Labor supply models

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Ambition for lecture

• Give a brief over structural labor supply models
• Specifically focus on the discrete choice model established to serve Norwegian policy-makers (LOTTE-Arbeid)
• Reading: Dagsvik, Jia, Kornstad and Thoresen (2012)
• More technical survey: Blundell, MaCurdy and Meghir (2007). Chapter 69, Handbook of Econometrics
Structural vs quasi-experimental

• Structural modeling versus results derived from quasi-experimental research designs discussed recently

• Not always clear distinction between them

• Structural model advantageous (needed?) for policy-making
Some important dimensions in labor supply

- Static versus dynamic labor supply models
- Structural vs quasi-experimental evidence
- Extensive versus intensive margin
- Unitary family
The standard textbook approach

The agent derives utility from consumption \((C)\) and leisure \((1-h)\) and maximize

\[
U = v(C, h)
\]

given a budget constraint

\[
C = wh + Y - \tau(I)
\]
Hausman approach for non-linear budget set

Utility maximization implies solutions for hours of work

\[ h_i = (w'(h), y(h), X, \varepsilon) \]

Can be specified in terms of a linear uncompensated labor supply function

\[ h_i = \alpha + \beta w'_i(h) + X_i \gamma + \delta y(h) + \varepsilon_i, \]

Marginal wage, \( w'_i(h) \)

Virtual income, \( y(h) \)

Individual characteristics, \( X_i \)

Random error term, \( \varepsilon_i \)

Unknown parameters, \( \alpha, \beta, \gamma, \delta \)
Virtual income
Estimation of the Hausman model

Individual maximizes $U = v(C, h)$

subject to

$C = y_1$, if $h = 0$,

$C = w_1'h + y_1$, if $H_0 < h < H_1$,

$C = w_2'h + y_2$, if $H_1 < h < H_2$,

etc
Hausman model: estimation issues

• Maximum likelihood estimation to obtain $\alpha, \beta, \gamma, \delta$
• Instrumental variables
• Measurement errors in working hours $h$
• Functional form
Hausman approach is close to theory

- Based on marginal criteria
- Slutsky equation applies

\[ \eta_{h,w}^M = \eta_{h,w}^H + \eta_{h,y} \]

\[ \eta_{h,w}^H = \frac{w \frac{\partial h^H}{\partial w}}{\frac{\partial h}{\partial w}} > 0 \]

\[ \eta_{h,y} = w \frac{\partial h}{\partial y} \leq 0 \]
But less used by practitioners recently

• Several papers by Hausman and co-authors around 1980.
• Complicated to use on real world tax systems
• Also
  – The focus on working hours as the main choice variable is a simplification
Discrete choice labor supply model

• Discretized sets of feasible hours
• Stochastic utility representations departing from the theory of random utility (McFadden, 1984)
  – Comparison of utility across choice alternatives
  – Lack of information for the econometrician or essential non-rationality at the economic agent level
• Assumption on the distribution of the error term
  – type III standard extreme value distributed
• Elasticities obtained from simulations
Conventional discrete choice model
(van Soest, 1995)

\[ U(C, h) = v(C, h) + \eta(C, h) \]

\[ C = f(h|w, I) \]

\[ \tilde{U}(h) \equiv U(f(hw, I), h) = v(f(hw|I), h) + \eta(f(hw, I), h) = \psi(h) + \tilde{\eta}(h) \]
Probability that the agent will supply $h$ hours from a finite set of options ($D$)

\[
p(h) = P(\tilde{U}(h) = \max_{x \in D} \tilde{U}(x)) = \frac{\exp(\psi(h))}{\exp(\psi(0)) + \sum_{x \in D} \exp(\psi(x))}
\]

\[
p(h) = \frac{\exp(\psi(h) + \gamma(h))}{\exp(\psi(0)) + \sum_{x \in D} \exp(\psi(x) + \gamma(x))}
\]
The job choice model

• Job choice is the fundamental decision variable

• Job characterized by
  – Wage
  – Working hours
  – Nonpecuniary attributes

• Straightforward to account for availability constraints
Job choice model includes $B$, set of possible jobs

\[ P(v(f(hw, I), h) + \epsilon(z) = \max_{x \in D \cup \{0\}} \max_{k \in B(x)} (v(f(xw, I), x) + \epsilon(k))) \]

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\[ = \frac{\exp(\psi(h))}{\sum_{x \in D} \sum_{z \in B(x)} \exp(\psi(x)) + \exp(\psi(0))} \]
The probability that the agent shall choose any job within $B(h)$

$$
\varphi(h) = \sum_{z \in B(h)} \frac{\exp(\psi(h))}{\sum_{x \in D, z \in B(x)} \exp(\psi(x)) + \exp(\psi(0))} = \frac{\exp(\psi(h))m(h)}{\exp(\psi(0)) + \sum_{x \in D} \exp(\psi(x))m(x)}
$$
$g(h)$ is the fraction of jobs available to the agent with working hours $h$

$$
\theta = \sum_{x \in D} m(x) \quad \text{and} \quad g(h) = \frac{m(h)}{\theta}
$$

$$
\psi(h) + \log g(h) = v(f(hw, I), h) + \log g(h)
$$
Empirical specification issues

• Simplifying by assuming individual specific wage
  – Not job-specific wages
• Random effects in wage loosens the somewhat restrictive form (IIA property)
Box-Cox functional form

\[ v(C, h) = \frac{\gamma(C^\alpha - 1)}{\alpha} + \frac{\delta((M - h)^\beta - 1)}{\beta} + \frac{\mu(C^\alpha - 1)((M - h)^\beta - 1)}{\alpha \beta} \]
Model performance, married males

Figure 1. Predicted and Observed Distributions of Hours of Work for Married Men.
Model performance, married females

Figure 2. Predicted and Observed Distributions of Hours of Work for Married Women.
Model performance, disposable income

Figure 3. Observed and Predicted Distributions of Disposable Income for Married Couples.
Summary

• Hausman approach complicated to use in practice
• Marginal criteria appealing
• Conventional discrete choice model (van Soest) popular among practitioners
• Job choice model provides more realistic decision model
• LOTTE-Arbeid (Statistics Norway) use job choice model
• Static models – policy issues may have important dynamic effects