Shared e-scooter service providers with large fleet size have a competitive advantage: Findings from e-scooter demand and supply analysis of Nashville, Tennessee

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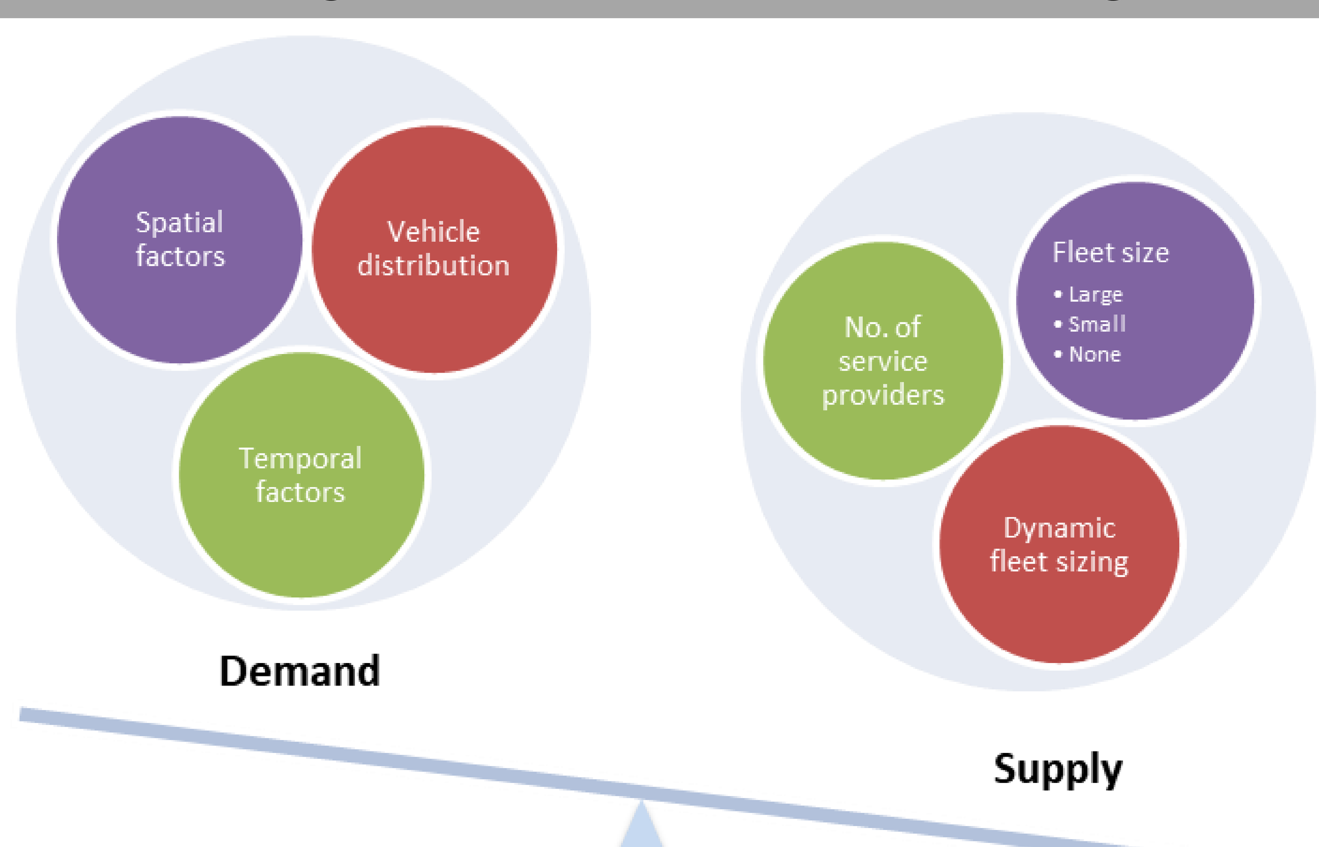
TRBAM-22-02111 | Monday 01/10/2022 10:30AM - 12:00PM

