Stated Preference (SP) Analysis on Cycling Safety

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Stated Preference Methodology in General

- Stated preference (SP) is a social experimentation which can be used in analyzing quantitative impacts of "hypothetical" policy measures
- SP can be employed for "evidence based" decision making
  - Effectiveness of policy measures
- Prone to "biases"
  - Main criticism regarding SP but various methodologies for minimization of bias have been developed

Stated Preference Methodology in Application

- Stated preference (SP) can be employed to seek answers to the following questions
  - Trade-offs between better infrastructure and travel time
  - Subjective utility/disutility associated with comfort factors or barriers
  - Which policy measures would be effective in increasing bicycle modal share?

- Route choice modeling vs. mode choice modeling

Bicycle routes

Copenhagen, Denmark

Sydney, Australia

City of Changwon, Korea

Seoul, Korea

Making cycling safer by regulating vehicle speed

Speed Limit of 30 km per hour

Binary route choice survey design

Route choice 1

- Bicycle/bus lane
- Travel time: 15 min
- Flat terrain

Route choice 2

- Dedicated/Segregated bicycle lane
- Travel time: 25 min
- Hilly terrain

Utility function estimation

$$U_{mo} = \alpha + \beta_1 \cdot Var\,1 + \beta_3 \cdot Var\,3 + \beta_5 \cdot Var\,5$$

$$U_{altmo} = \beta_2 \cdot Var2 + \beta_3 \cdot Var3 + \beta_4 \cdot Var4 + \beta_6 \cdot Var6$$

- Inferring the impact of policy variables by estimating and comparing the coefficients of the utility function from the binary choice data

- Test of “transferability”
- Statistical test of identical “influence”
  - → Asymptotic t-test
  - → Reject at 5% significance level

$$\frac{\hat{\beta}_i - \hat{\beta}_j}{\sqrt{\text{var}\left(\hat{\beta}_i - \hat{\beta}_j\right)}}$$

A SP Study by Stinson (Urban) and Bhat (2005)

- To survey commuters & evaluate route preferences of commuter bicyclists
- Explore differences in preferences
  - "Experienced" commuter cyclists
  - "Not experienced" in commuting by bicycle
- Usefulness for urban planners
  - Bicycle facility alignment decisions
  - Improve conditions for current cyclists
    → E.g., more direct route options
  - Generate more riding from inexperienced cyclists
    →Increase bicycle mode share

Model Estimation Results: Average Impact on Desirability of Route (Stinson & Bhat)

Route Choice Factor	Average Impact	
	Experienced	Inexperienced
Travel time	-2.5	-1.7
Bicycle lane	1.8	2.3
Major arterial	-1.8	-2.4
Separate path	1.6	2.0
Coarse sand surface	-1.5	-1.8
Non-motorized bridge	1.4	1.9
Smooth pavement	1.4	1.1
Barrier separation	1.3	1.7
Wide right-hand lane	1.1	0.9
Bicycle lane	1.0	1.3
# major cross streets	-0.8	-1.2
# stop signs per mile	-0.8	-0.3
Mountainous	-0.7	-1.4
Continuous facility	0.7	0.9
Minor arterial	-0.6	-0.8
Parallel parking permitted	-0.5	-0.5
# red lights	-0.3	0.3
Hilly	0.2	–

Findings and policy implications (Stinson & Bhat)

- Important route factors for experienced commuter bicyclists:
  - Most important: Travel time
  - Also very important: Bicycle facilities (safety-related)

- Important route factors for inexperienced commuter bicyclists:
  - Most important: Separation from motor vehicle traffic (safety-related)
  - Also very important: Travel time

- Bicycle Facility Design
  - To attract new cyclists, create safe facilities
  - To retain cyclists, design alignment to minimize travel time → direct connection between home and work is preferable
  - For all users, ideal commuter bicycling facilities will:
    - Minimize travel time
    - Minimize conflict potential with motor vehicles
- Bicycle Planners
  - Ideally, public agencies will employ planners who understand the complexity of bicyclist route choice
- Marketing / Promoting Commuter Bicycling
  - Differences in route choice preferences between experienced/inexperienced bicyclists → inform marketing strategies for promoting bicycle use

A developing country SP study by Jain, Tiwari and Zuidgeest (2010)

- Evaluate subjective cyclist safety perception by SP methodology
- A developing country case: captive rider vs. potential rider
  - Perceptions on barriers are different
- Potential users tend to regard hilly terrain as a significant barrier
- Captive cyclists prefer wide road with the possibility of faster travel
  - This finding coincides with Stinson et al's

- Unlike potential cyclists captive riders see the presence of pedestrians as a sign of higher security
- People's perception on security is also a significant factor in route or mode choice
- Also for both captive and potential users, land use mix seems to be not a major concern but higher activity mix increase the utility

Summary and further research

- Perceptions on cycling safety might differ across socio-economic classes as well as cyclist characteristics
- Actual safety might be different from perceived safety
- Policy measures aimed at increasing cycling safety should consider different cycling modal share (cyclist presence) among countries and cities

- Policy recommendations should reflect country or city specific characteristics regarding transport infrastructure and land use planning

  - Country specific empirical analysis is required for better evidence based policies

Thank you!

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