What is a “Choice Rider”?
A theoretical framework and empirical analysis

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Tracing the use of term

choice riders’

Replaced "choice riders" with "choice riders" to match how we processed the books.
Tracing the use of term
Tracing the use of the term

Term exclusively used in opposition to another transit market:

- Captive Rider
- Necessity Rider
- Dependent Rider
Tracing the use of the term
- Term comes into use largely after the public takeover of privately owned and operated transit systems

- Urban Mass Transportation Act of 1964 creates Urban Mass Transportation Agency which becomes the Federal Transit Administration

- Way to characterize transit user markets

- Used in government reports about transit, as well as textbooks and journal articles
So what is a choice rider? Associated keywords

In addition to some pervasive and circular definitions, the following keywords show up:

<table>
<thead>
<tr>
<th>Choice Riders</th>
<th>Captive/Necessity/Dependent Riders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car-owning</td>
<td>Carless</td>
</tr>
<tr>
<td>Driver</td>
<td>Non-driver</td>
</tr>
<tr>
<td>White-collar worker</td>
<td>Old</td>
</tr>
<tr>
<td>High-income / middle income</td>
<td>Young</td>
</tr>
<tr>
<td>Wealthy neighborhood</td>
<td>Housewife</td>
</tr>
<tr>
<td>Suburban</td>
<td>Poor / low-income</td>
</tr>
<tr>
<td>Low density</td>
<td>Racial minority</td>
</tr>
<tr>
<td>Rail</td>
<td>Inelastic</td>
</tr>
<tr>
<td>Long trips</td>
<td>Short trips</td>
</tr>
<tr>
<td>White</td>
<td>Central city</td>
</tr>
<tr>
<td>Majority</td>
<td>Bus</td>
</tr>
<tr>
<td>Central business district</td>
<td>Urban</td>
</tr>
<tr>
<td>Highway</td>
<td>Handicapped</td>
</tr>
<tr>
<td>High quality</td>
<td>Low quality</td>
</tr>
</tbody>
</table>
Broader uses and planning implications

Transit agencies must work to attract choice riders because:

- Dependent riders will use transit no matter.

- Justifications for transit investment relate to second-best pricing, whereby the economic justification for public takeover and subsidy relates to attracting people out of cars.

- Transit mode share cannot grow from dependent riders.

Therefore transit investments should focus on high-capacity transit to support white, suburban, wealthy, car-owning, workers with downtown jobs.
Some choice uses of the term

“A portion of this market will always exist—the captive rider as previously described. Another portion will exist only as long as transit service is attractive—the choice rider.”


“The captive rider has no choice but to wait, regardless of the headway between buses or trains, but the choice rider can get back in his car and drive.”


“And, in the nature of things, captive riders are not a particularly potent political force.”

- Contemporary academic literature does not much depart from the early uses and definitions of terms.


- Though many have noted that transit-agency practices are not well-aligned with their actual transit users (Garrett and Taylor 1999; Giuliano 2005; Pucher 1982)

- And that the concepts of choice and dependent riders have contributed to transit agencies neglecting their core users (Taylor and Morris 2014)

- Giuliano (2005) examining predictors of transit choice concludes: “...if transit service were available, reliable, safe, and moderately priced, more poor people would use transit and forgo the costs of car ownership.”
Study motivation

**Academic motivation**
After fifty years of use, the term choice rider has no strong theoretical or empirical definition.

**Policy motivation**
A poorly conceptualized and unmeasured term has encouraged investments and service priorities to favor wealthier, whiter, and more suburban households.

**Research Question**
What the heck is a choice rider?

**Research objective**
- Develop a theoretically valid and empirically-based model of choice ridership.
- Apply it to real-world data to examine who is most likely to respond to improvements in transit service quality.
Conceptual framework
Utility theory: a choice rider is a transit riders or driver on the cusp of choosing one more over the over.

Empirical framework
Random utility model predicting transit use vs car use
Research design

Predicting the utility of transit relative to car

Random utility framework

Binomial logit model

with random intercepts for Census tracts and clustered boot-strapped standard errors to account for correlated errors across individual trip-makers and households

\[
\begin{align*}
\text{e}^{V_i} \\
\cdot p_i = \frac{e^{V_i}}{1 + e^{V_i}}
\end{align*}
\]

Where
Pi is the probability of choosing transit
Vi is a vector of predictor variables (socioeconomic, trip-related, geographic, and service-related.)
Case context

Philadelphia Region
Relatively high transit use
Poorest big city in America
Substantial urban bus network
Substantial commuter rail service in wealthy areas
Sample: ~10,000 transit and car trips reported on the Delaware Valley Regional Planning Commissions' 2012 Household Travel Survey (exclusions of trips within same TAZ and with no transit alternative.)

Predictor Variables:

Socioeconomic: age, gender, race, household income, educational attainment, occupations, vehicles in household

Trip characteristics: origin and destination type, trip chain dummy, travel time, travel cost

Environmental characteristics: Distance to downtown, land use mix, parking price at destination, home population density, destination job density, bus service frequency, proximity to rail
Predictors of higher transit use

Socio-economic Characteristics

- Male
- Age 18-44
- Non-white
- Lower educational attainment (high school or below)
- Lower household income
- Office related occupation

Trip Characteristics

- Shorter transit travel time compared to auto
- Lower transit travel cost compared to auto
- Not part of a trip chain

Urban Environment Characteristics

- High degree of land use mix
- High parking cost at destination
- Home location closer to CBD
- Higher transit frequency
- Near rail
Cumulative distribution of transit probability

The graph shows the cumulative distribution of the probability of taking public transit, with the x-axis representing the probability of taking public transit and the y-axis representing the percentage of trip entries.
## Tail ends of the distribution

