

Milestone 6.5

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Abstract

Fuller (2019) claimed that the disruption in public transit services caused by Philadelphia's transit workers strike from November 1-7th led to short term increase in bikeshare use in Philadelphia when controlling for temperature, precipitation, and bikeshare use in similar cities during the same time. In this replication I recreated the interrupted time-series model that the authors used to model this natural experiment. I used the same raw data to create a linear model to explain bikeshare use per 100,000 population for Philadelphia, Boston, Washington DC, and Chicago. The model shows that while the disruption to normal transit availability caused short term increase in bikehsare usage, long term habits were not changed and usage returned to baseline within a short period. This may inform policy makers that in order to shift long term habits of the population long term incentives are likely required.

Introduction

My replication paper is **Impact of a public transit strike on public bicycle share use: An interrupted time series natural experiment study** by Fuller et al. (2019). This paper was published in the June 2019 volume of the Journal of Transport & Health. The data was publicly available to me on Harvard Dataverse Fuller (2018). The authors use Philadelphia's transit workers strike from November 1-7th, 2016, to generate a natural experiment in which other means of transit are interrupted to study the impact on bikeshare ride usage.

The statistical technique used is a Bayesian structural time-series model. The authors cited a separate paper detailing this modeling method and its efficacy Brodersen et al. (2015). That paper found the Bayesian structural time-series model to be useful in inferring causal impact, so assuming the authors applied the technique correctly it seems to be an accepted method. The authors looked at control cities in Washington DC, Boston, and Chicago which are similar to Philadelphia in their size and in the development of their bikeshare infrastructure. They also attempted to control for the temperature and precipitation levels as variables that would also affect bikeshare ride usage. The study found that bikeshare usage went up in Philadelphia during this transit strike when other options were limited, but that after the strike bikeshare usage returned to the pre-strike baseline. The authors concluded that while interventions directed to incentive bikeshare usage would likely work given the flexibility shown by Philadelphia commuters, these interventions would need to be long term in order to change commuter's habits.

I was able to completely replicate the interrupted time-series model that the authors of my paper used. The original authors used a flawed dataset and very difficult to read code. I rewrote all of the code myself and cleaned the data in a different way but still created the same model. I replicated both of the figures that were published in my paper. I added titles and captions for context but otherwise made one to one replications where possible. The original authors added some labels and elements of the legend outside of R that I could not replicate exactly. I did not replicate the Bayesian structural time-series model using the CausalImpact R package due to time constraints, and the fact that the authors concluded that this model yielded no different analysis than the time-series model did. All analysis for this paper is available on my Github¹.

Apparently we aren't supposed to bring in new data according to the email which Alice just sent out. I will have to think of a new idea for an extension. My proposed extension is to look at bikeshare data from March to see how Covid-19 has impacted bikeshare use. I think that this would serve as another interesting natural experiment different from the transit workers strike examined in the original paper. My hypothesis would be that early in the crisis more people might have used bikeshare to avoid crowded public transit, but later in the crisis as people begin to work from home, we would expect bikeshare usage to drop significantly. I would need to find the source of the bikeshare data that the authors used, but they said that it was publicly available in their paper. It may be that the data is not released quickly enough to look at such a recent phenomenon, in which case I would need to find a different extension. I would use the same time-series model and control for weather data like the original authors did, but Covid-19 has impacted all cities, so we would not be able to control with other cities.

Literature Review

Given that bikeshare schemes are a relatively new phenomenon, there aren't a huge number of papers looking into their effects, but all papers on the topic are relatively recent such as Bauman et al. (2017). Fuller et al. produced another paper in 2012 using similar methods to investigate a transit strike in London and the resulting effect on bikeshare use in that case Fuller et al. (2012). That 2012 paper found an increase use of bikeshare programs during the strike, with similar conclusions to my replication paper.

