THE UNIVERSITY OF CHICAGO

BIKE SHARE, A SOLUTION TO THE "LAST MILE PROBLEM" IN PUBLIC TRANSIT?

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Overview

- There has been little research focusing on how the accessibility of public transit affects bike share use. Previous studies failed to either take advantage of the publicly available observational data or focus explicitly on the connection between public transit and bike share. I seek to close this gap with an original approach to measuring the potential linkage between bike share uses and public transit rides, using observational data. To this end, I test the validity of the 300-meter proximity standard used in a prior study on Divvy, a bike share service in Chicago, IL.

The Last Mile Problem

- Passengers are less likely to use a public transit service when it leaves them an extra "mile" from their final destination with poor connecting options.
- Bike share is often seen as a "solution" to this last mile problem in public transit.

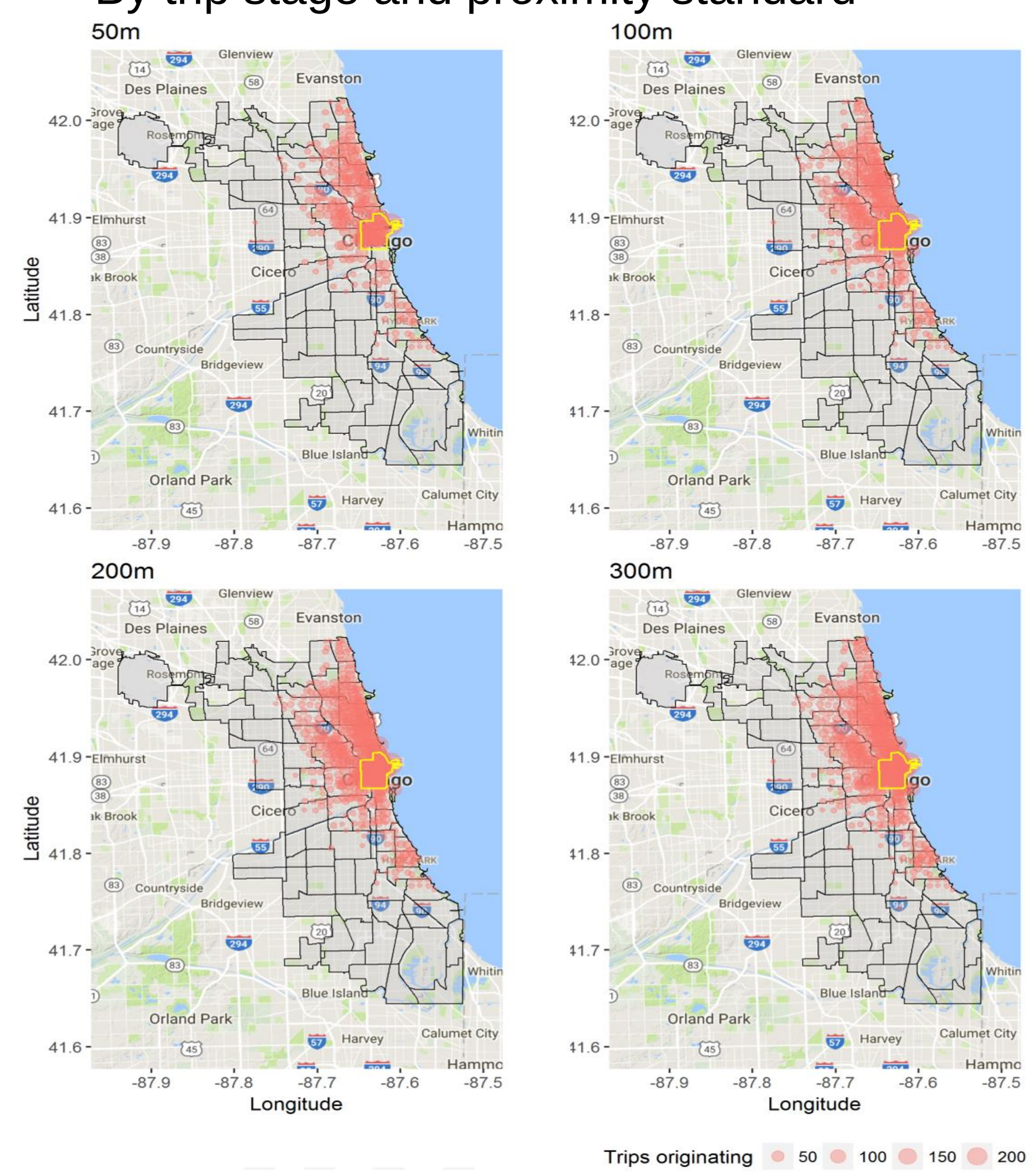
