TREATMENT EFFECTS IN ECONOMETRICS
An introductory seminar

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Treatment Effect or Policy Evaluation models are part of Causal Analysis in Econometrics. So let us ask more fundamental question, why study causality? As Judea Pearl recounts

“The answer to the question why study causation? is almost as immediate as the answer to why study statistics?

- We study causation because
  - we need to make sense of data,
  - to guide actions and policies
  - to learn from our success and failures

- We need to estimate
  - the effect of smoking on lung cancer,
  - of education on salaries,
  - of carbon emissions on the climate and many more.

Most ambitiously, we also need to understand how and why causes influence their effects.“(Pearl, J., Glymour, M., & Jewell, N. P. (2016))
What is this seminar about?

- In short it is about -
  - Treatment Effect models (or causal models) to answer very fundamental but often difficult to answer “what if” type questions.
  - Overview of basic framework and tools of causal analysis
  - Methods where we use observational data to answer causal questions.

- In first part, we see basic framework using causal graphs and randomized experiments
  - Very common in different areas such as Social Science, Computer Science, Psychology, Epidemiology and others.

- In second, we turn to new methods in Econometrics
  - Overview of some recent methods like Matching, Difference-in-Differences, Instrumental variable estimation, Regression Discontinuity Designs, etc.
  - We will first talk about identification, once it is solved we will focus on estimation and testing.
• Causal Inference

• Econometric Methods
What is causal analysis?

- In a broad sense, causal analysis is an analysis of counterfactuals.
- Counterfactuals are the *alternative state of the world that we cannot see*.
- Imagine you could go to either Harvard or Google, but you chose Harvard, what would happen if you would choose Google? Would you be more successful?
- Causal analysis tries to answer these “what if” type questions using observed data.
- Fundamental challenge - We would never know the counterfactual.
Possible Topics

- **Basic framework of causality:** Causal graphs, non-parametric identification using graphs, $d-$separation, frontdoor/backdoor criteria, counterfactuals and interventions.

- **Randomization and Classical Randomized Experiments:** Review of Rubin's causal model, selection bias, randomization, completely, stratified and paired randomized experiments.

- **Selection of Observables:** Matching, Propensity score matching and Weighting.

- **Selection of Unobservables:** Instrumental variables (IV), WALD estimators, 2SLS, LATE and heterogeneous treatment effects.

- **Panel Data Methods:** Difference-in-Differences (DD), DDD and synthetic control methods.

- **Regression Discontinuity Designs:** Sharp and fuzzy regression discontinuity designs.

- If we have interested participants we can also cover some additional and slightly advanced topics
  - Sample selection models,
  - Quantile Treatment Effect,
  - Machine Learning methods for estimating treatment effects,
  - High Dimensional Treatment Effect models, etc.
Organizational Matters: Structure, Schedules and Appointments

• Structure:
  - The seminar will be a block seminar, at the end of the semester participants have to submit a handout and give 45 minutes presentation.
  - The handouts must be submitted prior to presentations.

• Preliminary discussion
  - There will be a preliminary discussion (probably on the first week of the semester, time and place to be announced later, it can be flexible so that every interested participants can join!)
  - In preliminary discussion some topics will be given. After that, participants have to choose and work on their own topics.

• Schedules and Appointments
  - There will be an appointment with every participant before submitting the final handout.
  - If necessary it is possible to organize more.
  - The date of the presentation and handout submission will be announced later.
Seminar Works for you

- **Bachelor**
  - 30 minutes presentation
  - Submission of a handout/seminar paper
  - Actively participate and engage in discussion during the presentation

- **Master**
  - 45 minutes presentation
  - Submission of a handout/seminar paper
  - Actively participate and engage in discussion during the presentation
Send an email to hossain@statistik.tu-dortmund.de until 25.09.18
To do list

- Register in Moodle (not yet ready!).
- Read the relevant topics from the literature.
- Find a favorite topic that you are interested in.
- If you want to work with any other topic (not listed here but related to this seminar!) that is also possible, please send an email and we can talk about this.