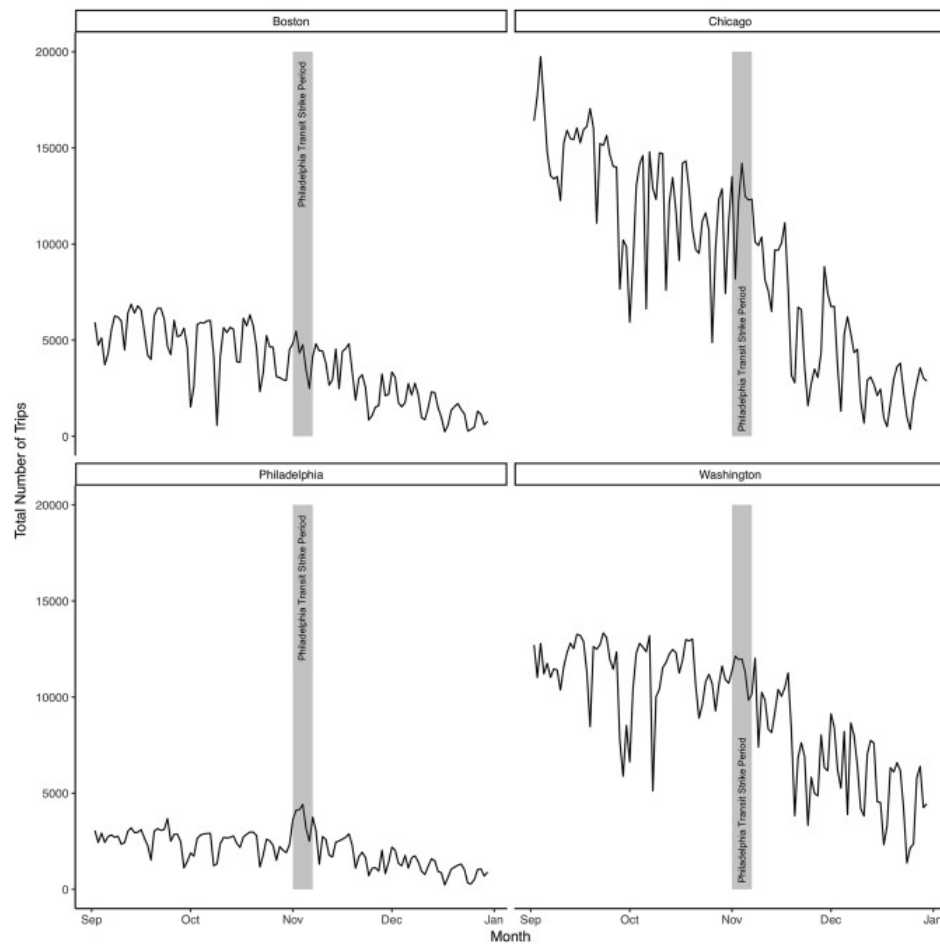
¹<https://github.com/ddeuel/1006-project>

References:

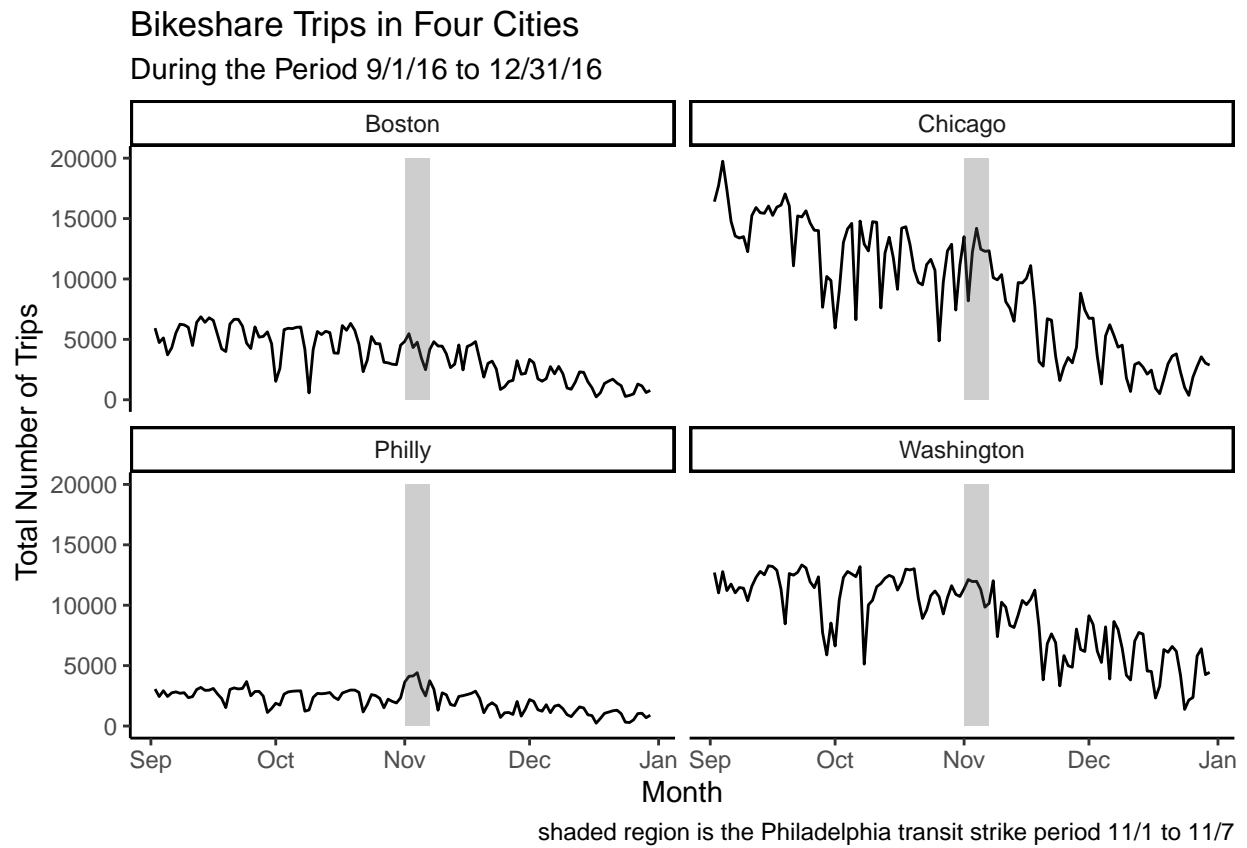
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Appendix:

