Evaluating Bike Share and E-Scooter Programs in the US and NJ

Charles T. Brown, MPA and Aashna Jain
Voorhees Transportation Center at Rutgers, The State University of New Jersey
New Jersey Tech Talk Event
Panel Session: Micromobility’s Launch in NJ and Beyond
February 20, 2020 | 1:30 am – 3:30 pm
Trenton, New Jersey
Equity

- Equity involves trying to understand and give people what they need to enjoy full, healthy lives.
- Equity is the presence of justice and fairness within the procedures, processes, and distribution of resources by institutions or systems.
- Facing equity issues requires an understanding of the underlying or root causes of inequalities and oppression within our society.
Bike Share Systems in the US and New Jersey
Research Objectives

- Explore inequalities in spatial distribution of bike share stations across different socioeconomic groups.
- Rank the BSS of the 10 cities by their spatial densities in the most-disadvantaged socioeconomic category.
- Serve as a reference model for assessing existing and developing bike share systems in the State of New Jersey.
Methodology

- Defining the BSS Study Areas
- Preparing Predictor Variables for the BSS Study Areas
  - Four of the 8 variables were taken from the Smith et al. (2015) study.
- Computing Socio-economic Hardship Scores at block group level and classifying them into Socio-Economic Hardship Quintiles
- Computing Station Densities for each block group and Socio-Economic Quintiles
- Social-economic quintiles: Most Advantaged, Advantaged, Neither Advantaged or Disadvantaged, Disadvantaged, and Most Disadvantaged
Predictor Variables

- Carless households (CL_HH)
- More than 30 percent of gross income as rent (MT30INC)
- Health insurance (NO_HI)
- Median household income (HINC100000)
- Education (LT_HS_EDU)
- Household size by median number of rooms (HHS_MNR)
- Minority population (MIN_POP)
- Unemployment (UNEMP)
Predictor Variables

Average Station Density by Population in a block group in a socio-economic category (or the BSS study area)

$$\sum \left( \frac{NUM_{BS} \times 1000}{ADULT\_POP} \right) \div N$$

Average Station Density by Area in a block group in a socio-economic category (or the BSS study area)

$$\sum \left( \frac{NUM_{BS}}{AR} \right) \div N$$

Where
- NUM_{BS} = Total number of bike stations in the block group
- ADULT\_POP = Total adult population in the block group
- AR = Area of the block group in square miles
- N = Total number of block groups in the socio-economic category (or the BSS study area)
Analysis

New York City, NY

Oakland, CA

Jersey City, NJ
#1 Biketown – Portland, OR

Figure 1a: Spatial densities by population in socio-economic categories – Portland, OR

Figure 1b: Spatial densities by area in socio-economic categories – Portland, OR
Map 10: Bike share stations and socio-economic categories in Houston, TX

Figure 10a: Spatial densities by population in socio-economic categories - Houston, TX

Figure 10b: Spatial densities by area in socio-economic categories - Houston, TX
Hudson Bike Share – Hudson County, NJ

Figure 11a: Spatial densities by population in socio-economic categories – Hudson County, NJ

Figure 12b: Spatial densities by area in socio-economic categories – Hudson County, NJ
**Discussion**

**Table 1a:** Average spatial densities by population in a block group, by Socio-economic Category

<table>
<thead>
<tr>
<th>Socio-economic Category</th>
<th>Most Advantaged</th>
<th>Advantaged</th>
<th>Neither Advantaged nor Disadvantaged</th>
<th>Disadvantaged</th>
<th>Most Disadvantaged</th>
<th>Study Area Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta</td>
<td>0.38</td>
<td>0.34</td>
<td>0.28</td>
<td>0.14</td>
<td>0.12</td>
<td>0.25</td>
</tr>
<tr>
<td>Metro Boston</td>
<td>0.41</td>
<td>0.26</td>
<td>0.32</td>
<td>0.29</td>
<td>0.21</td>
<td>0.30</td>
</tr>
<tr>
<td>Chicago</td>
<td>0.40</td>
<td>0.21</td>
<td>0.26</td>
<td>0.17</td>
<td>0.30</td>
<td>0.27</td>
</tr>
<tr>
<td>Houston</td>
<td>0.05</td>
<td>0.04</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Miami Region</td>
<td>0.88</td>
<td>0.92</td>
<td>0.76</td>
<td>0.32</td>
<td>0.14</td>
<td>0.60</td>
</tr>
<tr>
<td>New York City</td>
<td>0.32</td>
<td>0.16</td>
<td>0.23</td>
<td>0.05</td>
<td>0.04</td>
<td>0.16</td>
</tr>
<tr>
<td>Oakland</td>
<td>0.13</td>
<td>0.46</td>
<td>0.41</td>
<td>0.26</td>
<td>0.12</td>
<td>0.28</td>
</tr>
<tr>
<td>Portland</td>
<td>0.05</td>
<td>0.22</td>
<td>0.26</td>
<td>0.32</td>
<td>0.43</td>
<td>0.25</td>
</tr>
<tr>
<td>San Francisco</td>
<td>0.20</td>
<td>0.15</td>
<td>0.15</td>
<td>0.20</td>
<td>0.16</td>
<td>0.17</td>
</tr>
<tr>
<td>Metro DC</td>
<td>0.29</td>
<td>0.54</td>
<td>0.51</td>
<td>0.48</td>
<td>0.30</td>
<td>0.42</td>
</tr>
</tbody>
</table>

