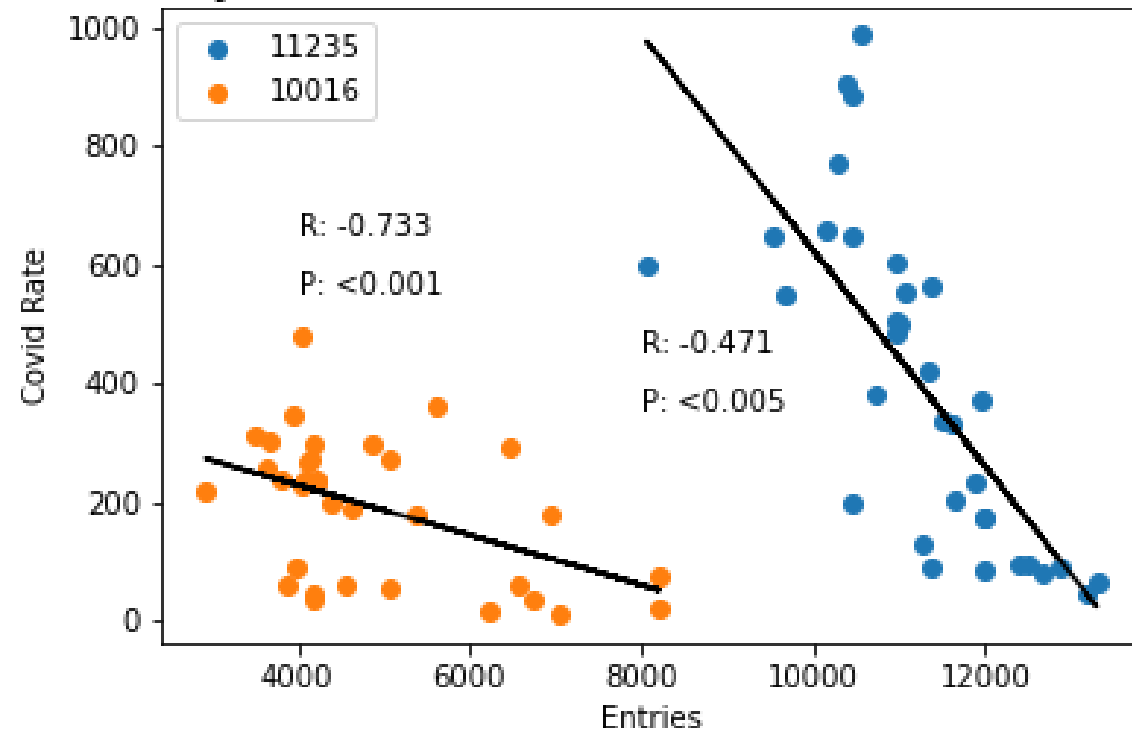# SPATIOTEMPORAL ANALYSIS OF NEW YORK METRO TRANSIT RIDERSHIP AND COVID-19 TRANSMISSION

PETER GATTO

INTRODUCTION

- Motivation: How does subway ridership contribute to Coronavirus epidemiology?

