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RFC: Surge-Pricing During Peak Times and Peak Locations for Divvy Bike Sharing

Executive Summary

I propose to test whether Divvy will receive more profit if they implement surge-pricing during peak times and locations.

The efficacy of the measure will be determined by comparing the profit received during a period where surge pricing is not implemented and the profit received during a period where surge pricing is implemented.

Introduction

Divvy is a Chicago Bicycle Share business. It operates mainly in the main downtown area of Chicago. It boasts about 580+ bike stations and 5,800 bikes.

Divvy has three main ways to pay to use their bikes. Customers are able to just pay for each trip at the cost of $3 for a 30-minute ride and $3 for each additional 30 minutes. Next, customers are able to pay for a day pass at $15 for an unlimited amount of 3-hour rides for 24 hours and $3 for each additional 30 minutes over the 3 hours. Finally, customers are able to purchase a $99/year subscription for an unlimited amount of 45-minute rides and $3 for each additional 30 minutes of ride time.
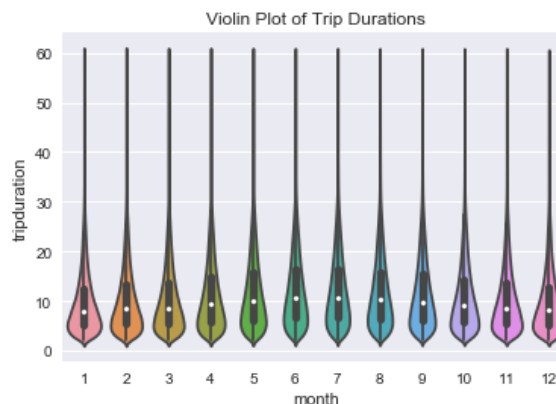
Car rideshare companies such as Uber and Lyft are known to use surge-pricing in their applications. I believe it would be beneficial to see if they can utilize surge-pricing on the price of extra time on top of a customer's base subscription.
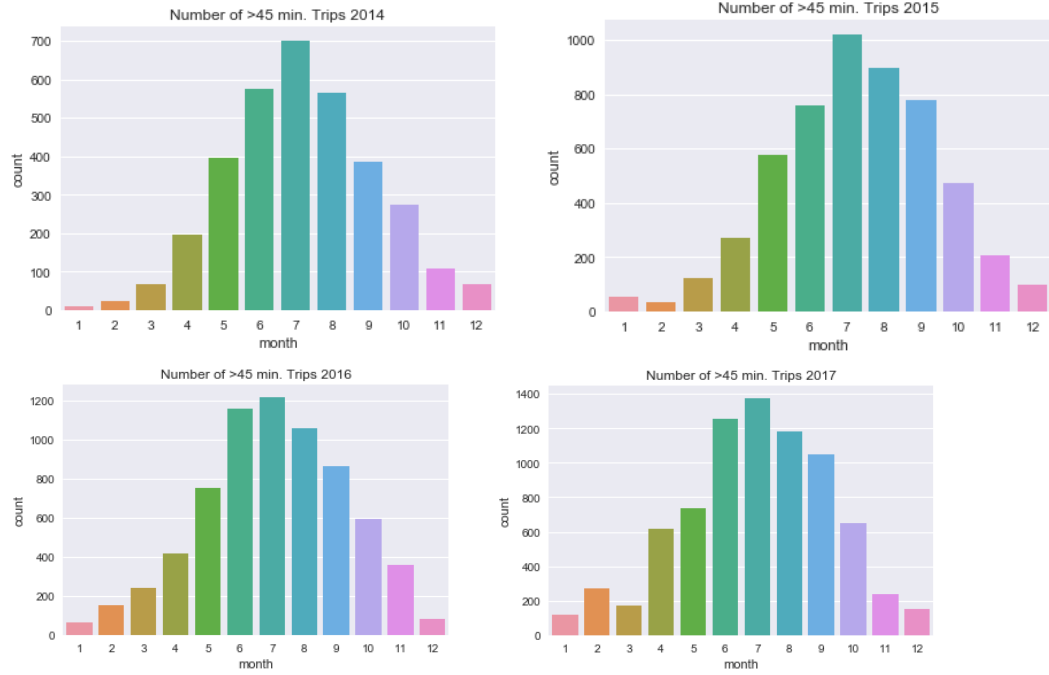
Problem Statement

