Do Variable-Pricing Strategies Influence Activity-Travel Patterns of Carsharing Users? A Case Study

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WORKSHOP 196:
Using Experimental and Behavioral Economics to Improve the Understanding of Road, Transit, and Parking Pricing

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What is Carsharing?

• Short-term auto rental option
• Hourly flat rate
• Annual membership fee
• No gasoline costs
• Unlimited mileage
• No parking costs
Program Implementation

• Launched at USF main Campus in July, 2009
• Four hybrid vehicles
  – 3 Toyota Prius (later changed to 2 Nissan Cubes & 1 Ford Focus) at $7.50/hour
  – 1 Ford Escape at $9.00/hour
  – $30.00 overnight
  – $70.00 daily
Program Participation

![Graph showing program participation over time with categories for nonrenewals, active members, and net members (cumulative).]
Monthly Rentals

Rentals by Month

Cumulative User Data

- Alums
- Grad Students
- Undergrads
- Faculty & Staff
- Unspecified
**Member Profile**

**Why did you join WeCar?**  
(n=34)

- Do not own a car/truck
- Need a vehicle for occasional errands
- Do not want to depend on others for transportation
- Gas, insurance and maintenance are too expensive
- Save money
- Eliminate the need to buy a car or truck
- Protect the environment
- Want access to different car types
- Did not bring my car/truck to campus

**Where do you go with WeCar?**  
(n=34)

- Shopping/errands
- Social/recreational
- Go out/hang out...
- Visit public place: historical
- Drop someone off
- Other work related
- Family personal...
- Get/eat meal
- Go to work
- Buy services: video rentals/dry...
- Take someone and wait
- Go to school as student
- Pet care: walk the dog/vet visits
- Go to library: school related
- Use personal services:
- Go to gym/exercise/play sports
**Usage Patterns**

**Rentals by Day of Week**

- Sun: 250
- Mon: 250
- Tue: 275
- Wed: 300
- Thu: 300
- Fri: 350
- Sat: 350

**Rentals by Time Period**

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Rentals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday - Off Peak</td>
<td>189</td>
</tr>
<tr>
<td>Weekday - Morning Peak (7 to 9 AM)</td>
<td>103</td>
</tr>
<tr>
<td>Weekday - Evening Peak (4 - 6 pm)</td>
<td>1119</td>
</tr>
<tr>
<td>Weekend</td>
<td>746</td>
</tr>
</tbody>
</table>
Participant Selection

• Random selection of 30 Carsharing members
• 15 assigned to treatment (pricing)
• 15 to control (no pricing)
• Length of Experiment: from February 10 to April 29, 2011
• All given cell phone with TRAC-IT app
Interactive Data Collection

LEGEND

- HTTP(S)
- TCP
- UDP
- JDBC
- SMTP
- POP3/IMAP/Exchange
- FTP
- SOAP

TRAC-IT GIS Data Storage
Database Server

TRAC-IT Survey Participant

TRAC-IT Mobile Application
Cell Phone

Web or Desktop Applications
Data Viewing/Analysis

TRAC-IT Web Application
Web Services

TRAC-IT Emails
Email Server

TRAC-IT File Storage
Web Server

TRAC-IT Database Toolkit
Automated/Manual Batch Data Processing

Processed Data

Application & Location Data

Toolkit Monitors Web Application

Application Data

TRAC-IT Administrator / Data Analyst

User Feedback

Personalized Emails

File URL

KML, GPX, ICS files

Personalized Emails

KML, GPX, ICS files

TCP

Adaptive Location Data Buffering

Location Data

Application Data
Communicating with Users

“This is my trip to campus, via the Bull Runner, to pick up the WeCar. I then drove the WeCar to the CVS on Fowler to pick up medication and then drove to the grocery store on Bears Ave. After shopping, I dropped the groceries off at home and then drove back to campus to return the WeCar. I then took the Bull Runner back home.”
## Data Collection

