Project Title: *Using visual information to determine the subjective valuation of public space for transportation: application to subway crowding costs in NYC*

Principal Investigator: Ricardo A. Daziano

Subway demand in NYC has been on the rise, reaching 1.8 billion trips in 2014. Overcrowding delays have extended to non-peak hours and weekends; weekend overcrowding delays grew 141.2% in 2014-2015 (NY Daily News, 2015). In addition to delays, nonmonetary crowding costs include discomfort and a loss in security that play against overall perceptions of public transportation. In fact, subway crime has also been on the rise (NY Daily News, 2015). The evaluation of projects such as investment in open gangway cars (MTA is planning to spend $52.4 million on 10 of these cars; Wired, 2016), which are expected to increase capacity up to 10%, requires correct measurement of crowding externalities.

The objective of this project is to explore the role of visual information in determining the users' subjective valuation of multidimensional trip attributes that are relevant in decision-making but are neglected in standard travel demand models. More specifically, this project aims at analyzing overcrowding perceptions in discrete choice experiments, with the use of visualization of passenger density in subway cars. Econometrically comfort valuation is derived as crowding multipliers that represent the willingness to accept longer travel times in exchange for lower passenger density.

Microdata was collected in New York City (N=1849), but a pretest with a small sample size was performed with international collaborators in the subway system of Santiago, Chile. The online survey contained a binary choice experiment where two alternative subway routes were compared, differing in travel time, cost (to derive value of time VOT estimates), passenger density (subway car diagrams as a proxy of overcrowding) and whether the rider would be standing or sitting in the subway car.

From the VOT estimates, crowding multiplier estimates were derived. On the one hand, the MNL, mixed logit with normally distributed parameters and mixed logit with lognormally distributed parameters produce average crowding multipliers that are almost undistinguishable: for the average subway rider traveling seated in a subway car at technical capacity (6 passengers per square meter) travel time bothers twice as much as traveling on an empty subway car. If the passenger is standing, travel time bothers the passenger 15% more. On the other hand, from the mixture-of-normals logit specification it is very clear to see one class that is relatively less sensitive to crowding, with crowding multipliers that are around 80% of the value of the MNL and MMNL average results, and a class that is very sensitive to crowding. For the segments of subway riders that are very sensitive to crowding, travel time under extreme overcrowding (technical capacity) while standing is perceived as 4.4 times worse than under zero passenger density. Even if the passenger is seated the crowding multiplier at 6 passengers per square meter is 4.2. In fact, the crowding multipliers between standing and sitting conditions are not very different for this class of riders, which can be interpreted again as travelers that focus on comfort in terms of crowding much more than the possibility of traveling seated.

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