Potentially Multi-Modal trips

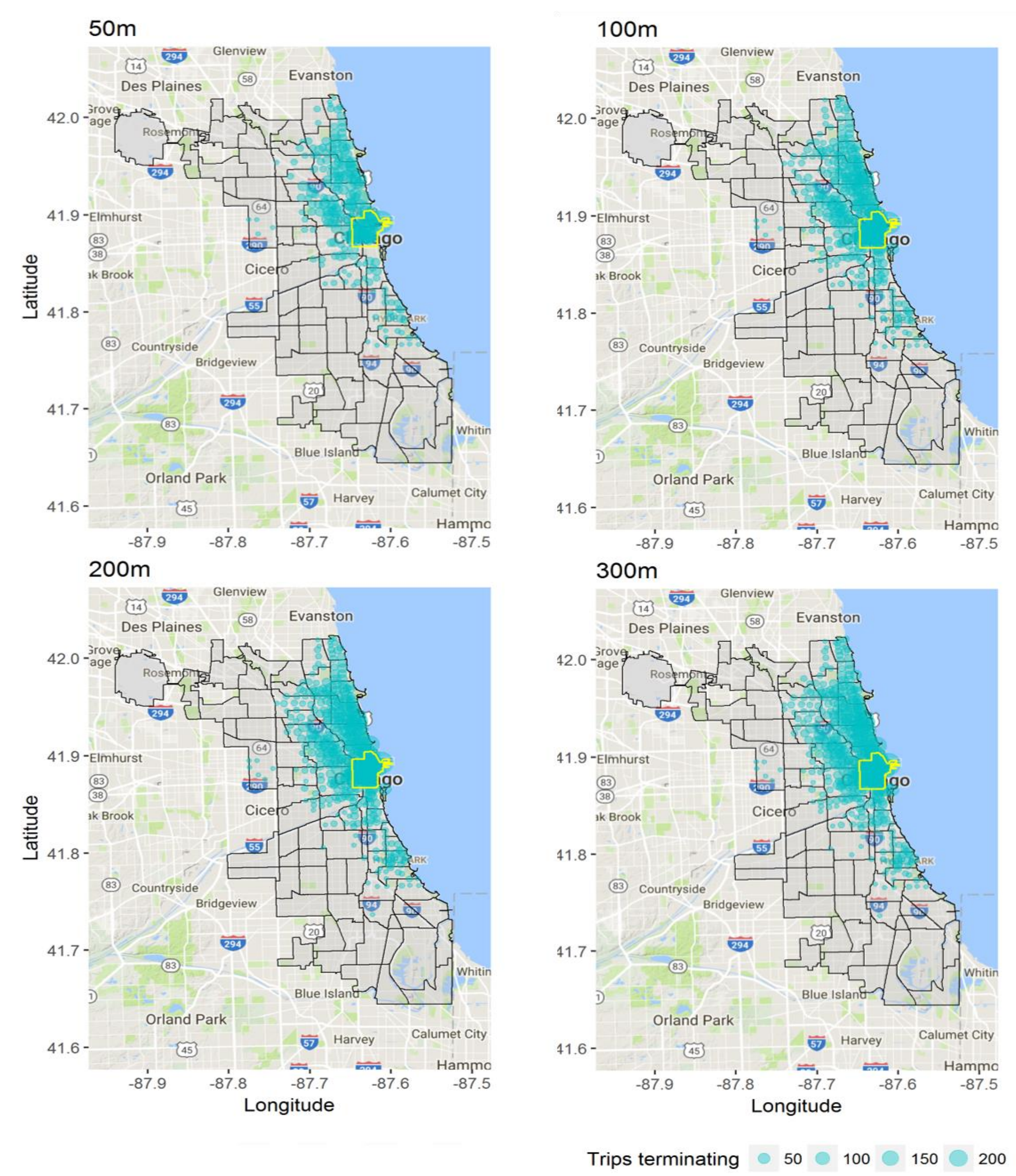
- Multi-modal trips: trips that incorporate both CTA bus/rail rides & Divvy bike uses → evidence that bike share is a solution to the last mile problem.
  - A major implication of the effect of the access to public transit on bike share trips.
- No data on such trips → a need for a proxy.
- Potentially Multi-modal (PMM) trips: Trips that are likely multi-modal for a traveler that is also a rational actor who seek to minimize the cost of any given trip.
  - *Spatial condition* for a PMM trip:
    - The trip must begin from/end at the Divvy station with easy access to CTA stop;
    - Proximity standards: 50m, 100, 200m and 300m
  - *Temporal condition* for a PMM trip:
    - The temporal gap between the end of the Divvy trip and the departure of a bus/rail from a nearby CTA stop (and vice versa) must be under a certain threshold.

Divvy Trips

- A sample of Divvy trips for each trip stage, augmented by CTA route schedule data, ACS demographic data, and NCEI weather data ($N = 20{,}000$).

