*E*conomics

*of H*uman

*C*apital

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Economics of Human Capital

Static model of educational choice

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Introduction

Figure: Motivation

Carneiro & al. (2011) Carneiro & al. (2003)

Heckman (2008) defines three policy evaluation tasks:

- ▶ Evaluating the impact of historical interventions on outcomes including their impact in terms of well-being of the treated and the society at large.

- ▶ Forecasting the impact of historical interventions implemented in one environment in other environments, including their impact in terms of well-being.

- ▶ Forecasting the impacts of interventions never historically experienced to various environments, including their impact on well-being.

Econometrics of policy evaluation

- ▶ is important

- ▶ is complicated

- ▶ is multifaceted

Numerous applications

- labor economics

- development economics

- industrial economics

- health economics

Numerous effects

- conventional average effects

- policy-relevant average effects

- marginal effects

- distributional effects

- effects on distributions

Numerous estimation strategies

▶ instrumental variables

▶ (quasi-)experimental methods

▶ matching

Model

Generalized Roy model

Potential Outcomes

$Y_1 = \mu_1(X) + U_1$

$Y_0 = \mu_0(X) + U_0$

Observed Outcome

$Y = DY_1 + (1 - D)Y_0$

Choice

$D = I[\mu_D(X, Z) - V > 0]$

Individual Heterogeneity

Individual-specific Benefit of Treatment

$$Y_1 - Y_0 = (\mu_1(X) - \mu_0(X)) + (U_1 - U_0)$$

Sources of Heterogeneity

▶ Difference in observables

▶ Difference in unobservables

  ▶ Uncertainty

  ▶ Private information

Figure: Distribution of benefits
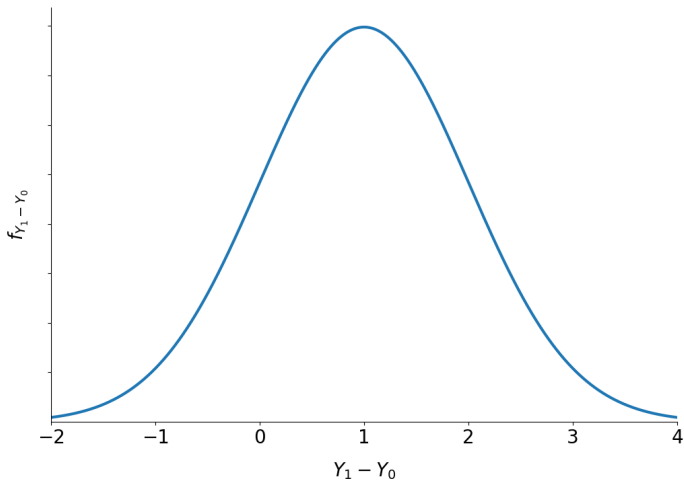
Econometric problems

- ► **Evaluation problem**, we only observe an individual in either the treated or untreated state.

- ► **Selection problem**, individuals that select into treatment differ from those that do not.

Essential Heterogeneity

Definition: Individuals select their treatment status based on gains unobservable by the econometrician. More formally,

$$Y_1 - Y_0 \not\perp\!\!\!\perp D \quad | X = x.$$

$\Rightarrow$ consequences for the choice of the estimation strategy

Objects of interest

Useful Notation

$$P(X, Z) = \Pr(D = 1 \mid X, Z) = F_V(\mu_D(X, Z))$$
$$U_D = F_V(V)$$

▶ V is unobserved and captures the individual's dislike of treatment.

