Choice with multiple alternatives

Derivation of the logit model

Michel Bierlaire

Introduction to choice models

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

The choice set

For all $i \in \mathcal{C}_n$

$$U_{in} = V_{in} + \varepsilon_{in}$$

- What is $\mathcal{C}_n$?
- What is ε_{in}?
- What is V_{in}?

Choice set

Universal choice set

- All potential alternatives for the population
- Restricted to relevant alternatives

Mode choice

- driving alone
- sharing a ride
- taxi
- motorcycle
- bicycle
- walking
- transit bus
- rail rapid transit

Choice set

Individual's choice set

- No driver license
- No auto available
- Awareness of transit services
- Transit services unreachable
- Walking not an option for long distance

Mode choice

- ~~driving alone~~
- sharing a ride
- taxi
- motorcycle
- bicycle
- ~~walking~~
- ~~transit bus~~
- rail rapid transit

Choice set

Choice set generation is tricky

- How to model "awareness"?
- What does "long distance" exactly mean?
- What does "unreachable" exactly mean?

We assume here deterministic rules

- Car is available if n has a driver license and a car is available in the household
- Walking is available if trip length is shorter than 4km.

Availability conditions

$$\delta_{in} = \left\{ \begin{array}{ll} 1 & \text{if } i \in \mathcal{C}_n, \\ 0 & \text{otherwise.} \end{array} \right.$$

Choice model

$$P_n(i|\mathcal{C}_n) = P_n(i|\delta_n, \mathcal{C}) = \Pr(U_{in} + \ln \delta_{in} \geq U_{jn} + \ln \delta_{jn})$$