Accessibility, Connectivity and Captivity
Impacts on Transit Choice
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Edward Beimborn
Michael Greenwald
Xia Jin

Center for Urban Transportation Studies
University of Wisconsin-Milwaukee
Market share and mode split can often be poorly defined, since we have limited knowledge of the true population of people who have a feasible choice to use transit.

Methods are needed to understand the size of transit markets and the relationship between level of service and mode captivity.
Develop better methods to define transit market segments.

Explore how level of service and accessibility influences mode captivity and mode choice.

Determine if market segmentation improves forecasts of transit use.
Is there acceptable transit service available?

No

Is there acceptable auto service available?

No travel

Yes

Auto dependent user

Yes

Choice user

No

Transit captive user
Transit use will only occur when the following conditions exist:

- **Accessibility** -- The user must be able to get to their origin to a transit stop and from their destination to a transit stop within a reasonable amount of time. At least one end involves walking.

- **Connectivity** -- Service must exist between origin and destination and provide a return trip at times that match users’ schedule.
Knowledge: The user must have knowledge on how to use the transit services

Usability: The user is able to physically get on and off the vehicle and be able to carry anything related to the trip

Security: Users must feel safe and secure in the vehicle, while waiting and while traveling to and from the vehicle.
Transit Captives

- People who do not have an automobile available for a particular trip and
- All five conditions for transit use exist

Non-Transit Captives

- One or more of the conditions are not met, i.e.
- There are no feasible alternatives that connect their origin and destination at the preferred time
- Other reasons: knowledge, security or usability apply
Data Source: Portland, Oregon 1994 Household Activity and Travel Diary Survey, 50,000 trips in area of study

Data were analyzed to determine the specific location of the both the origin and destination along with a ¼ mile (403 meter) air buffer around each end of the trip as well as transit stop location.
Results of Work Trip Classification

- **Transit not Connected**: 15%
- **Transit Captive**: 3%
- **Auto Captive**: 28%
- **Transit Choice**: 54%

<table>
<thead>
<tr>
<th>Work Trip Total (6578)</th>
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<tbody>
<tr>
<td>Transit Trip (419)</td>
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<tr>
<td>Auto Trip (6159)</td>
</tr>
<tr>
<td>Transit Connected (5619)</td>
</tr>
<tr>
<td>Transit not connected (959)</td>
</tr>
<tr>
<td>Transit Captive (214)</td>
</tr>
<tr>
<td>Transit Choice (3576)</td>
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<tr>
<td>Auto Captive (1829)</td>
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Method: calibrate logit mode-split models for work trips

Hypothesis:

- Transit usage is highly dependent on the circumstances of the traveler and availability of acceptable service.
- It is possible to predict transit usage with greater accuracy with market segmentation into choice users and captive users.
The data were used to calibrate five logit mode-split models:

- For all trips
- For captive transit trips (no auto available)
- For captive transit trips (above and with service within 1/4 mile)
- For captive automobile trips
- For choice trips
The trend in the pseudo-$R^2$ values indicates:

- When the general model is segmented with the captivity conditions, the explanatory power increases;
- The models for captive users gives a better fit to the data while choice model behaves worse.
The patterns of pseudo-$R^2$ indicate that

- Unrestricted models will underestimate the variation in travel mode choice behaviors for captive users, while simultaneously overestimating the attractiveness of transit to choice travelers.
- Proper market segmentation should improve the ability to predict transit use.
Choice Users

All Trips

Transit captive -A

Transit captive -B

Auto captive

Number of vehicles in home
Walk Coefficient X 2
Model coefficients for the alternative models were quite different.
The auto availability coefficient is about twice as high for the captive models as for the overall model during rush hours.
For ‘true’ choice users, the auto availability coefficient is about a third of the overall model while the walk access time coefficient is two and a half times as large.
Differences in the coefficients for work trips indicate that a segmented model will place more emphasis on the ability to walk to transit stops for choice users and more emphasis on auto ownership for captive users.

Transit plans that emphasize good walk access to services will perform well with an improved understanding of choice and captivity conditions.
Segmentation of travelers into choice and captive users can increase the ability to forecast work trip transit use.

Among riders who can be classified as captive, behavior can be predicted based on auto ownership per household.
Among travelers who have a choice for work trips

- Difference in travel times between automobile and transit modes does little to influence the choice of whether or not to use transit

- Significant variables were:
  - access to the transit system,
  - transfer time
  - wait time.

- Other factors such as usability, knowledge and security may help improve model accuracy
This research points to the need for a better understanding of how transit access can be incorporated into transit mode split models.

A clear methodological improvement would be the use of actual transit walk access buffers that followed the travel network.
Additionally, the framework needs to be expanded to deal with non-work trip purposes and park and ride travel.

Access is important!
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