- Objectives: Also consider impact of COVID-19 on MTA ridership

Subway Entries and Covid Caserate Correlations
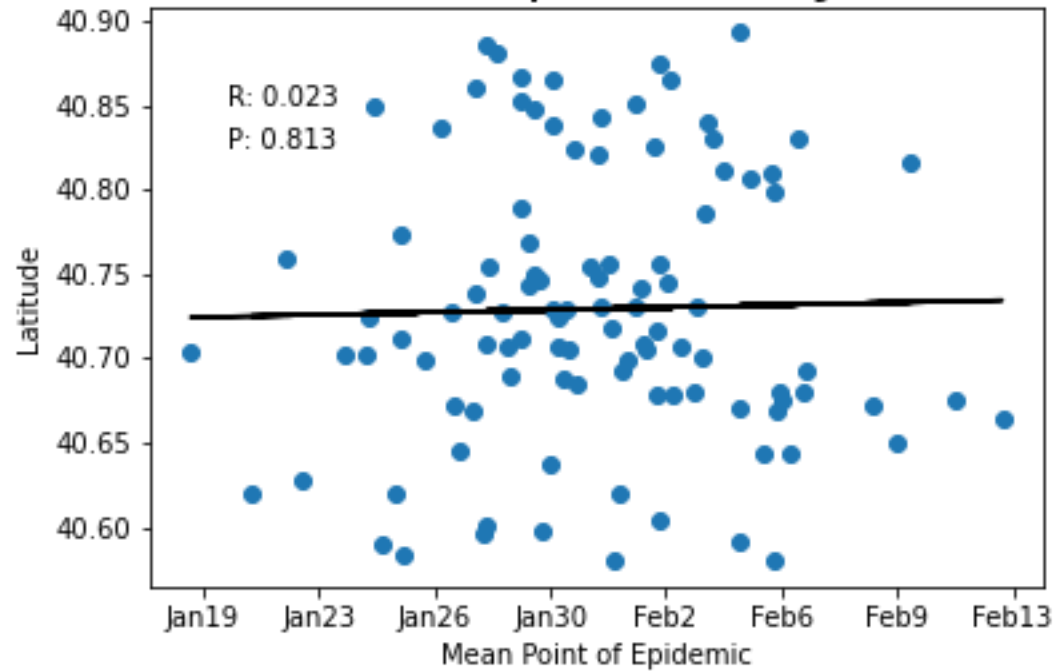
METHODOLOGY