Figure: First-stage unobservable
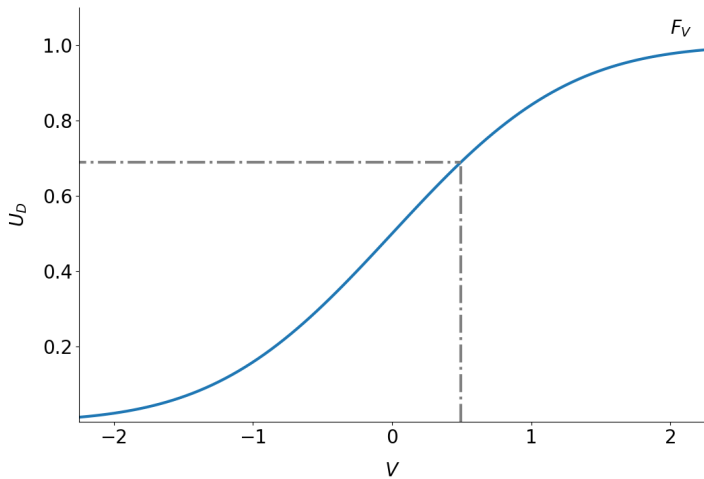
Figure: Support
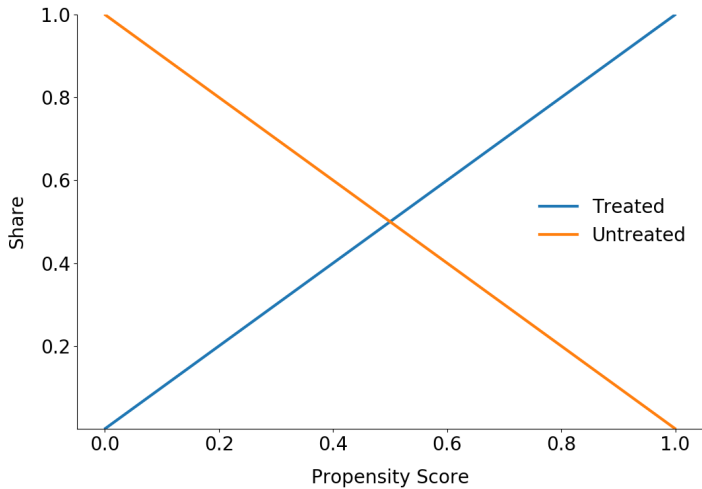
Figure: Distribution of benefits
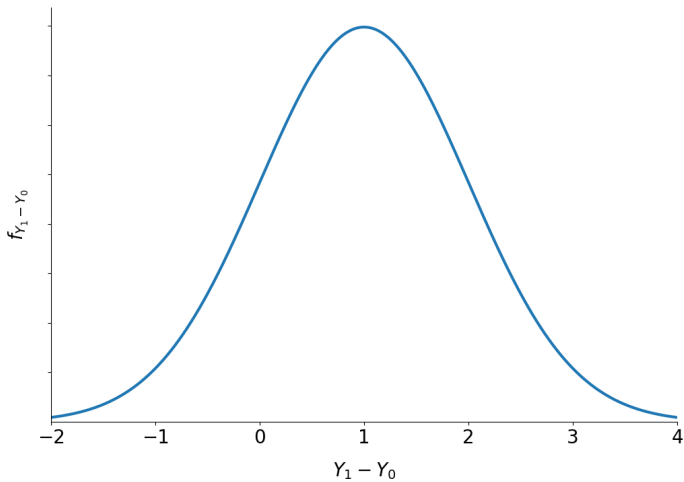
Figure: Conditional expectation and essential heterogeneity
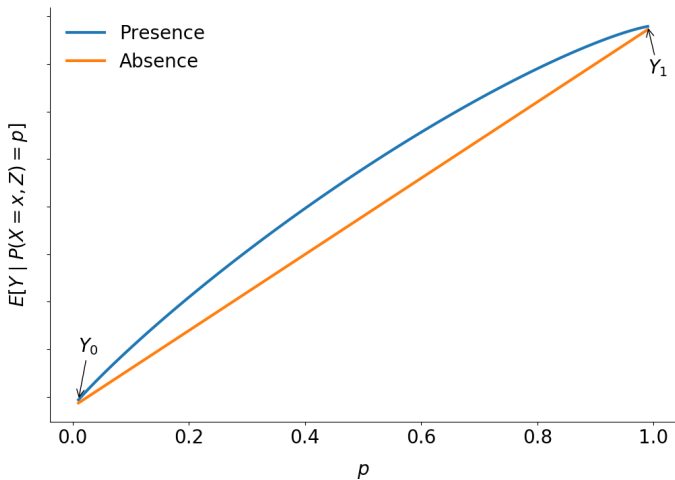
Conventional Average Treatment Effects

Conventional Average Treatment Effects

$$B^{ATE} = E[Y_1 - Y_0]$$
$$B^{TT} = E[Y_1 - Y_0 \mid D = 1]$$
$$B^{TUT} = E[Y_1 - Y_0 \mid D = 0]$$