Abstract

In response to service providers' rapid deployment of e-scooter vehicles, several city governments have regulated shared e-scooters through permits and pilot programs. Although these regulations have several policy dimensions, including the number of service providers, their fleet size, and provisions for expanding/downsizing the fleet size, the literature lacks an empirical analysis of the demand elasticity of shared e-scooters. We used a log-log fixed-effect model to evaluate the demand elasticity of e-scooter vehicle deployment and price using the Shared Urban Mobility Device (SUMD) dataset of Nashville, Tennessee, between March 2019 and February 2020. This dataset includes disaggregated e-scooter trip summary data and vehicle location data that updates approximately every five minutes. We found that the demand of e-scooter vehicle deployment is inelastic (0.43), with a slightly higher value of elasticity on weekends than weekdays (0.43 vs. 0.37). By contrast, the demand elasticity of the cost per minute is elastic (-2.57) and higher during the weekdays than on weekends (-2.97 vs. -2.62). Furthermore, service providers with large average per-day fleet sizes (>500) have a demand elasticity of e-scooter deployment that is 1.4 times higher than that of medium fleet-sized service providers (250-500) and 3.5 times higher than that of small fleet-sized service providers (<250).

Background & Research Design



Research Objective: Estimate the demand elasticity of deployed e-scooter vehicles and the cost per minute

Study Area: Nashville, Tennessee

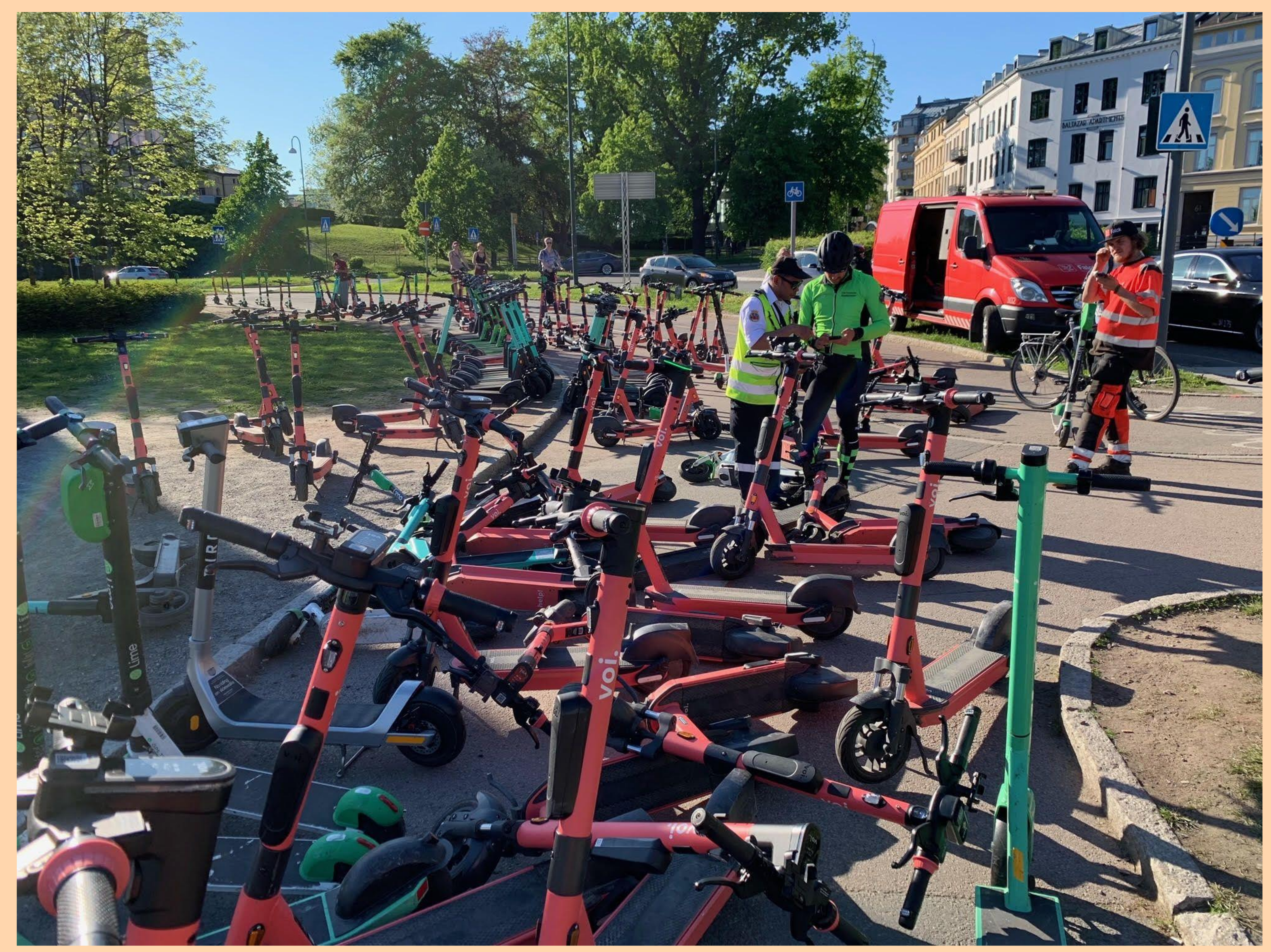
Study Period: March 1, 2019 to February 29, 2020

