Difference of Leisure behavior between sunny day and rainy day

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Introduction

If rainy, I guess leisure activity is...
- Go to a place near their house and not go to far place
- Change their means of transport

See the influence on distance for leisure activity caused by weather.
Basic Analysis

Trip Distance

Trip distance is almost equal

Trip Numbers

Sunny day: Trip numbers are large

Future works: Research the influence of leisure caused by weather
Suggest model

**Age**

- Most of data are from the middle class (36-45).
- 6 people (20%) are unanswered.
  → Precision is low, and we cannot count them in variable.
A man has more number of the trips per 1 tour than a woman.
The destination is limited to the available place *even on a rainy day*. Movement distance and total required time get longer.
On a rainy day, we use public transport to avoid rain even if we need to pay money.
→ More costly
Suggest model

- To utilize the 3 elements of the foregoing as an explanatory variable

Activities are different from weather
→ Introduction of “\( R_n \)” (Rain dummy) as a dummy variable.

\[
\begin{align*}
U_1 &= \beta_{SEX1} \cdot S_1 + \beta_{TIME1} \cdot T_1 + \beta_{COST1} \cdot C_1 + \beta_{RAIN1} \cdot R_1 \\
U_2 &= \beta_{SEX2} \cdot S_2 + \beta_{TIME2} \cdot T_2 + \beta_{COST2} \cdot C_2 + \beta_{RAIN2} \cdot R_2 \\
U_3 &= \beta_{SEX3} \cdot S_3 + \beta_{TIME3} \cdot T_3 + \beta_{COST3} \cdot C_3 + \beta_{RAIN3} \cdot R_3
\end{align*}
\]

<table>
<thead>
<tr>
<th>List</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_n )</td>
<td>SEX (DUMMY)</td>
</tr>
<tr>
<td>( T_n )</td>
<td>TOTAL TRAVEL TIME</td>
</tr>
<tr>
<td>( C_n )</td>
<td>TOTAL COST</td>
</tr>
<tr>
<td>( R_n )</td>
<td>RAIN (DUMMY)</td>
</tr>
</tbody>
</table>
### Result of estimation

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Std err</th>
<th>t-test</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{RAIN1}$</td>
<td>0.854</td>
<td>0.397</td>
<td>2.15</td>
<td>0.03</td>
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<tr>
<td>$\beta_{RAIN2}$</td>
<td>-0.116</td>
<td>0.449</td>
<td>-0.26</td>
<td>0.80</td>
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<tr>
<td>$\beta_{SEX1}$</td>
<td>1.83</td>
<td>0.285</td>
<td>6.43</td>
<td>0.00</td>
</tr>
<tr>
<td>$\beta_{SEX2}$</td>
<td>1.18</td>
<td>0.293</td>
<td>4.04</td>
<td>0.00</td>
</tr>
<tr>
<td>$\beta_{COST1}$</td>
<td>0.000597</td>
<td>0.000305</td>
<td>1.96</td>
<td>0.05</td>
</tr>
<tr>
<td>$\beta_{COST2}$</td>
<td>0.000562</td>
<td>0.000246</td>
<td>2.28</td>
<td>0.02</td>
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<tr>
<td>$\beta_{TIME2}$</td>
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<td>0.00532</td>
<td>-4.49</td>
<td>0.00</td>
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<tr>
<td>$\beta_{TIME2}$</td>
<td>-0.0157</td>
<td>0.00497</td>
<td>-3.15</td>
<td>0.00</td>
</tr>
</tbody>
</table>

In t-test,

RAIN1 is + and that of RAIN2 is - : The weather influences the first action
COST is + : It becomes easy to move so as to take cost
1. Shortening of the movement time:
   - Increasing number of service of the public transport
   - Increasing facilities which are available on a rainy day

2. Restraint of the movement expense
   - Discounting in a destination and public transport

3. Environmental maintenance for women to be easy to go out
Will the number of the trips increase if they discount 20% of fares of the railroad?

If they discount 20% of fares of the railroad, the proportion of person with number of the trips per a tour more than 3 doubles.
ex.) Increase flights of buses on a rainy day (遠州鉄道バス)

If the probability of rain tomorrow of the day before 11:00 is more than 50%, they increase flights buses at some routes.
# APPENDIX: Results of Nested Logit

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Std. Error</th>
<th>T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_{\text{rain1}}$</td>
<td>0.854</td>
<td>0.394</td>
<td>2.17</td>
</tr>
<tr>
<td>$\beta_{\text{rain2}}$</td>
<td>-0.116</td>
<td>0.448</td>
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<tr>
<td>$\beta_{\text{rain3}}$</td>
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<tr>
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<td>0.285</td>
<td>6.44</td>
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<tr>
<td>$\beta_{\text{sexdummy2}}$</td>
<td>1.18</td>
<td>0.293</td>
<td>4.04</td>
</tr>
<tr>
<td>$\beta_{\text{sexdummy3}}$</td>
<td>0</td>
<td>Const.</td>
<td></td>
</tr>
<tr>
<td>$\beta_{\text{totalcost1}}$</td>
<td>0.000597</td>
<td>0.000305</td>
<td>1.96</td>
</tr>
<tr>
<td>$\beta_{\text{totalcost2}}$</td>
<td>0.000562</td>
<td>0.000246</td>
<td>2.28</td>
</tr>
<tr>
<td>$\beta_{\text{totalcost3}}$</td>
<td>0</td>
<td>Const.</td>
<td></td>
</tr>
<tr>
<td>$\beta_{\text{traveltime1}}$</td>
<td>-0.0239</td>
<td>0.00532</td>
<td>-4.49</td>
</tr>
<tr>
<td>$\beta_{\text{traveltime2}}$</td>
<td>-0.0157</td>
<td>0.00497</td>
<td>-3.15</td>
</tr>
<tr>
<td>$\beta_{\text{traveltime3}}$</td>
<td>0</td>
<td>Const.</td>
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</tr>
<tr>
<td>$\mu$</td>
<td>1.00</td>
<td>1.8*10^{308}</td>
<td>0.00</td>
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</tbody>
</table>

Parameter result is not appropriate