$\Rightarrow$ correspond to *extreme* policy alternatives

Selection Problem

$$E[Y \mid D = 1] - E[Y \mid D = 0] = \underbrace{E[Y_1 - Y_0]}_{B^{ATE}}$$

$$+ \underbrace{E[Y_1 - Y_0 \mid D = 1] - E[Y_1 - Y_0]}_{\text{Selection on gains}}$$

$$+ \underbrace{E[Y_0 \mid D = 1] - E[Y_0 \mid D = 0]}_{\text{Selection on levels}}$$

$$E[Y \mid D = 1] - E[Y \mid D = 0] = \underbrace{E[Y_1 - Y_0 \mid D = 1]}_{B^{TT}}$$

$$+ \underbrace{E[Y_0 \mid D = 1] - E[Y_0 \mid D = 0]}_{\text{Selection Bias}}$$

$\Rightarrow$ the bias depends on the parameter of interest

Figure: Distribution of effects with essential heterogeneity
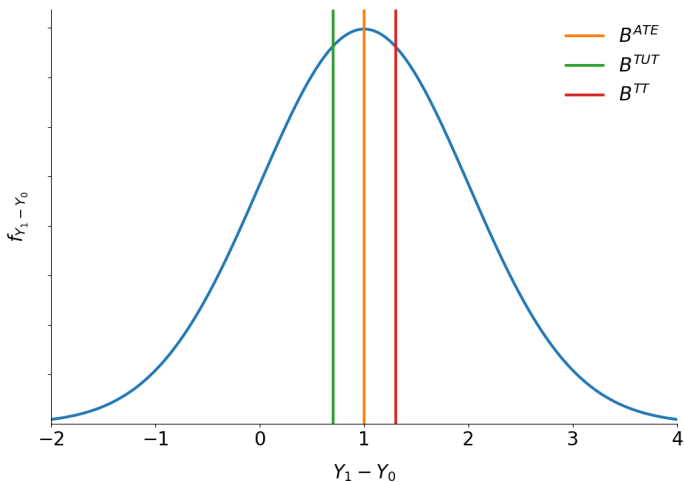
Figure: Distribution of effects without essential heterogeneity
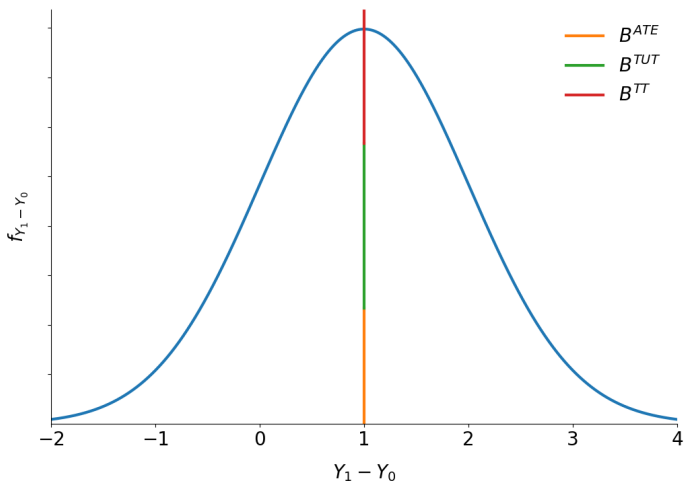
Policy-Relevant Average Treatment Effects

Observed Outcomes

$$Y_B = D_B Y_1 + (1 - D_B) Y_0$$
$$Y_A = D_A Y_1 + (1 - D_A) Y_0$$

Effect of Policy

$$B^{PRTE} = \frac{1}{E[D_A] - E[D_B]} (E[Y_A] - E[Y_B])$$

Marginal Benefit of Treatment

Marginal Benefit of Treatment

$$B^{MTE}(x, u_D) = E[Y_1 - Y_0 \mid X = x, U_D = u_D]$$

Intuition: Mean gross return to treatment for persons at quantile u_D of the first-stage unobservable V or a willingness to pay for individuals at the margin of indifference.