Figure 1 from paper:



My Replication:



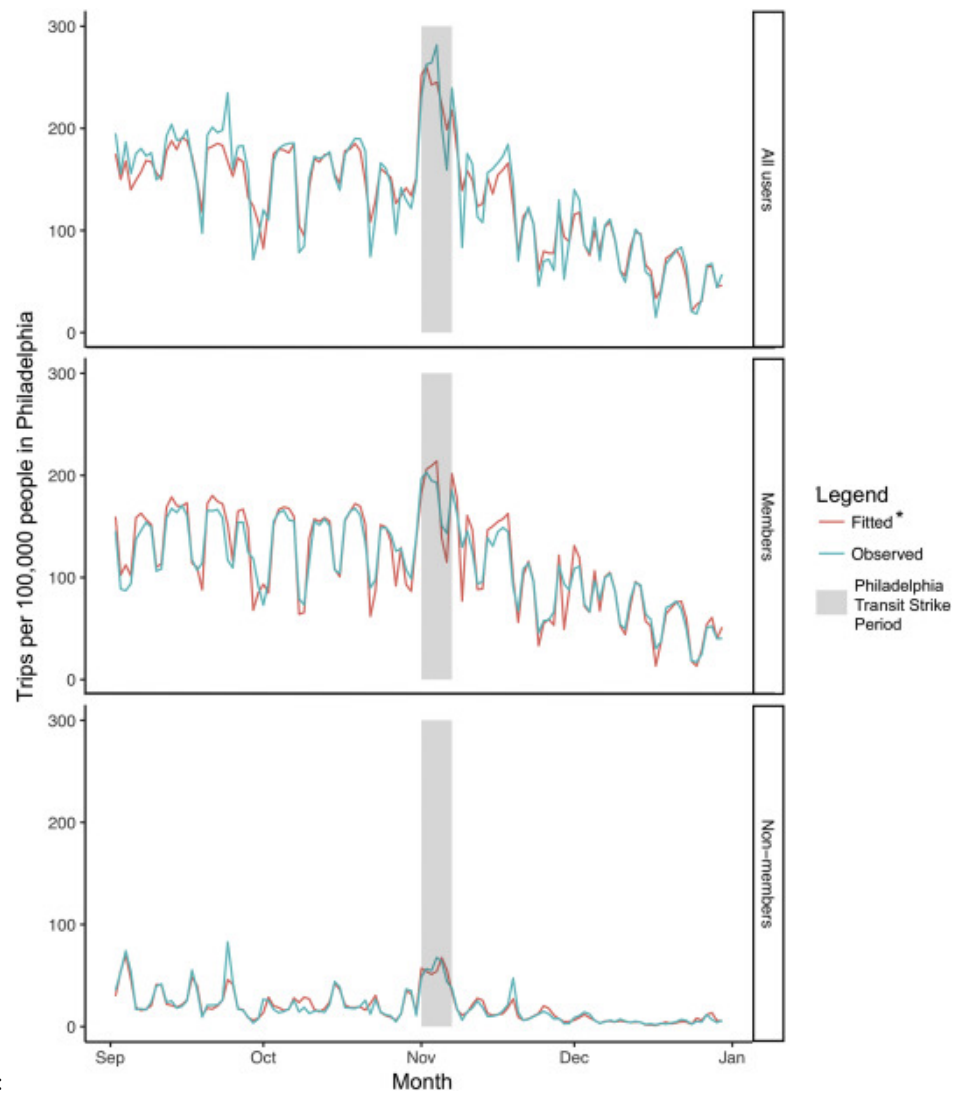


Figure 2 from paper:

My replication:

