

How do climatic conditions impact people's use of Citibikes?

Redouane Dziri

Surely people's use of Citibikes is greatly dependent on weather conditions: there will probably be a lot less trips on rainy days than on dry days, the more snow on the ground the less likely people are to rent a bike. Those are hypotheses that we want to test through exploration of the data collected from the Central Park weather station and Citibike's data.

We will first explore how the number of trips varies with the precipitation level. The data used here is the number of trips and precipitation level in inches from October 2014 (included) until October 2018 (not included).

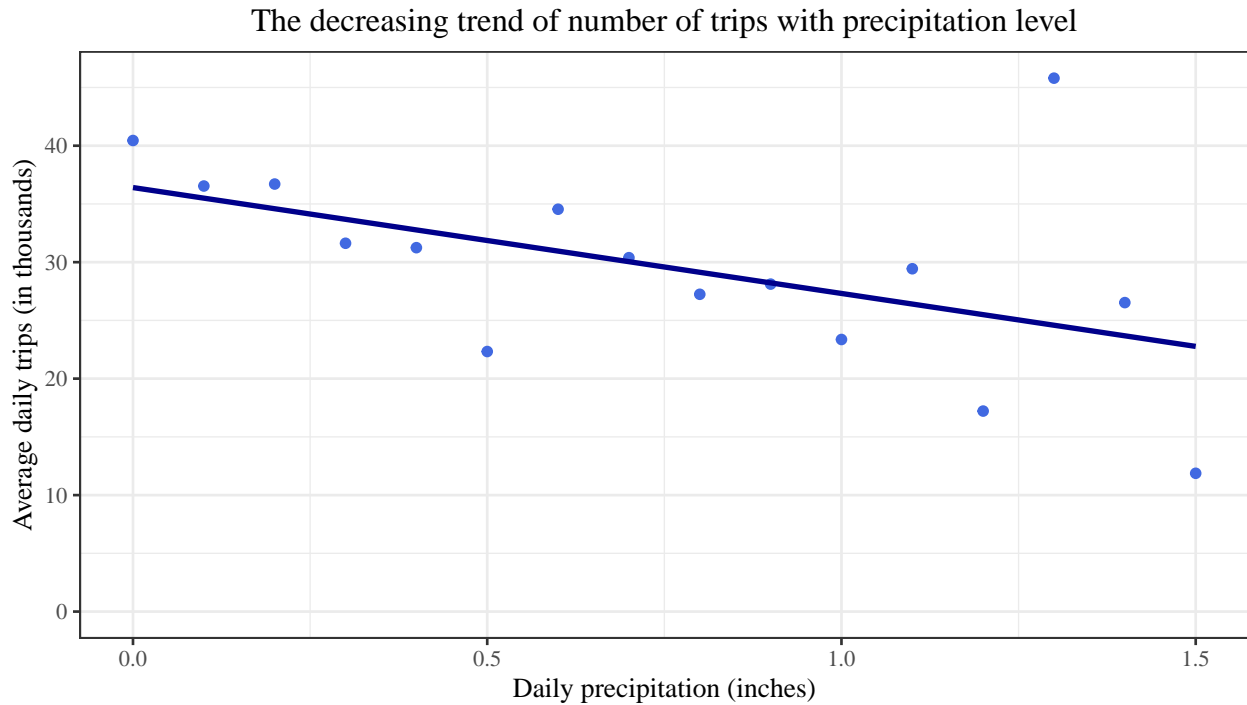


Fig 1. The average daily number of trips against the precipitation level (bucketed with a binwidth of 0.1 inch)

On top of the aggregated data points, we plotted a linear smoother that visually highlights the decreasing trend in the average number of daily trips against precipitation. There is a linear-like behavioral trend but this should be interpreted as a ground-truth uncovered in the data. The higher the value of daily precipitation, the less data was available for gathering (there are few number of days with high levels of precipitation in New York past a certain threshold, at least during the past 5 years). The attempt at modelling represented by the straight line fails to capture this weakness in the data - which also explains the outlier around 1.3 inches of daily precipitation.

Nevertheless, we can interpret this plot as telling us that the average number of daily trips decreases with precipitation, in approximation linearly. One could expect the decrease to be quite sudden as daily precipitation slowly increases from 0 and then the trend to be less obvious, or less abrupt. After all, the difference between no rain and rain, and rain at 0.7 inches and rain at 0.8 inches is not the same for the human experience of biking. The former is much more informative and can act as a powerful deterrent for

bike use while the latter is harder to evaluate and is less likely to have a big impact on a person's decision to rent a bike.