Data Source: Shared Urban Mobility Device (SUMD) & Nashville Activity-Based Model

Method: log-log fixed-effect model

Service Provider Segmentation: three categories based on their average fleet size per day: large (>500), medium (250-500), & small (<250)

More e-scooters on the street does not increase the number of trips at the same rate, but large service providers have a competitive advantage



We recommend the following to city governments:

- Permit few shared e-scooter service providers with large fleet sizes
- Consider dynamic fleet sizing on weekdays and weekends to manage the public space

Results

Demand elasticity of vehicles deployed by segmented service providers

Estimated elasticity	Weekly	Weekday	Weekend
Number of e-scooter vehicles deployed (all service providers)	0.43***	0.37***	0.43***
TAZ fixed effect	Yes	Yes	Yes
Time fixed effect	Week	Week	Week
R square	0.69	0.50	0.56
Number of observations	15,239	15,239	14,928
Service providers segmented by fleet size			
Large fleet-sized service providers (>500)	0.39***	0.36***	0.40***
Medium fleet-sized service providers (250-500)	0.27***	0.28***	0.32***
Small fleet-sized service providers (<250)	0.11***	0.14***	0.22***
TAZ fixed effect	Yes	Yes	Yes
Time fixed effect	Week	Week	Week
R square	0.71	0.67	0.60
Number of observations	15,239	15,239	14,928

Note: *** P < 0.01, ** P<0.05, * P<0.1

Demand elasticity of vehicles deployed and price

Estimated elasticities	Weekly	Weekday	Weekend
Number of vehicles deployed (log)	0.64***	0.65***	0.77***
Cost per min (log)	-2.57***	-2.97***	-2.62***
Week Fixed effect	Yes	Yes	Yes
R square	0.64	0.59	0.53
Number of observations	15,239	15,239	14,928

Note: *** P < 0.01, ** P<0.05, * P<0.1

Key findings

- Demand elasticity of e-scooter vehicles is positive and inelastic (0.44) and is higher during weekends than weekdays
- Demand elasticity of price is negative and elastic (-2.57) and is higher during weekdays than weekends
- Large service providers (avg. fleet size >500) have demand elasticity of e-scooter vehicles 1.4 times higher than that of mid-sized service providers (avg. fleet size 200-500), and 3.5 times higher than that of small-sized service providers (avg. fleet size <200)

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ACKNOWLEDGMENT

The authors would like to thank the Public Records department of Nashville MPO for providing the shared e-scooter dataset. This study was supported in part by the Transit-Serving Communities Optimally, Responsively, and Efficiently (T-SCORE) University Transportation Center Grant No. 69A3552047141 T-SCORE University Transportation Center with matching funds from the Tennessee Department of Transportation (TDOT) and also by the Oak Ridge National Laboratory GATE fellowship program.