The Fundamental Evaluation Problem and its Solution

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The Evaluation Problem

1. Evaluation Problem
2. Treatment Effects
3. Selection Bias
4. Solution Approaches

Hagen, Tobias und Bernd Fitzenberger (2004), Mikroökonometrische Methoden zur Ex-post-Evaluation, in: Hagen, Tobias und Alexander Spermann, *Hartz-Gesetze – Methodische Ansätze zu einer Evaluierung,* ZEW-Wirtschaftsanalysen, 74, S.45-72

1. Evaluation Problem – Example

Example:
Evaluation of programs of active labour market policy (e.g. job creation measures)

→ Investigation of a program's effect on a certain outcome variable (e.g. the employment probability)

1. Evaluation Problem – Example

Measurement of the program‘s success by the share of individuals entering employment during a certain period of time is not sufficient.

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Problem:
The causal effect of the program is not measured – employment take-up could happen without program participation

1. Evaluation Problem – Example

Causal effect:

Employment probability of participants versus employment probability of participants had they not participated

Problem:
„counterfactual situation“ – participants cannot simultaneously be non-participants!

1. Evaluation Problem – Example

Solution:

Estimation of the hypothetical employment probability participants in case of non-participation by using the employment probability for non-participants.

Use of a „comparison or control group“, to be able to estimate the success of participation.

1. Evaluation Problem – Example

In case <u>participants and control group</u> differ with respect to observable or non-observable characteristics that do have an influence on outcome variables

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Selection Bias

Question:
What is the effect of a program on the outcome variable y?

y_1: Outcome variable in case of participation

y_0: Outcome variable in case of non-participation

C : Dummy variable, set to 1 in case of participation

The <u>actual observed outcome variable</u> for an individual *i* results from:

$$y_i = y_{0i} + C_i(y_{1i} - y_{0i})$$

The program is:

$$y_{1i} - y_{0i}$$

Problem:

It is not possible to calculate an individual causal effect.

No individual can be in two different states of participation at the same point in time.

2. Treatment Effects

However, it is possible to estimate

- The mean effect of participation on the group of participants („**Average Effect of Treatment on the Treated**" – ATT).

- The mean effect of participation expected for an individual drawn randomly from a population of participants and non-participants („**Average Treatment Effect**" – ATE).

2. Treatment Effects

$$(1)\ ATT = E[y_1 - y_0 \mid C=1] = E[y_1 \mid C=1] - \underbrace{E[y_0 \mid C=1]}_{\text{not observable}}$$

$$(2)\ ATE = E[y_1 - y_0] = E[y_1] - E[y_0]$$

$E[y_1]$ only is observable for participants and $E[y_0]$ only is observable for non-participants.
Intuition of ATT/ATE: Actual minus potential outcome of Participants

Case differentiation:

1. **Participants and non-participants („control group“) differ neither with respect to observed nor to unobserved characteristics →** consistent estimates of expected value of the outcome variable using the sample mean:

2. Treatment Effects

$$\hat{ATT} = \frac{1}{T}\sum_{C=1} y_1 - \frac{1}{NT}\sum_{C=0} y_0$$

Whereas	T:	Number of participants
	NT:	Number of non-participants

2. **Participants and non-participants differ in regard to observed and unobserved characteristics**
   → Selection Bias

$$\Rightarrow E[y_0 \mid C=1] \neq E[y_0 \mid C=0]$$

→ Difference of sample means does not lead to consistent estimators

2. Treatment Effects – homogeneous vs. heterogeneous

X-Heterogeneity: Heterogeneity of the treatment effect that can be explained by differences in observed variables.

U-Heterogeneity: Heterogeneity of the treatment effect that can be explained by differences in unobserved variables.

2. Treatment Effects – homogeneous vs. heterogeneous

Definition homogeneous treatment effect:

Treatment has the same effect on individuals with different observed attributes, i.e. no X-heterogeneity.

Measure has the same effect on individuals with different unobserved attributes, i.e. no U-heterogeneity.

Treatment effect is identical for all individuals and ATT=ATE.

2. Treatment Effects – homogeneous vs. heterogeneous

X-Heterogeneity / U-Heterogeneity:
→ Heterogeneous treatment effect
→ Selection bias

1. Selection bias due to observed variables
2. Selection bias due to unobserved variables

3. Solution Approaches I