Independence of Irrelevant Alternatives: IIA (Luce, 1959)

IIA is the most important limitation of the standard logit model. It simply states that the ratio of probabilities of selecting two goods is independent of the attributes of the other alternatives in J. This is a consequence of the large tractibility of the model

The Odds Ratio: P_{ij}/P_{is}, the ratio of probabilities

$$P_{ij} = \frac{e^{V_{ij}}}{\sum e^{V_{ij}}} \quad \therefore \quad P_{ij}/P_{is} = e^{V_{ij}} / e^{V_{is}}$$

⇒ The odds ratio is independent of the number and characteristics of other alternatives (attributes not characteristics) → characteristics refers to individuals, attributes to products

This is highly restrictive. If there is a change we get Proportional Substitution

Tractability of Logit

↓

IIA

↓

Proportional Substitution

ie. Constant Elasticities

Relevant when the choice set changes or the attributes of the irrelevant good change (P changes)

Two Busses

Two busses is a classic example of why IIA is awful. This shows why vanilla logit is a bit shit... Some question if it even represents any behaviours

Consider... A car and blue bus are available as modes of transport. They have an equal probability of being chosen s.t. the odds ratio = 1. A red bus now is added to the choice set s.t. the two busses are perfect substitutes

Expectation: The probability of the car should remain the same and the probability of each bus fall to 1/4

Logit: The odds ratio between the blue bus and car must stay 1, therefore the probability of all falls to 1/3. Weird consumer behaviour

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Solutions To IIA: More complex models permitting flexible preferences

- Mixed Logit (Random Coefficient Models)
- Models that allow for correlation amongst the error terms, such as MNP
- Nested Logit (allowing for correlation between choices)

→ All of these extensions are from McFadden