Figure: Margin of indifference
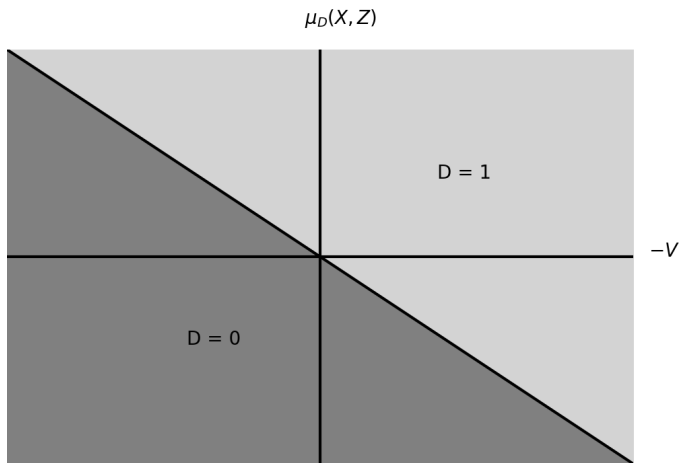
Figure: B^{MTE} and essential heterogeneity
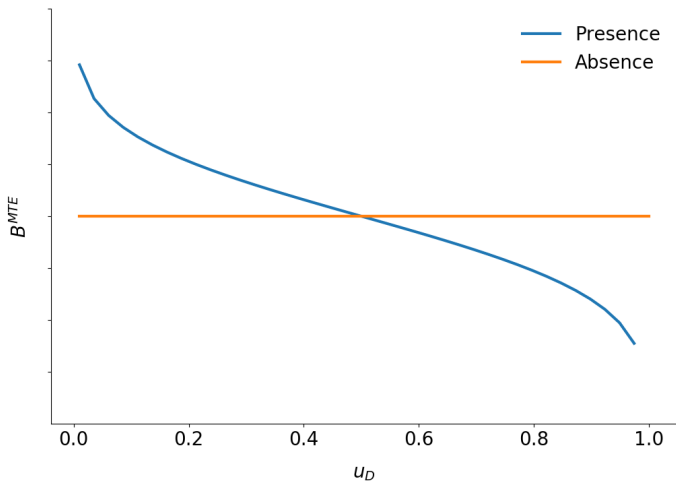
Effects of treatment as weighted averages Parameter Δ_j, can be written as a weighted average of the $B^{MTE}(x, u_D)$.

$$\Delta_j(x) = \int_0^1 B^{MTE}(x, u_D)\omega^j(x, u_D)du_D,$$

where the weights $\omega^j(x, u_D)$ are specific to parameter j and integrate to one.

Weights

$$\omega^{ATE}(x, u_D) = 1$$
$$\omega^{TT}(x, u_D) = \frac{1 - F_{P|X=x}(u_D)}{E[P \mid X = x]}$$
$$\omega^{TUT}(x, u_D) = \frac{F_{P|X=x}(u_D)}{E[1 - P \mid X = x]}$$

Figure: Effects of treatment as weighted averages

Local Average Treatment Effect

Local Average Treatment Effect

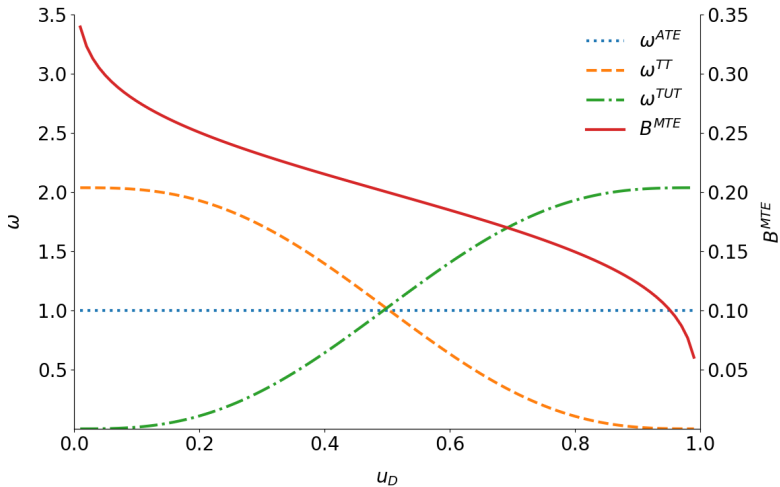- **Local Average Treatment Effect:** Average effect for those induced to change treatment because of a change in the instrument.

  ⇒ instrument-dependent parameter

- **Marginal Treatment Effect:** Average effect for those individuals with a given unobserved desire to receive treatment.