The plot suggests that some people either aren't phased by rain very much or that renting Citi Bikes is a necessity for some users - either for timing reasons or unavailability of transport alternatives for their routes. Therefore, we expect that the effect of rain might be stronger during the weekends, during which people generally rent bikes for fun, versus morning and evening rush hours during weekdays when people have to leave home to work and vice-versa within a restricted timeframe.

We will proceed to test this hypothesis in the following, for the months of February, July and October 2018 for which we have data on every trip - including the exact timing within the day.

Does the number of trips decrease similarly during morning rush hour and across the weekend with precipitation?

We plotted the average number of trips against precipitation, distinguishing between the two groups.

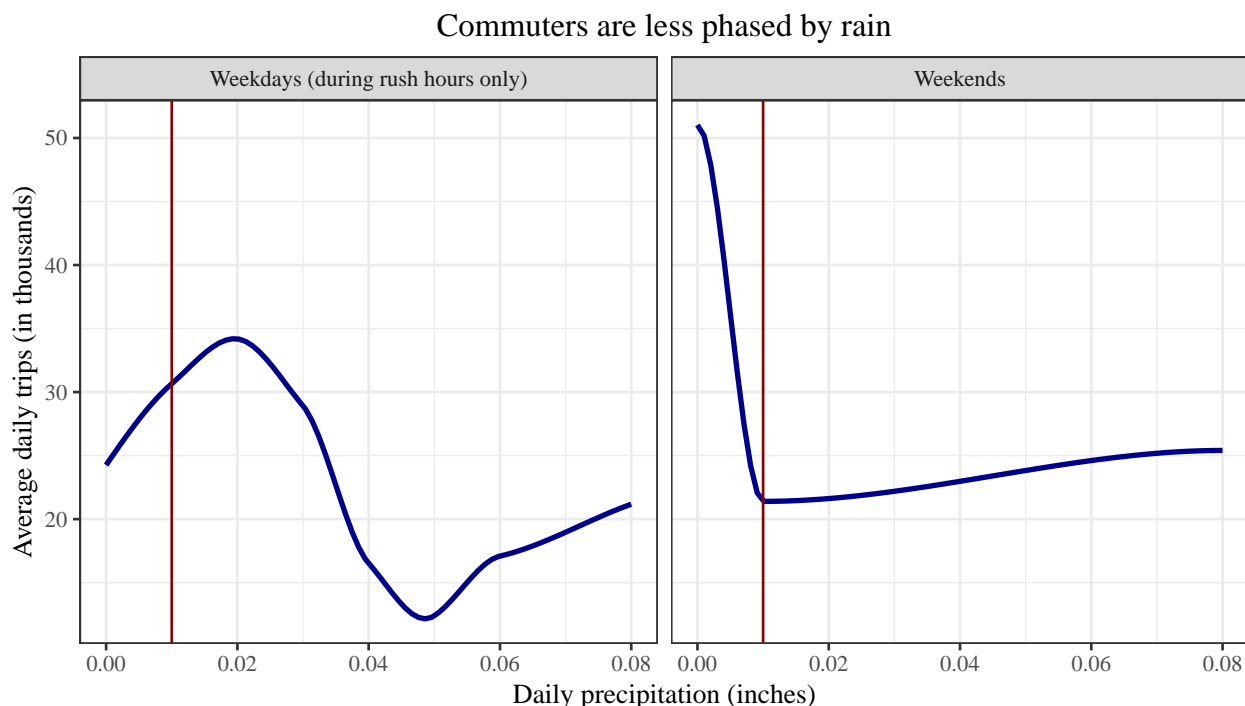


Fig 2. The average daily number of trips against the precipitation level faceted on day of the week (distinguishing weekdays and weekends). The red vertical lines are drawn for inch = 0.01, to highlight behaviour of riders from no rain (inch = 0) to a drizzle - which some might see as a sign of more rain to come.

We see that the first signs of rain have much more of an impact on bikers during the weekend than it does on commuters. Commuters that have to get from point A to point B are probably expecting to spend less time on their bikes than bikers for fun on the weekends. The first drizzle does not discourage most of them, which is reflected by a non-decreasing trend as daily precipitation slowly increases from 0 - even increasing !

On the other hand, tourists and bikers for fun on the weekends probably expect to spend a lot of time biking and enjoying their ride. The first signs of rain are seen as bad omens for the weather to come and the number of daily trips on those days quickly decreases as daily precipitation increases from 0 to 0.01 inches. It increases after 0.01 inches but there are very few data points with high precipitation on weekends in our data so we should not blindly accept this smoother model as an accurate representation for reality for those values of daily precipitation.