- Sources and sinks
- Cross correlation function:
  - Looks at correlation of two time series, shifted to consider lag
- Mean point of epidemic:
  - Average of time distribution of diagnoses
- Weekly ridership data by zip code to agree with covid data
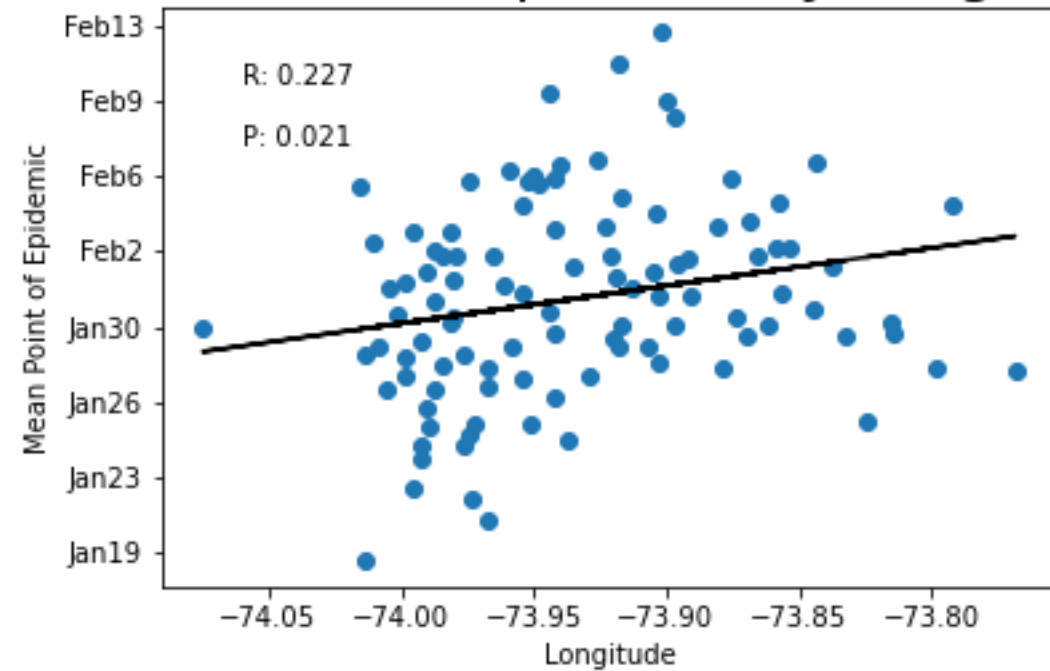
ENTRIES / EXITS DISPARITY AND OUTBREAK TIMING
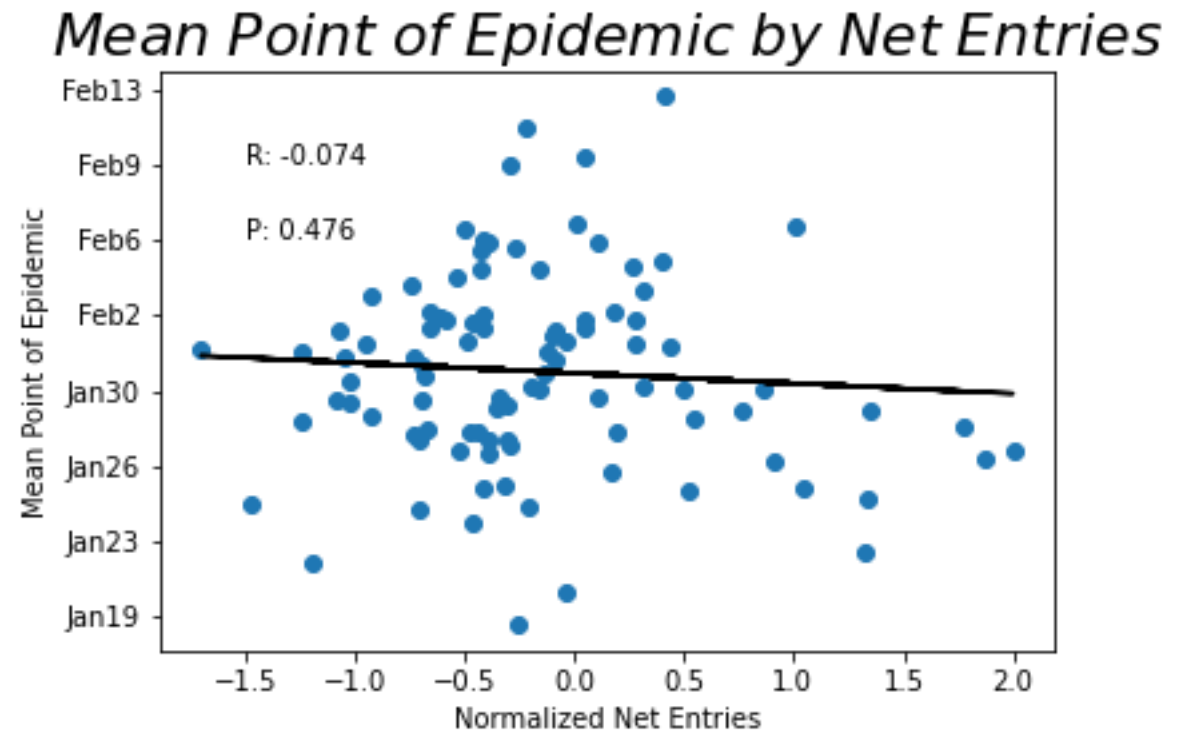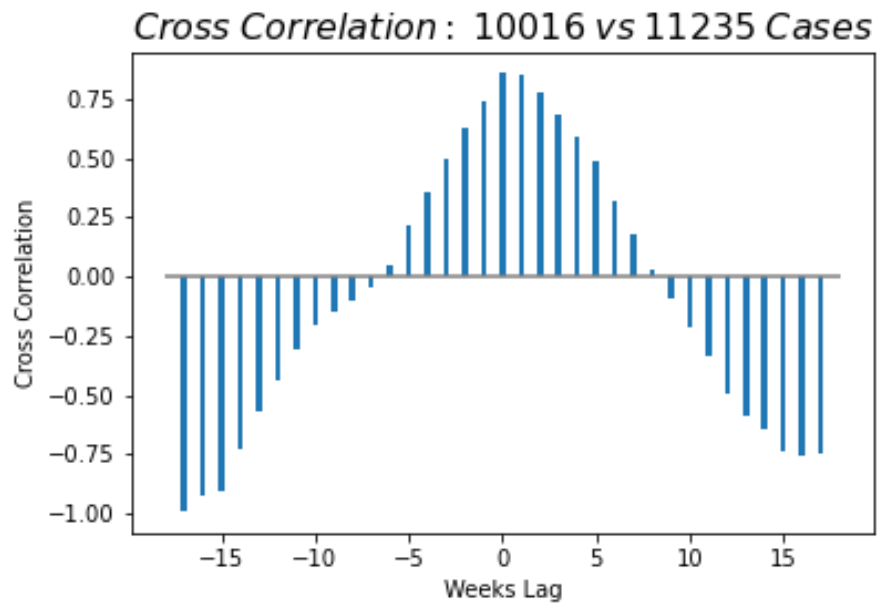
GEOSPATIAL ANALYSIS OF OUTBREAK TIMING