  ⇒ deep economic parameter

$$B^{LATE} = \frac{E[Y \mid Z = z] - E[Y \mid Z = z']}{P(z) - P(z')}$$

$$B^{LATE}(x, u_D, u_{D'}) = \frac{1}{u_D - u_{D'}} \int_{u_D}^{u_{D'}} B^{MTE}(x, u)du,$$

Figure: Local average treatment effect
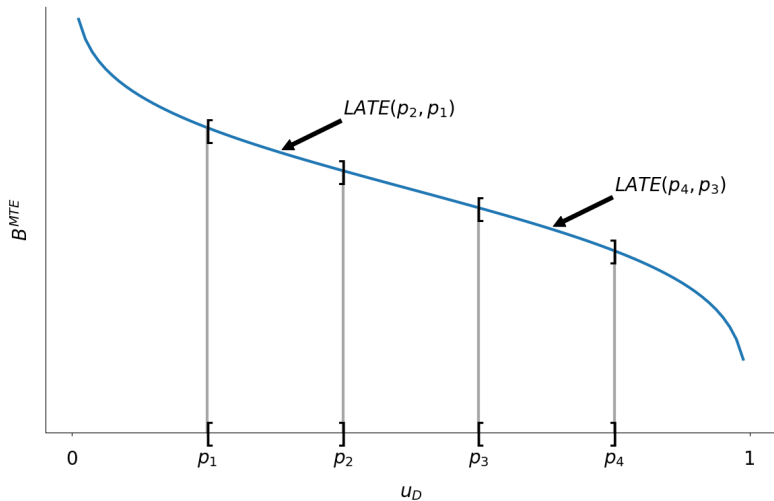
Distributions of Effects

Distrbutions of Effects

- ▶ marginal distribution of benefits

- ▶ joint distribution of potential outcomes

- ▶ joint distribution of benefits and surplus

Figure: Distribution of benefits

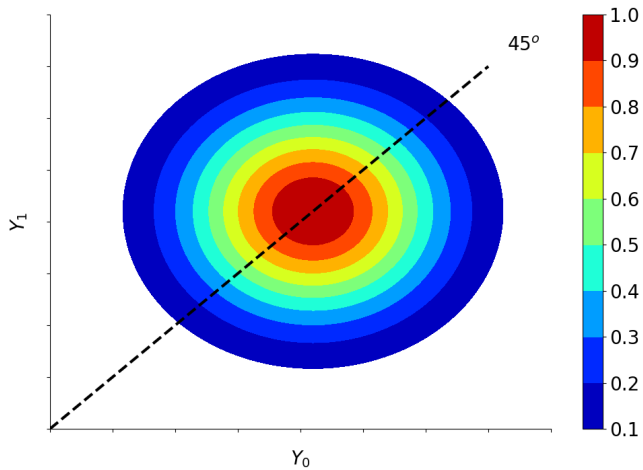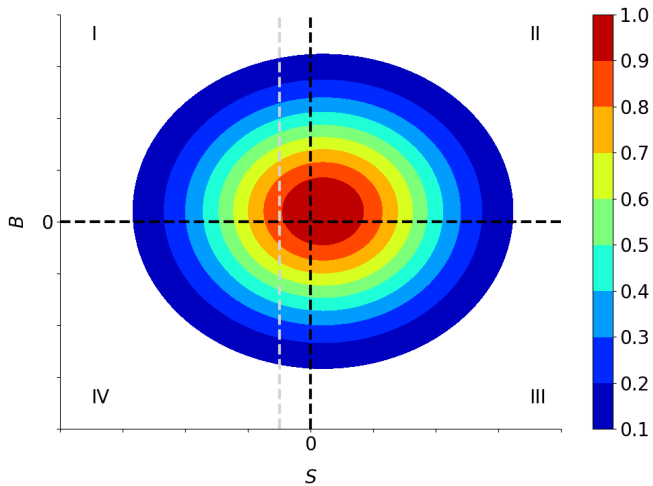Figure: Distribution of potential outcomes

Figure: Distribution of benefits and surplus

Conclusion

Appendix

References

Becker, G. S. (1964). *Human capital* (1st ed.). New York City, NY: Columbia University Press.

Heckman, J. J. (2008). Schools, skills, and synapses. *Economic Inquiry*, *46*, 289–324.