<table>
<thead>
<tr>
<th></th>
<th>Highest Probability</th>
<th>Lowest Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home location</td>
<td>Philadelphia</td>
<td>Bucks County</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Age</td>
<td>25 to 34</td>
<td>65 to 74</td>
</tr>
<tr>
<td>Race</td>
<td>Black</td>
<td>Hispanic or Latino</td>
</tr>
<tr>
<td>Education</td>
<td>Some college but no degree</td>
<td>Bachelor’s or undergraduate degree</td>
</tr>
<tr>
<td>Occupation</td>
<td>Protective Service</td>
<td>Food Preparation And Serving Related</td>
</tr>
<tr>
<td>Household Income</td>
<td>$10,000 to $24,000</td>
<td>$75,000 to $99,999</td>
</tr>
<tr>
<td>Car ownership</td>
<td>None</td>
<td>2</td>
</tr>
<tr>
<td>Parking provided?</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Tail ends of the distribution

<table>
<thead>
<tr>
<th>Trip</th>
<th>Highest Probability</th>
<th>Lowest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning commute to work at 6:17 a.m. by taking two SEPTA Buses / Trolley Buses and arrived at 6:58 a.m.</td>
<td>Drove to work at 6:45 a.m. and arrived at 7:05 a.m.</td>
<td></td>
</tr>
<tr>
<td>Left work at 2:58 p.m. by taking two SEPTA Buses / Trolley Buses and arrive at home at 3:25 p.m.</td>
<td>Left work at 4:30 p.m. and arrived at home at 5:00 p.m.</td>
<td></td>
</tr>
<tr>
<td>Work location is close to Philadelphia city center.</td>
<td>Work location far away from Philadelphia city center and no transit available at home location.</td>
<td></td>
</tr>
</tbody>
</table>
So, what’s a choice rider?

Two approaches:

(1) Compare those with 40% - 60% probability to the rest of the dataset

(2) Use a clustering algorithm to develop archetypes of choice riders
So, what’s a choice rider?

A choice rider is substantially more likely to earn below $25k per year.
So, what’s a choice rider?

A choice rider is substantially more likely to be non-white
So, what’s a choice rider?

A choice rider is less likely to have a BA but more likely to have a graduate degree.
So, what’s a choice rider?

A choice rider more likely to be carless
So, what’s a choice rider?

A choice rider is much more likely to live closer to the downtown.
So, what’s a choice rider?

In short, an actual choice rider looks a lot more like the stereotype of a captive rider that has long biased transit planning documents and academic writing

There is, however, also a lot of variance in choice riders and we give a sample of three trips close to a 50% probability of using transit or a car
A sample of choice riders and their trips

<table>
<thead>
<tr>
<th></th>
<th>Archetype 1</th>
<th>Archetype 2</th>
<th>Archetype 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home location</td>
<td>Philadelphia</td>
<td>Philadelphia</td>
<td>Delaware County</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
<td>45 to 54</td>
<td>45 to 54</td>
<td>55 to 64</td>
</tr>
<tr>
<td>Race</td>
<td>White</td>
<td>Black</td>
<td>White</td>
</tr>
<tr>
<td>Education</td>
<td>Graduate degree</td>
<td>High school</td>
<td>Bachelor’s Degree</td>
</tr>
<tr>
<td>Occupation</td>
<td>Community and Social Service</td>
<td>Unemployed</td>
<td>Management</td>
</tr>
<tr>
<td>Household Income</td>
<td>$100,000 to $149,999</td>
<td>$0 to $9,999</td>
<td>$100,000 to $149,999</td>
</tr>
<tr>
<td>Car ownership</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Parking provided?</td>
<td>NA</td>
<td>NA</td>
<td>Free Parking for Employee</td>
</tr>
</tbody>
</table>
Who chose transit?
Drove from home to a medical appointment at 8:30 am and returned home at 11:45 am. Then she left home at 12:10 pm and arrived at work at 1:05 pm. After work, she drove to a social / religious / community gathering and stayed until 4:45 pm, when she drove home. She arrived at home at 4:50 pm.
She left home at 6:55 am and took SEPTA bus to do everyday shopping. Afterwards, she took another SEPTA bus for personal business. From there she walked to shop at another location. At 10:45 am she took SEPTA bus to return home.
Took SEPTA bus and then walked to a restaurant for dinner. Afterwards she walked to two different places to shop and then walked home.
Conclusion

Popular, professional, and academic characterizations of choice riders are almost certainly inaccurate.

A re-conception of choice ridership based on a solid theoretical and empirical grounding will tend to encourage investments that improve service for poorer, minority households living in more central urban areas.

Improving service for poorer, minority households living in more central urban areas will do much more to draw travelers out of cars and thus produce more environmental and economic benefits than investments geared toward existing mischaracterizations of choice riders.
Takeaways for practice

I suspect that many of the primary findings about choice ridership come as little surprise to many transit planners and city planners.

For these practitioners, I hope that the general framework and findings provide theoretical and empirical support for investing in the kinds of neighborhoods where residents are most likely to respond to changes in service quality.

For practitioners that still make the distinction between choice and captive transit riders, I hope that these findings encourage greater care in discussing who is a choice rider and perhaps even leads to the abandonment of the term captive rider. Very few transit riders are truly captive and those with the highest probability of taking transit (and thus could possibly be thought of as captive) tend to have high quality transit options.
Next steps

Add other measures associated with “captive” transit users, e.g., physical disabilities

Simulate effects of transit service improvements on transit use by income group, racial group, and other important predictor categories

Generate and examine more archetypes of choice riders and their trips

Develop maps and groups of where users are most responsive to service improvements