Commuters are rapidly discouraged by the rain starting at 0.02 inches until 0.05 inches. There aren't too many days with more precipitation in our data so the following increasing slope could very well just be an artefact of overfitting the little data available.

Are visitors sensitive to temperature? How does temperature impact 24 hour passes sales?

After examining the effect of precipitation on the number of trips by Citibike users we will turn to the effect of another climatic feature which we believe might have a significant impact on riding patterns: temperature. We will focus on whether temperature affects the number of 24-hour passes bought each day. Those are mostly purchased by tourists and therefore, we expect our exploration to help us gain new understanding of how New York City visitors use the ride share network.

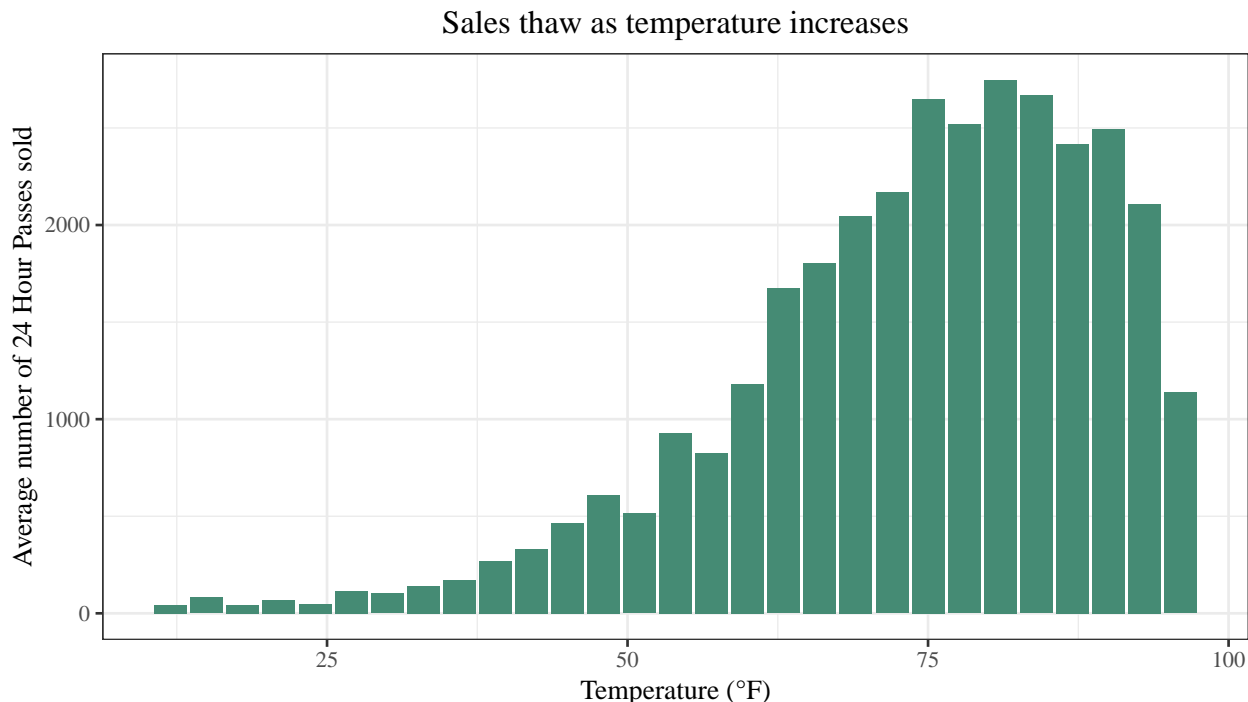


Fig 2. The average number of 24 Hour Passes sold by buckets of temperature (of size 3 degrees Fahrenheit)

We see that as temperature increase from 12 degrees to around 80 degrees, average sales of 24 hour passes increase (first slowly, and then more rapidly). We expected low sales for low temperatures as fewer people venture out in the cold and riding in the cold can worsen its effects by amplifying wind speed. Furthermore, snow is often associated with low very low temperatures, which makes biking around the city even more unpractical.

Use of Citi bikes starts to decrease around 80 degrees, with extreme temperatures seemingly yielding less 24 Hour passes: visitors are less likely to bike under the harsh Summer New York sun. Although this could also be a discrepancy due to the lack of sufficient data for those hot days that are in small numbers across the five last years compared to the other temperature bins.