Mean Point of Epidemic by Latitude — R: 0.023, P: 0.813
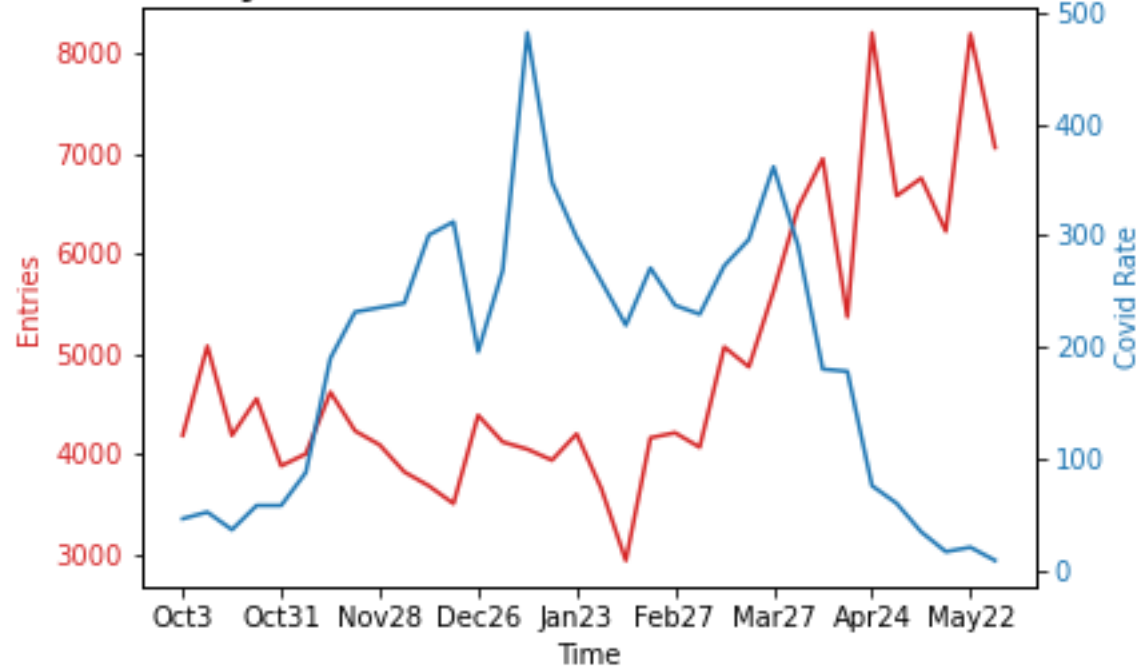Mean Point of Epidemic by Longitude — R: 0.227, P: 0.021