By trip stage and proximity standard





Model

- Y is a categorical variable with five discrete outcomes:

$$y = \{PMM1, PMM2, PMM3, PMM4, None\}$$

  - $PMM1$: PMM trips by the 50m proximity standard
  - $PMM2$: by the 100m standard, excluding $PMM1$
  - $PMM3$: by the 200m standard, excluding $PMM2, PMM1$
  - $PMM4$: by the 300m standard, excluding $PMM3, PMM2, PMM1$
  - $None$: Not PMM by any proximity standard
- Multinomial logistic regression:

$$\Pr(Y_{is} = j) = \pi_{ijs} = \frac{\exp(\eta_{ijs})}{\sum_{j=1}^{J} \exp(\eta_{ijs})}, \text{ where}$$

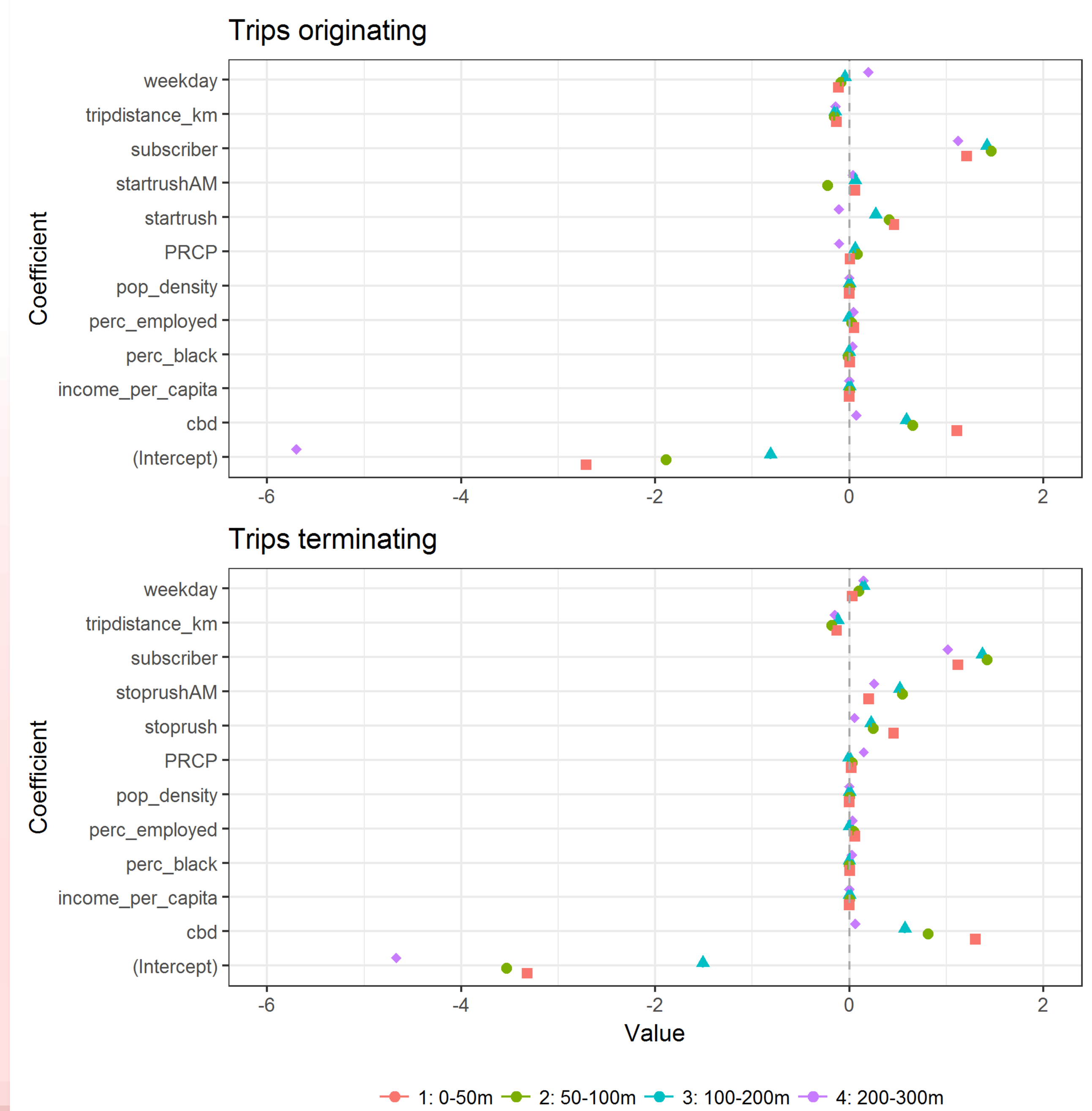
$$\eta_{ijs} = \log\left(\frac{\pi_{ijs}}{\pi_{iJs}}\right) = \mathbf{x}'_{is}\boldsymbol{\beta}_{js}\,,$$

$$\text{for } i = 1, 2, \ldots, N \text{ and } j = 1, 2, \ldots, J-1.$$

  - s is trip stage, $s \in \{originating, terminating\}$.
  - $y = None$ is the baseline (J^{th}) category.

