San Francisco City CarShare
Travel & Car Ownership Impacts

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Core Research Questions:
- Do members significantly reduce car ownership with time?
- In contrast to near-term impacts, does this and other factors lead to travel reduction?
San Francisco City CarShare: Steady Growth (4 Years into Program)

May 2005:
• 3800 Active Members
• 87 vehicles among 43 PODs
• Average reservation distance: 20 miles
• Average reservation length: 3.25 hours
• Average reservation cost: $23.66
• Most members: occasional users (~ 50% once a month or less)
San Francisco City CarShare: In-Vehicle Survey April 2005

- Mean Age of surveyed carshare users: 39.6 years
- Median Household Income: $50,000

- 3/4 of surveyed carshare users were from carless households
- Most live alone or in non-traditional households

Carsharing in the Bay Area clearly serves a unique niche market:
- modest-income
- non-traditional households
- carless households
San Francisco City CarShare: In-Vehicle Survey April 2005

Most trips discretionary

Only 11% would have been by private car (driven or as a passenger)
San Francisco City CarShare: No. Reservations as function of cost, supply, others: Selective Fit

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.863a</td>
<td>.745</td>
<td>.713</td>
<td>.48603</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), LNTREND, LNCOSTMI, LNCOST, LNACF, LNPODS

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>8.852</td>
<td>1.449</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>LNPODS</td>
<td>-1.131</td>
<td>.706</td>
<td>-.755</td>
<td>-1.603</td>
</tr>
<tr>
<td>LNCOSTMI</td>
<td>-2.977</td>
<td>1.042</td>
<td>-.284</td>
<td>-2.856</td>
</tr>
<tr>
<td>LNACF</td>
<td>7.220</td>
<td>2.916</td>
<td>.409</td>
<td>2.476</td>
</tr>
<tr>
<td>LNTREND</td>
<td>1.666</td>
<td>.502</td>
<td>1.622</td>
<td>3.320</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LNRESERV

A doubling of costs to users led to a 2/3 reduction in number of reservations, controlling for other factors.
Analytical Framework

Difference of Difference of Means

FOCUS: 24 Month Impacts

Impact = (T_{t,4} - T_{t,1}) - (T_{c,4} - T_{c,1})

T = trip or impact measure;

T = "test" (car-sharing) cases;

c = "control" (non-car-sharing) cases;

4 = 4\textsuperscript{th} survey; and

1 = 1\textsuperscript{st} survey.

e.g., rainfall: survey #1 = 5.4”; #4 = 1.8”
### Comparison of Car Ownership Trends: March 2001-March 2003

<table>
<thead>
<tr>
<th>Change in Motor Vehicle Ownership</th>
<th>Members (A)</th>
<th>Non-members (B)</th>
<th>Difference between Members and Non-members (A-B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced by 2 or More</td>
<td>2.5%</td>
<td>0</td>
<td>2.5%</td>
</tr>
<tr>
<td>Reduced by 1</td>
<td>26.6%</td>
<td>8.0%</td>
<td>18.6%</td>
</tr>
<tr>
<td>Did Not Change</td>
<td>63.2%</td>
<td>80.0%</td>
<td>-16.8%</td>
</tr>
<tr>
<td>Increased by 1</td>
<td>7.2%</td>
<td>12.0%</td>
<td>-4.8%</td>
</tr>
<tr>
<td>Increased by 2 or More</td>
<td>0.4%</td>
<td>0</td>
<td>0.4%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

- 67.5% of members (vs. 39.2% of non-members) said they forewent the purchase of a new car.
- In all, 73.3% of members reduced car ownership or opted not to buy a vehicle (vs. 42.9% of non-members).
Travel Consumption Metrics

- **VMT** = daily miles logged in motorized vehicles
- **MVMT** = mode-adjusted VMT \( \text{(VMT/occupancy level)} \)
- **MEVMT** = mode & engine-size adjusted VMT \( \text{[(VMT*engine size)/occupancy level]} \)\]
- **Gasoline Consumption** = MVMT/\text{mpg}
- **Greenhouse Gas Emissions** = MVMT/(CO\text{\textsubscript{2}}/\text{mile})
Evaluation
Reduced or Induced Travel?

• Change 2001-2003 for typical weekday

• VMT, MVMT, MEVMT, Gas Consumption & CO$_2$ emissions: for members & non-members

• Travel Times: mean values for both, though more rapidly for members
## Difference of Difference Results

Changes of Members Minus Changes of Non-Members, Weekday/Workday, Survey #1 to Survey #4

<table>
<thead>
<tr>
<th></th>
<th>Difference</th>
<th>T-Statistic</th>
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</thead>
<tbody>
<tr>
<td>MVMT</td>
<td>-1.12</td>
<td>-1.63</td>
</tr>
<tr>
<td>MEVMT</td>
<td>-1.671</td>
<td>-0.95</td>
</tr>
<tr>
<td>CO₂ Emissions</td>
<td>-0.76</td>
<td>-0.91</td>
</tr>
<tr>
<td>Travel Time</td>
<td>-6.06</td>
<td>-0.048</td>
</tr>
</tbody>
</table>
Predictive Models of Private Car Choice

Binomial Logit

• Controlling for Modal (e.g., travel time differentials), Trip (e.g., transit pass, purpose), and Socio-demographic (e.g., Vehs./HH member) attributes:

  Likelihood of Private car use for a trip was 45% less for Carshare members than non-members
Conclusions

• Evidence of reduced travel (VMT fell for members but rose for non-members) over the longer term:
  – Reduced car ownership and foregoing of new purchases
  – Judicious use of car (in contrast to “perverse incentives” to drive when owning car)

• City CarShare reduces “ecological footprint”:
  – Lower VMT plus small, fuel-efficient cars and relatively high occupancy levels
  – Extrapolating to current fleet of ~85 cars & 3800 members, each weekday City CarShare saves:
    • 13,000 VMT
    • 750 gallons of gasoline
Conclusions

• Benefits of:
  – Faster average speeds (reduced travel times)
  – Increased mobility (often off-peak) and choices

• Generalizable?
  – Directionality? Yes
  – Magnitude? Probably on the high end given San Francisco as an outlier
For more Information

www.bayareasurvey.com

R. Cervero & Y. Tsai, *San Francisco City CarShare: Travel-Demand Trends and Second-Year Impacts*, August 2003