Motivation

• Individuals with different characteristics may show different treatment responses and there have been empirical studies manifesting heterogeneity in responses.
• Most welfare programs are designed to support certain groups of people. If "who benefits" from such programs could be recovered from data, this would be informative in judging whether the targeted groups by the policy actually benefit from it.
• The signs of individual specific treatment effects would be informative in investigating distributional consequences of any treatment or intervention. We can tell who benefits by identifying the signs of the treatment effects when "who" is indicated by individuals' characteristics.
• Despite the usefulness measuring individual-specific causal effects is not a simple issue because of the missing data problem. In this paper a nonparametric econometric model is proposed and that the signs of individual-specific causal effects of a discrete treatment can be identified. is known

Alternative ways of recovering heterogeneity

I. Potential outcomes approach – Causal Effects are measured by the difference between the counterfactual outcomes

• Quantile Treatment Effects (QTE) – No causal interpretation

II. Structural approach – Ceteris paribus effect of a discrete endogenous variable is measured by partial difference of a structural function

Local Selection Response Match (LSRM) model

• Restriction EX : Triangularity / Monotonicity / IV

W = h(1, U), Y = g(Z, V),
with $g(z, r) = y^r Z u^r | v \leq P_z(u_v)$,
and $u \in \{1, 2, ..., M - 1\}, U \in V = Unif[0, 1]$

• RC (Rank Condition) : There exist instrumental values of $Z$, $(z_0, z_1)$ such that $P_{\mu}(z_1) \geq P_{\mu}(z_0)$

• Restriction LSRM :

Identification Results

Theorem 1 : Under Restriction EX, RC, LSRM, we have the following inequality

$$\phi'(r, y, z) \leq h'(r, u) \leq \phi(r, y, z)$$

where $u = Q_{\mu_{y|x}}(y|x, z)$.

Corollary : Under Restriction EX, RC, LSRM, we have the following inequality

$$\phi'(r, y, z) \leq h'(r, u) \leq \phi(r, y, z)$$

where $u = Q_{\mu_{y|x}}(y|x, z)$.

The bounds are sharp.

Theorem 2 : Under Restriction EX, RC, LSRM, the heterogeneous treatment effects are identified by

$$B^l \leq h(1, u) - h(0, u) \leq B^h$$

The bounds are sharp.

Illustration

The impacts of Vietnam veteran status on earnings : Angrist (1990)
• Angrist (1990) : He was interested in whether Vietnam-era veterans was compensated enough for their military service.
• To measure the causal effects of veteran status on earnings Angrist used a binary IV, draft eligibility – the use of IV is motivated by the possibility that certain types of men are more likely to serve the army.
• Draft eligibility is randomly assigned by the lottery(1970-1974). The lottery assigned numbers from 1 to 365 to dates of birth in the cohorts being drafted. Men with the lowest numbers (up to a ceiling that are determined by the government) were called to serve.
• W : annual earnings Y: veteran status Z: draft-eligibility (based on the draft lottery number), X-white, aged 26-29

Estimated Bounds

• Signs of treatment effects are identified

• Heterogeneity in treatment effects among the observationally same individuals (with the same observed characteristics) seem to exist.

Implications on $F_{y|x}$ from the LSRM

When the observed characteristics are similar, the veteran status shows negative impacts on those whose unobserved characteristic is high (high ranked individuals in income distribution), while the veteran status has positive impacts on the low ranked individuals in income distribution.

If we believe the LSRM restriction is true, we could derive implications on the distribution on the unobservables as the above. Those with low U, U and V are positively correlated, while those with high U, U and V are negatively correlated.