The Impact of Covid-19 on Travel

Data Science Major Capstone
Marisa Papagelis | Wellesley College

Motivation

I found it both relevant and of interest to look into the potential effects Covid-19 had on travel trends, and how these trends differ based on sociodemographic factors.

Research Question

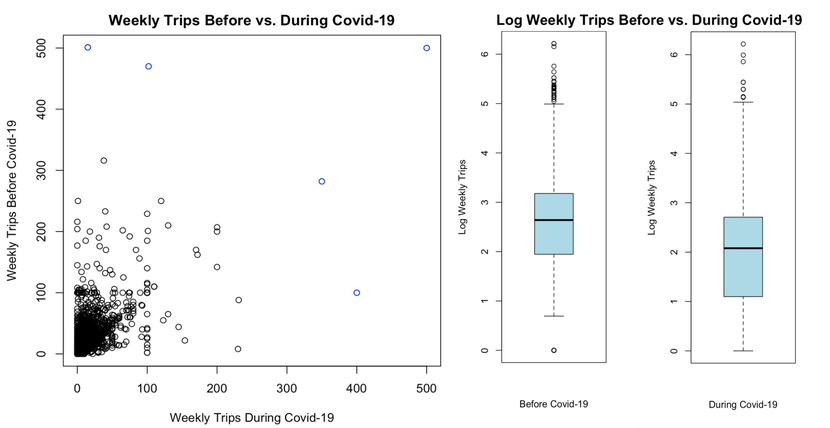
How has Covid-19 impacted weekly travel trends within Chicago, Washington DC, Dallas, and Seattle?

Data

The data was collected by researchers at MIT Sloan as a survey sent to 4000 randomly selected participants in 4 major U.S. cities. The survey was sent out twice, once before and once during Covid-19 to the same cohort of participants. For the purposes of this capstone, the participants in the four cities were aggregated because the travel trends did not appear to vary between cities. The question of interest in the survey was:

In the past week, how many trips did you make using each of the following transportation modes?

Of 3993 respondents*, 2593 (64.9%) traveled *less*, 884 (22.1%) traveled *the same*, and 488 (12.2%) traveled *more* during Covid-19 than they had before.



*Of the 4000 participants, seven did not answer both instances of the question of interest, and they were removed from the dataset for the entire research analysis.

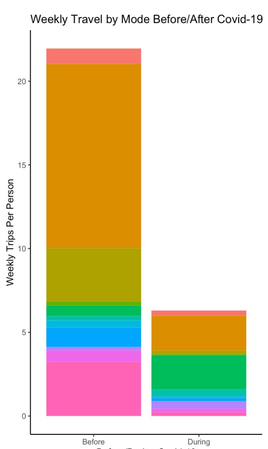
Average Weekly Change in Trips by Mode

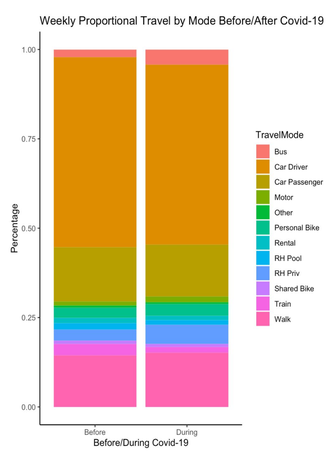
Mode	*Avg. Before*	*Avg. During*	*% Change*
Car Passenger	3.178	0.21	-0.934
Walk	3.219	0.223	-0.931
RH Private	1.17	0.167	-0.857
Car Driver	11.008	2.09	-0.810
Motor	0.238	0.059	-0.751
RH Pool	0.406	0.11	-0.730
Train	0.708	0.217	-0.694
Bus	0.926	0.296	-0.681
Rental Car	0.274	0.419	+0.528
Shared Bike	0.202	0.451	+1.230
Personal Bike	0.62	2.053	+2.31

% Change = (During - Before) / Before
**missing data were removed prior to calculations*

While overall transportation usage did decline, the three modes of transportation that increased were Rental Cars, Shared Bike, and Personal Bike. Travel is understood as a "derived demand" meaning it stems from the activities at the destination rather than the travel itself.

So, even though overall transport declined, people did not appear to be switching modes of transport, but those who could appeared to be dropping their preferred method of travel completely.





Model Selection

Which sociodemographic factors contribute to predicting the change in # of trips before/during Covid-19?

Response Variable: The difference in number of trips during - before Covid-19 for each individual

Predictor Variables of Interest: 30 sociodemographic predictors including age, race, education, city, etc.

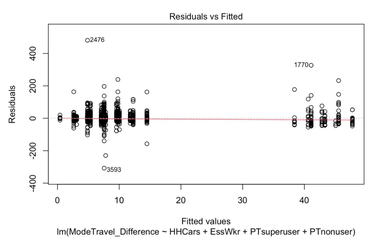
Stepwise Regression, AIC/BIC Criterion.

The five outliers seen in blue in the leftmost plot were kept in the dataset as linear regressions are robust to outliers.

Model Diagnostics

The BIC model was chosen due to its smaller CV score, and thus a better predictive performance. The BIC model satisfies the constant variance and normality assumptions.

Measure	*AIC*	*BIC*
# of predictors	11	4
5-fold CV score	117.7	105.6



Final Model

$$\widehat{ModeTravel\_Difference} = 7.79 - 2.32\,Number\ of\ Household\ Cars - 3.03\,Essential\ Worker\ Status\ (Yes/No) + 26.54\,Public\ Transportation\ Superuser\ (>10\ weekly\ trips) - 4.94\,Public\ Transportation\ Nonuser\ (0\ weekly\ trips)$$

Conclusion

Covid-19 decreased aggregate weekly travel trends. However, when looking at the *proportion of trips* by travel mode, individuals did not appear to be switching modes of transport due to Covid-19, as expected. Automatic model selection showed that number of household cars, employment status, and public transportation usage were key predictors in determining change in weekly travel on an individual level.