Module 3: Estimating Demand with Market Level Data

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Econ 771

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Basics of Discrete Choice

Setup

Indirect utility of person i,

$$u_{ij} = x_{ij}\beta + \epsilon_{ij},$$

where x_{ij} denotes person (and perhaps product) characteristics and ϵ_{ij} denotes an error term.

- Standard logit: one choice, $j = 0, 1$
- Multinomial logit: many possible choices, $j = 0, 1, \ldots, J$

Logit terminology

A few different terms for very similar models:

- Multinomial Logit
- Conditional Logit
- "Mixed" Logit

Multinomial

- Individual covariates only
- Alternative-specific coefficients

$$u_{ij} = x_i \beta_j + \epsilon_{ij},$$

such that

$$p_{ij} = \frac{e^{x_i \beta_j}}{\sum_k e^{x_i \beta_k}}$$

Conditional

Allow for alternative-specific regressors, such that

$$u_{ij} = x_{ij}\beta + \epsilon_{ij}$$

Mixed

Allow for individual and alternative-specific regressors, such that

$$u_{ij} = x_{ij}\beta + w_i\gamma_j + \epsilon_{ij}$$

but people sometimes use "mixed" to refer to random-coefficients logit

Does it matter?

These are really all the same and it's just a matter of specification (e.g., interact individual covariates with product characteristics or with product dummies). I'll refer to them as "multinomial" logit.

The Indepenence of Irrelevant Alternatives

Fundamental issue with logit models...the ratio of choice probabilities for j and k does not depend on any other alternatives:

$$\frac{P_{ij}}{P_{ik}} = \frac{e^{V_{ij}}}{e^{V_{ik}}}.$$

Relaxing IIA

- This is really an omitted variables problem...with enough interactions, we can allow for a sufficiently rich substitution pattern
- Alternatively, relax assumptions on the error term with nested logit or random-coefficient logit (or multinomial probit)

Discrete Choice with Market Data

Setup

Utility of individual i from selecting product j is

$$U_{ij} = \delta_j + \epsilon_{ij},$$

where $\delta_j = x_j\beta + \xi_j$, and ξ_j represents the mean level of utility derived from unobserved characteristics.

Estimating with market shares

- Standard logit imposes cross-price elasticities that are proportional to market shares (limited substitution patterns)
- Relax with nested logit or random-coefficients logit
- For details, see Berry (1994) or come talk to me