1. Pricing is dependent on whether they are subscribers or non-subscribers. The majority of the people who use the bike share are subscribers, so we will focus on the subscribers for the experiment. For subscribers, it costs $3 for each additional 30 min. over their unlimited 45 minute ride.
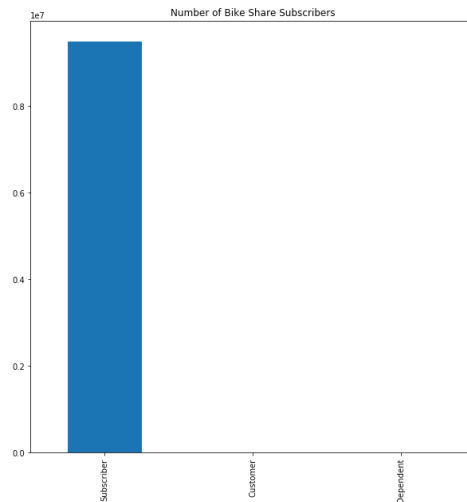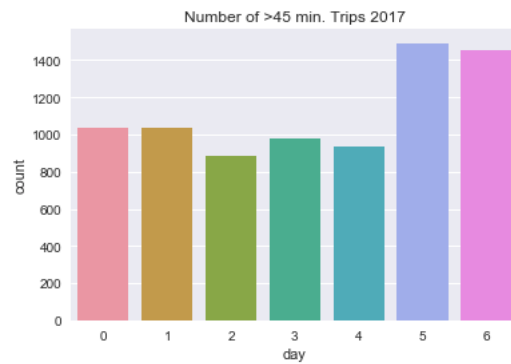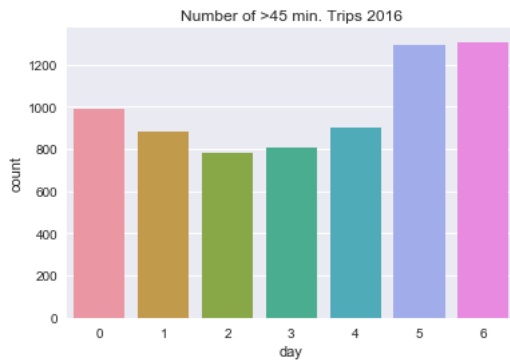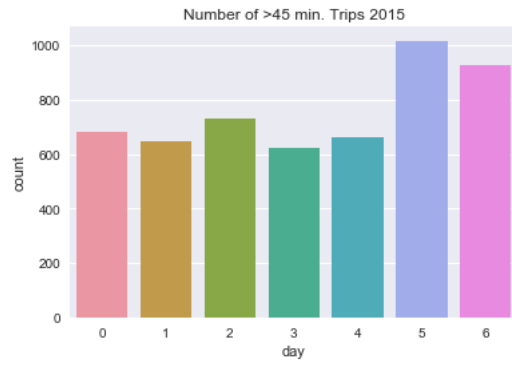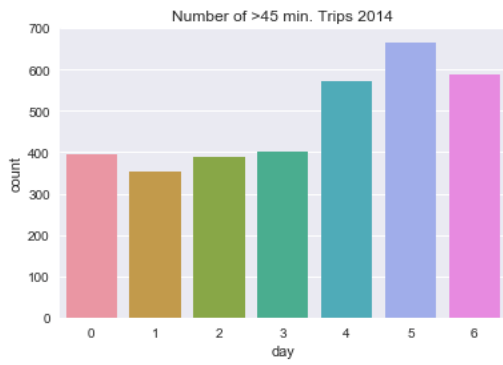

2. We will only focus on trips with trip durations > 45 min. Let's see what specific months, days, hour, and departing bike stop has the most > 45 min. trips. It looks like there are longer trip durations in the summer, specifically in the month of July. For the months, it seems July is the month with the most trips over 45 min.

Number of >45 min. Trips 2014

Number of >45 min. Trips 2015

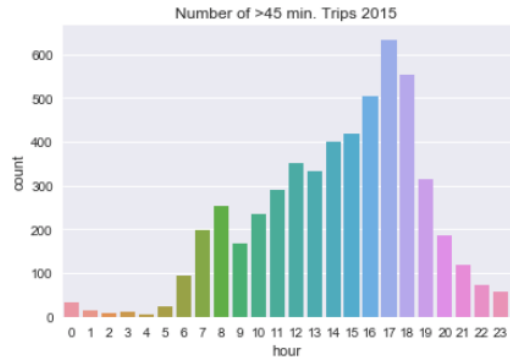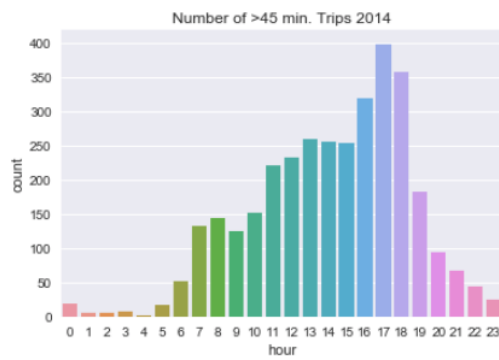Number of >45 min. Trips 2016

Number of >45 min. Trips 2017

3. When analyzing the trip counts by day we see that Fridays and Saturdays have the most number of trips greater than 45 min. The below Facet Grid has the days as the rows and months as the columns. Regardless of the day, June, July, and August have the most number of trips greater than 45 min.