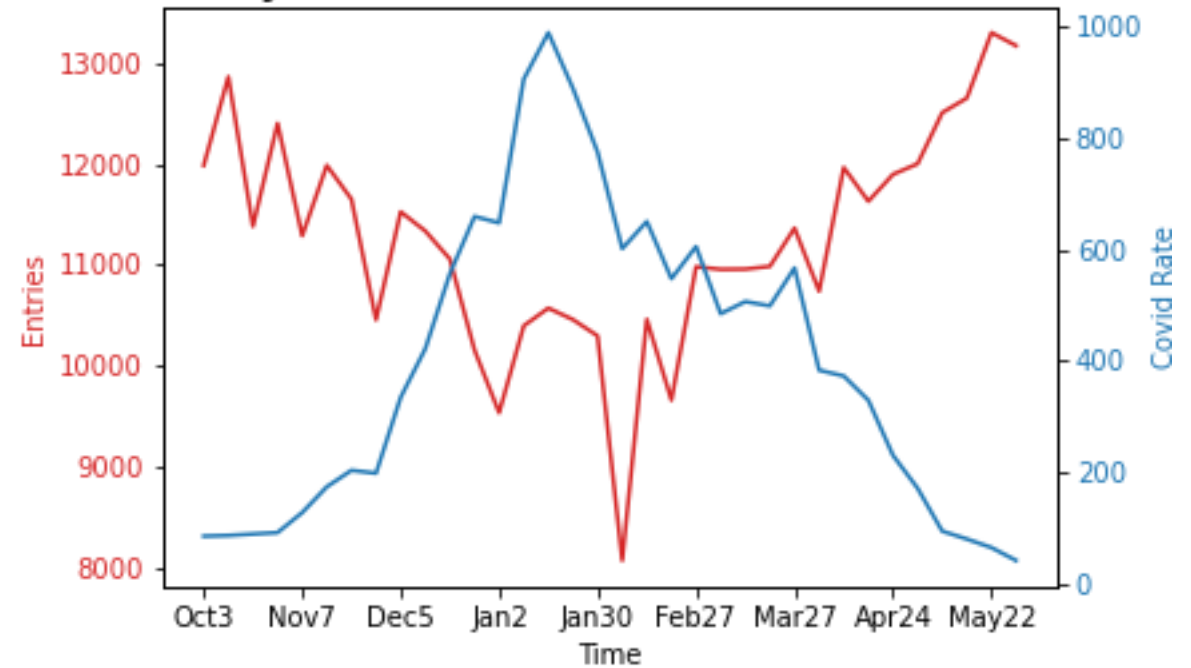
MEAN POINTS OF EPIDEMIC BY BOROUGH
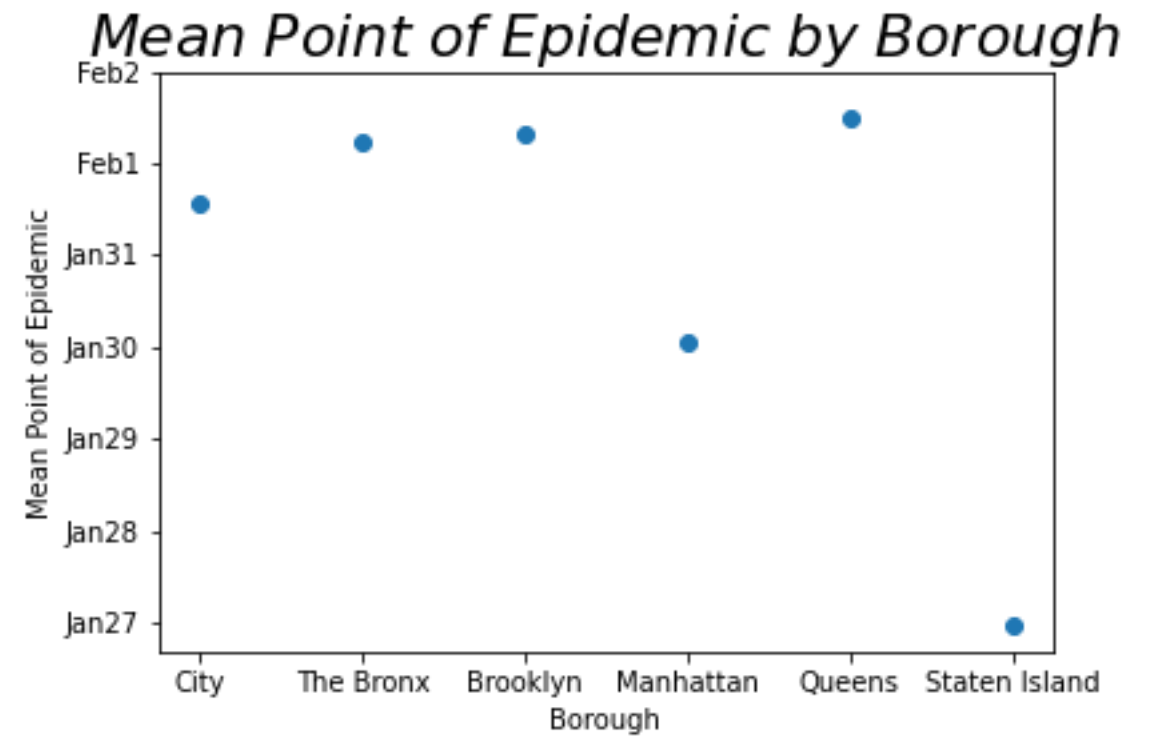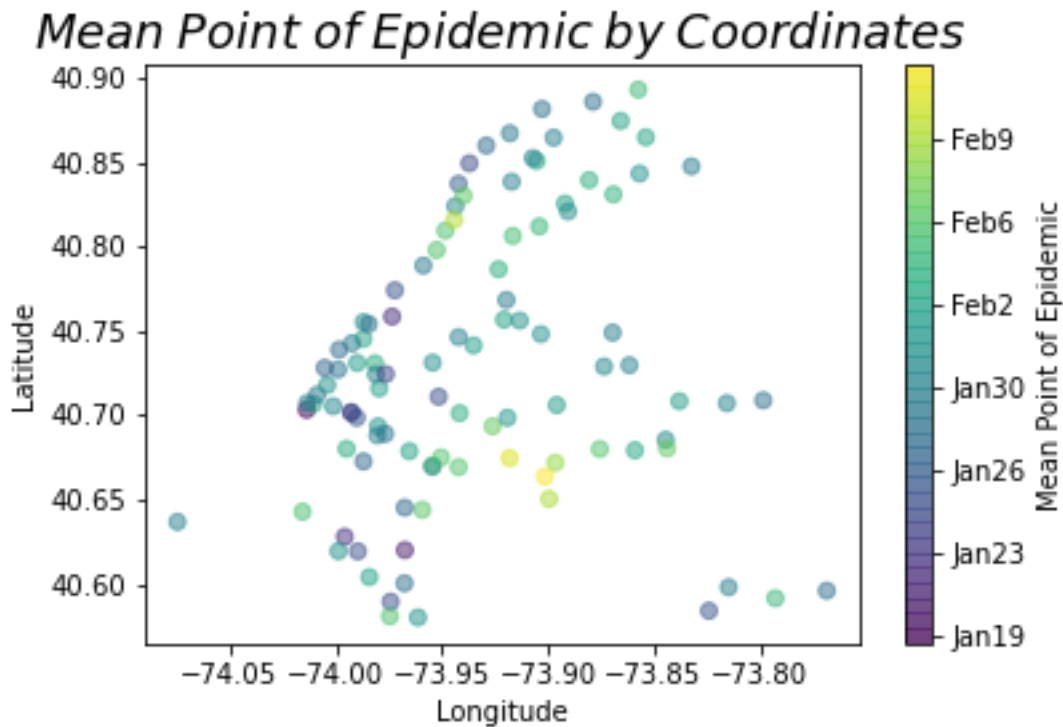
MTA TURNSTILE AND COVID TIME SERIES