**Table 1b:** Average spatial densities by area in a block group, by Socio-economic Category

<table>
<thead>
<tr>
<th>Socio-economic Category</th>
<th>Most Advantaged</th>
<th>Advantaged</th>
<th>Neither Advantaged nor Disadvantaged</th>
<th>Disadvantaged</th>
<th>Most Disadvantaged</th>
<th>Study Area Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta</td>
<td>1.69</td>
<td>1.69</td>
<td>1.42</td>
<td>0.39</td>
<td>0.41</td>
<td>1.12</td>
</tr>
<tr>
<td>Metro Boston</td>
<td>2.42</td>
<td>2.82</td>
<td>2.09</td>
<td>3.14</td>
<td>2.07</td>
<td>2.51</td>
</tr>
<tr>
<td>Chicago</td>
<td>4.15</td>
<td>2.20</td>
<td>1.45</td>
<td>1.03</td>
<td>1.52</td>
<td>2.07</td>
</tr>
<tr>
<td>Houston</td>
<td>0.18</td>
<td>0.11</td>
<td>0.05</td>
<td>0.01</td>
<td>0.02</td>
<td>0.08</td>
</tr>
<tr>
<td>Miami Region</td>
<td>8.86</td>
<td>5.83</td>
<td>4.44</td>
<td>4.23</td>
<td>1.28</td>
<td>4.91</td>
</tr>
<tr>
<td>New York City</td>
<td>7.96</td>
<td>3.21</td>
<td>3.02</td>
<td>1.44</td>
<td>1.19</td>
<td>3.36</td>
</tr>
<tr>
<td>Oakland</td>
<td>0.74</td>
<td>2.44</td>
<td>3.26</td>
<td>2.42</td>
<td>1.06</td>
<td>1.98</td>
</tr>
<tr>
<td>Portland</td>
<td>0.15</td>
<td>0.97</td>
<td>0.97</td>
<td>1.49</td>
<td>2.13</td>
<td>1.14</td>
</tr>
<tr>
<td>San Francisco</td>
<td>2.26</td>
<td>1.71</td>
<td>1.99</td>
<td>2.81</td>
<td>3.49</td>
<td>2.45</td>
</tr>
<tr>
<td>Metro DC</td>
<td>0.99</td>
<td>3.35</td>
<td>4.12</td>
<td>3.80</td>
<td>2.51</td>
<td>2.96</td>
</tr>
</tbody>
</table>
Discussion

By Population

- **2 cities** – Portland and San Francisco – have their highest average station density by population in one of the two disadvantaged socio-economic categories.

- **3 systems** – Portland, San Francisco and Metro DC – have their lowest spatial densities by population in either of the advantaged categories.

By Area

- **3 systems** – Portland, San Francisco and Boston – have their highest average station density by population in one of the two disadvantaged socio-economic categories.
## Conclusion

<table>
<thead>
<tr>
<th>Station Density by Population Rankings</th>
<th>Station Density by Area Rankings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Portland</td>
<td>1. San Francisco</td>
</tr>
<tr>
<td>2. Chicago</td>
<td>2. Metro DC</td>
</tr>
<tr>
<td>3. Metro DC</td>
<td>3. Portland</td>
</tr>
<tr>
<td>5. San Francisco</td>
<td>5. Chicago</td>
</tr>
<tr>
<td>6. Miami Region</td>
<td>6. Miami Region</td>
</tr>
<tr>
<td>7. Atlanta</td>
<td>7. New York City</td>
</tr>
<tr>
<td>8. Oakland (East Bay)</td>
<td>8. Oakland (East Bay)</td>
</tr>
<tr>
<td>9. New York City</td>
<td>9. Atlanta</td>
</tr>
</tbody>
</table>
Potential Next Steps

- Analyze spatial equity across socio-economic characteristics of jobs (workers).
- Future research to incorporate additional factors such as street network density, availability of bikes and presence of bicycle infrastructure in the analysis.
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Research Report Overview

- Pilots/Program Structure & Regulations
- Equipment & Operations Requirements
- Managing the Right-of-Way
- Methods of Community Outreach & Education
- Equity Practices and Policies
- Data Analytics and Data Sharing
- Lessons Learned
- Appendix: City Summaries
Tips for Implementing E-Scooter Share Programs in NJ

1. Establish Clear Operational Regulations & Permitting Requirements
   – Align selection criteria with program objectives
   – Implement fee structure to reinforce program accountability and sustainability
   – Address operational concerns, especially maximum e-scooter speeds

2. Effectively Manage the Right-of-Way
   – Clearly identify parking zones
   – Prioritize development of safe, comfortable and complete streets

3. Incorporate Equitable Service Standards

4. Engage, Educate and Collaborate

5. Provide Open and Standardized Data and Reporting
THANK YOU

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