Number of >45 min. Trips 2014

Number of >45 min. Trips 2015

Number of >45 min. Trips 2016

Number of >45 min. Trips 2017

4. When analyzing the trip counts by hour we see that the hours between 4pm-6pm are the peak times.

Number of >45 min. Trips 2014

Number of >45 min. Trips 2015

Number of >45 min. Trips 2016 / Number of >45 min. Trips 2017
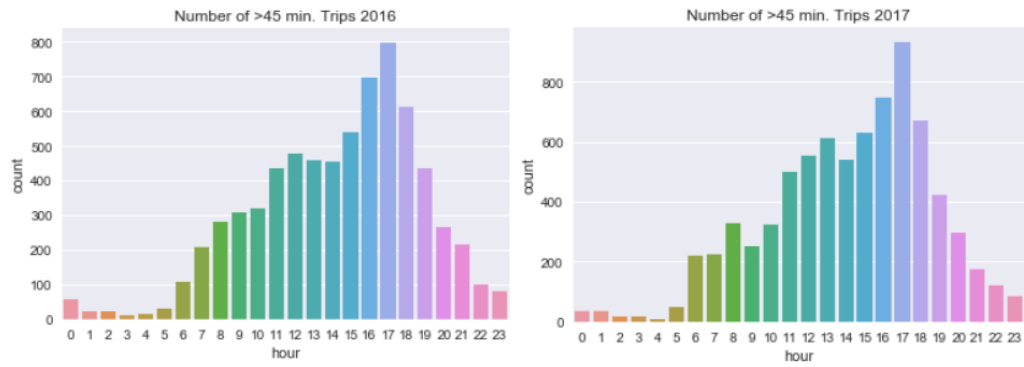
5. When analyzing the trip counts by departing station, we see that the top two station ids are 35 and 76. There station names are 'Streeter Dr & Illinois St" and "Lake Shore Dr & Monroe St" respectively. These locations are close by the scenic Chicago Riverwalk and overlook the Chicago Harbor.