Subway Entries and Covid Caserate 10016

Subway Entries and Covid Caserate 11235

CONCLUSION

- Large variance in timing of covid outbreaks across New York City

- Outbreaks spread from Manhattan to outer boroughs

- Subway ridership negatively correlated with coronavirus prevalence

APPENDIX: DATA

- Turnstile data from:

- http://web.mta.info/developers/turnstile.html

- Coronavirus cases by zip data from NYC Department of Health:

- https://github.com/nychealth/coronavirus-data/trends/caserate-by-modzcta.csv

- Subway station/zip code mapping from Metis alumni:

- https://github.com/galenballew/Metis-Submissions/projects/01 Benson/data/processed/zips.csv

APPENDIX: NET ENTRIES CALCULATION

- Net entries calculation from cumulative Entries and Exits:

- Average = [(Entries$_f$ – Entries$_i$) + (Exits$_f$ – Exits$_i$)]/ 2

- Percent Difference = [(Entries$_f$ – Entries$_i$) - (Exits$_f$ – Exits$_i$)]/ Average

APPENDIX: EXAMPLE ZIP CODE SELECTION

ZIP	ENTRIES	EXITS	AVERAGE	NET_ENTRIES	%DIFFERENCE
10533	22606	336045	179325.5	-313439	-1.747877
11235	55538	684949	370243.5	-629411	-1.699992
10033	74525	484520	279522.5	-409995	-1.466769
10012	406700	1742849	1074774.5	-1336149	-1.243190
10013	350896	1484064	917480.0	-1133168	-1.235087
...	...	...	...	...	...
11223	128311	25391	76851.0	102920	1.339215
11414	108703	20953	64828.0	87750	1.353582
10463	296711	17588	157149.5	279123	1.776162
10016	170727	5649	88188.0	165078	1.871887
10301	27591	5	13798.0	27586	1.999275