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date Range</strong></td>
<td>2/10/2011 to 4/29/2011</td>
</tr>
<tr>
<td><strong>Total Number of Users</strong></td>
<td>30</td>
</tr>
<tr>
<td><strong>Total Number of Sessions</strong></td>
<td>1,857</td>
</tr>
<tr>
<td><strong>Avg. Session Length (hrs)</strong></td>
<td>15.44</td>
</tr>
<tr>
<td><strong>Total Survey Time (days)</strong>*</td>
<td>1,194.80</td>
</tr>
<tr>
<td><strong>Avg. Survey Time per User (days)</strong></td>
<td>39.83</td>
</tr>
<tr>
<td><strong>Total Number of GPS fixes Received</strong></td>
<td>4,023,917</td>
</tr>
<tr>
<td><strong>Avg. Number of GPS fixes per Session</strong></td>
<td>2,166.89</td>
</tr>
<tr>
<td><strong>Avg. Number of GPS fixes per User</strong></td>
<td>134,130.57</td>
</tr>
</tbody>
</table>
Trips by Mode and Purpose

<table>
<thead>
<tr>
<th>Mode</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>666</td>
<td>40.8%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>155</td>
<td>9.5%</td>
</tr>
<tr>
<td>Bus</td>
<td>132</td>
<td>8.1%</td>
</tr>
<tr>
<td>Scooter</td>
<td>18</td>
<td>1.1%</td>
</tr>
<tr>
<td>Walking</td>
<td>410</td>
<td>25.1%</td>
</tr>
<tr>
<td>Carsharing</td>
<td>31</td>
<td>1.9%</td>
</tr>
<tr>
<td>Not Reported</td>
<td>221</td>
<td>13.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,633</td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Communicating Pricing Changes

• Incentives to encourage off-peak travel
• 50-percent reduction in hourly rates
• Rate changes communicated by email to treatment:
  – Scheduling constraints accounted for
  – Discount applied on actual rental starting time
Hourly Pricing Schedule

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Rate ($/hour)</th>
<th>Time period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honda Civic</td>
<td>$3.75 (50 % reduction)</td>
<td>9:00 a.m. to 11:00 a.m. and 1:00 p.m. to 3:00 p.m. --&gt; Monday through Friday (note that the rate goes back to the base rate between 11 a.m. and 1 p.m.)</td>
</tr>
<tr>
<td>Nissan Cube</td>
<td>$3.75 (50 % reduction)</td>
<td>9:00 a.m. to 11:00 a.m. and 1:00 p.m. to 3:00 p.m. --&gt; Monday through Friday</td>
</tr>
<tr>
<td>Ford Escape</td>
<td>$4.50 (50 % reduction)</td>
<td>9:00 a.m. to 11:00 a.m. and 1:00 p.m. to 3:00 p.m. --&gt; Monday through Friday</td>
</tr>
</tbody>
</table>

Implementation Schedule

<table>
<thead>
<tr>
<th>Implementation Schedule</th>
<th>Starting Date</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Strategy A</td>
<td>March 1 to March 21, 2011</td>
<td>USF to communicate schedule to carsharing on 02/21/2011</td>
</tr>
<tr>
<td>Pricing Strategy B</td>
<td>March 28 to April 28, 2011</td>
<td>USF to communicate schedule to carsharing on 03/21/2011</td>
</tr>
</tbody>
</table>
Before/After Trip Distribution
Spatial Behavior

<table>
<thead>
<tr>
<th>User Type</th>
<th>Trip Length (miles)</th>
<th>SDE (square miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Carsharing</td>
<td>Average Non-Carsharing</td>
</tr>
<tr>
<td>Carsharing</td>
<td>2.6</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>8.0</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Non-Carsharing</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>7.8</td>
<td>7.8</td>
</tr>
</tbody>
</table>
Rental Cost and Rental Time

Before Variable Pricing

After Variable Pricing
Discussion (1)

• The research examined changes in travel behavior through pricing mechanisms based on time-of-day and day-of-week hourly rate discounts.
• The study found that overall carsharing users are price sensitive
• Changes in rental rates of the order of 20 to 50 percent have a significantly large impact on daily rentals.
• The analysis shows that carsharing users’ activity space contracts while using carsharing as a mode of transport.
Discussion (2)

• User interaction and real-time data monitoring contributed to continued participation throughout the study.

• Participants responded positively to this interaction and expressed a sense of confidence in the GPS tracking tool.

• Further work is needed to test if the pricing response would be the same by penalizing carsharing travel during peak-hour travel (i.e., increasing hourly rates).