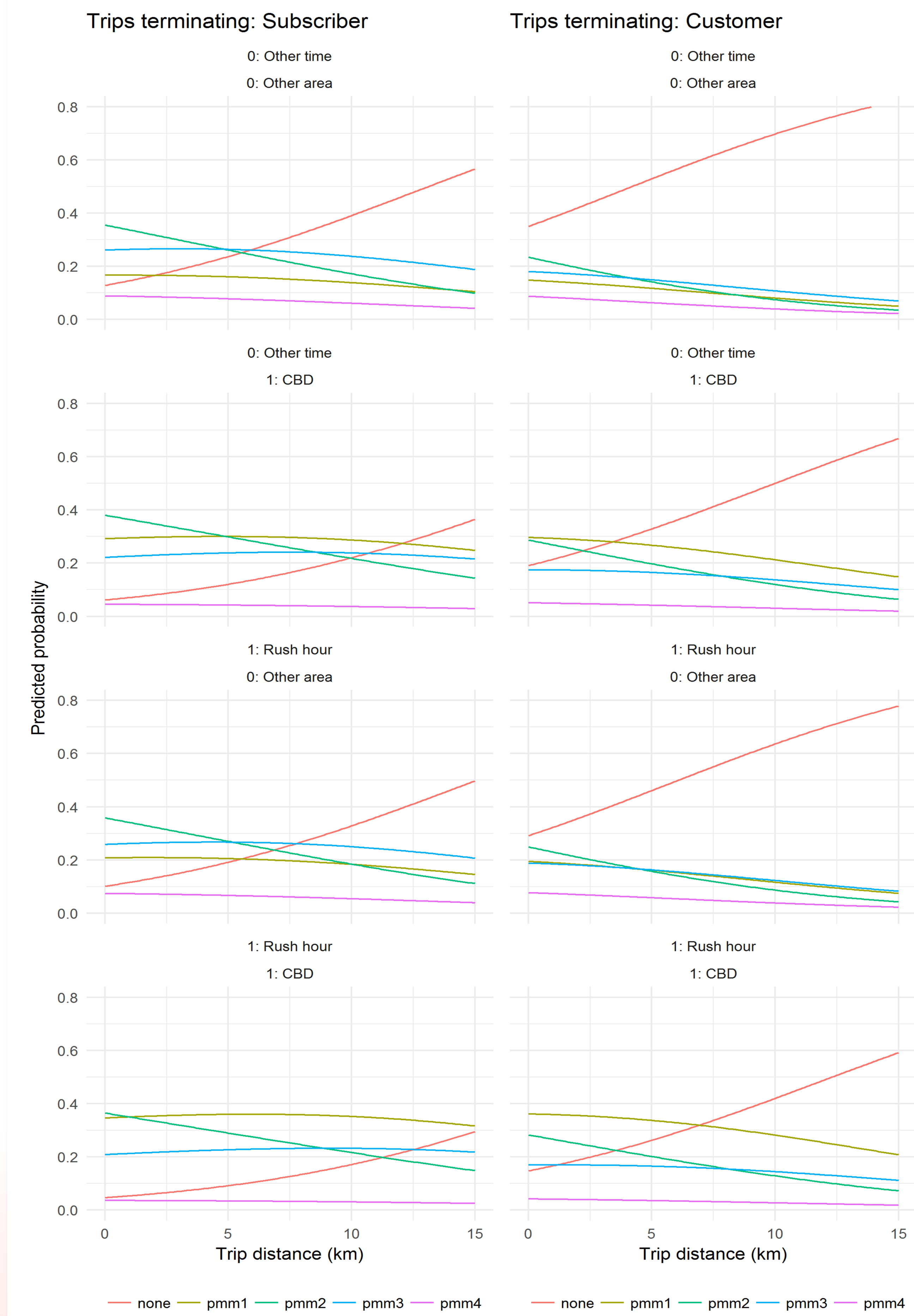
Estimated Model Coefficients

- Coefficients given in terms of the relative log-odds against the baseline category, $y = None$



Predicted Probabilities

- Example: Trips terminating, for the various values of user type, rush hour, central business district (CBD), and trip distance (holding other variables constant).



Takeaway Points

- Different proximity standards lead to different results → a challenge to using the 300m distance to evaluate the effect of public transit access.
- The rational actor framework favors the proximity standard with a shorter distance.
- Cannot conclude that 50m (or any other) is the *right* choice for the proximity standard.
- Demographic features are not discriminative.