Number of >45 min. Trips 2014 / Number of >45 min. Trips 2015

Number of >45 min. Trips 2016 / Number of >45 min. Trips 2017
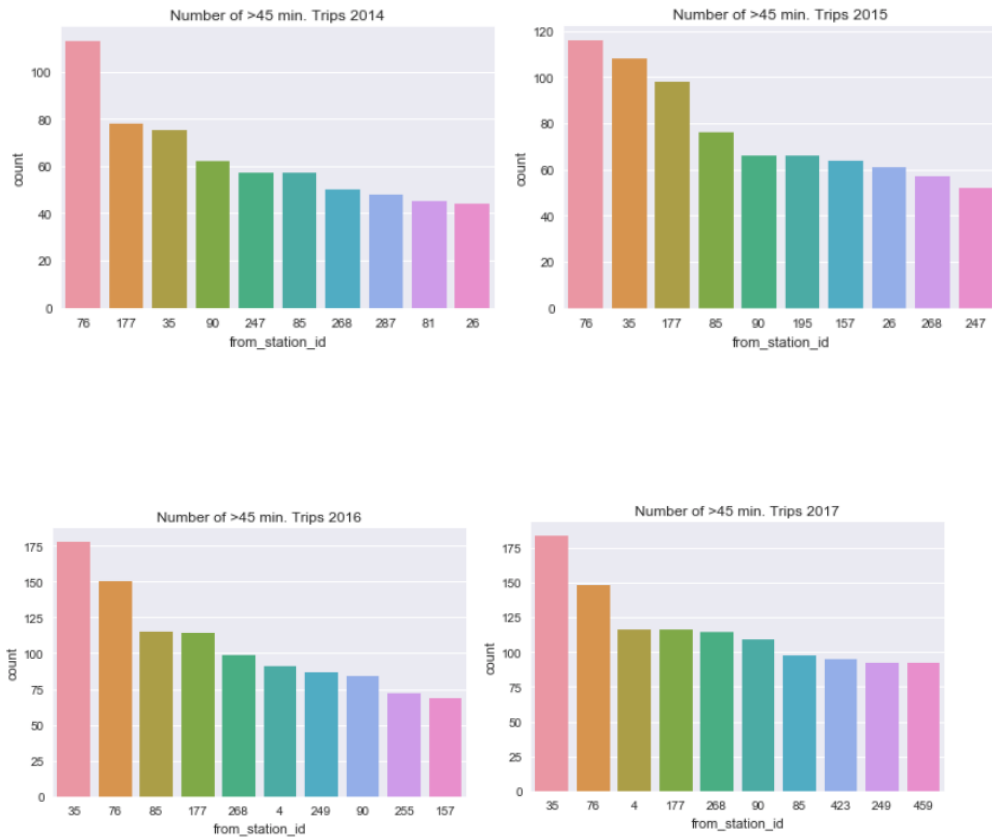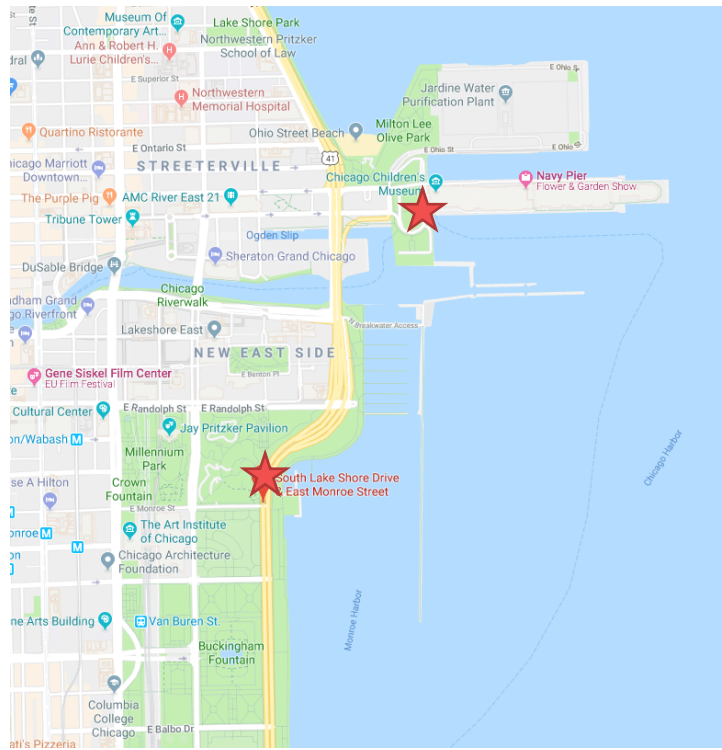
6. In summary, it would be ideal to implement surge pricing during the month of June and July, on Friday and Saturday, during the times of 4pm-6pm, and from the stations 76 and 35.

7. For the month of July there were 1,376 trips that went over their unlimited 45-minute ride. Here are the revenues that Divvy received on their current $3 overage pricing and the revenue that Divvy could receive if it implemented a $4 overage pricing for the month of July:
   a. Current overage pricing of $3: $4128
   b. Overage pricing of $4: $5504

Proposal

1. I propose for the whole month of July that we implement surge pricing, an increase of $1 from the current $3 overage price, so $4 for every 30 min. above their unlimited 45 min. ride.
2. If surge pricing is implemented for the month of July it would be only implemented for subscribers.
3. The purpose of the surge pricing is to see if Divvy can get increase their revenue for the month by taking advantage by the increase of the demand for >45 min. bike rides in July.

Evaluation

1. A t-test will be conducted between the revenue of June 2018 (increased overage pricing) and June 2017 (old overage pricing).
2. The t-test would be conducted as such:

$$t \; = \; \frac{\overline{y}_{old} - \overline{y}_{new}}{\sqrt{s^2_{old}/N_1 \; + \; s^2_{new}/N_2}}$$

3. The t-value must be statistically significant for the experiment to be considered a success.

Resulting Actions

1. If the mean profit of the "price-surge" month has a statistically significant positive difference than the previous months than the experiment will be considered a success.
2. If the t-value is not significant for the month of June 2018, we will repeat the test for the month of July 2018. If the t-value is not significant for the month of July 2018 we try for the last time in the month of August 2018. If all three months do not provide a statistically significant value the experiment will not be considered a success.
3. It will be recommended that the surge-pricing algorithm be implemented for the rest of the month of July (the peak month) if the "price-surge" month produces a statistically significant positive difference.

4. Also, it would be suggested that we look into implementing surge pricing for secondary peak months or implementing overage pricing depending on the locations, day, and time of day.