Economics 628 : Assignment 3

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Economics 326

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Complete one of the following problems. These questions are intentionally somewhat open-ended, and one could spend a very long time working on them. If after 5 hours or so, you are not nearing a complete solution, it is okay to simply describe how far you have gotten and what difficulties you encountered.

Problem 1: Using data from a randomized experiment, conduct a similar exercise as in the slides on the PKH experiment.

- Reproduce the main results.
- Estimate group average treatment effects and best linear predictions of the conditional average treatment effect using machine learning proxies.
- If notable treatment heterogeneity is found, investigate the means of covariates conditional on groups.
- Discuss your findings.

Data from many randomized experiments can be found on journal websites. If you do not want to search for one (which admittedly is time-consuming), there are a few experimental datasets at `https://github.com/gsbDBI/ExperimentData`. Also, the classic Lalonde data on the NSW training program is available at `http://users.nber.org/~rdehejia/data/nswdata2.html`.

Problem 2: For a semiparametric model (that we have not discussed in class and is not used as an example in Chernozhukov et al. (2018)) derive a double debiased machine learning estimator. If you can't come up with an appropriate model, Chen (2007) begins with a few examples, or feel free to ask for suggestions.

- Describe the model and its original moment conditions.
- Derive an orthogonal moment condition.
- Either:
    - State primitive conditions on your model, data, and estimator for nuisance parameters such that the conditions of theorem 3.1 of Chernozhukov et al. (2018). See sections 4 and 5 of Chernozhukov et al. (2018) for examples of what I mean. As remarks 4.1 and 5.1 say, the rate conditions stated in the paper are "non-primative." Replace them with primitive conditions. For example, a more precise version of "The true function being estimated is approximately sparse with sparsity index satisfying some rate condition. We estimate with Lasso with penalty chosen in some specific way." OR
    - Simulate the model and estimation method. Compare either the performance of different machine learning methods for estimating the nuisance parameters (like I did in the notes for the partially linear model) and/or estimation based on the orthogonal or non-orthogonal moment condition.

References

Chen, Xiaohong. 2007. "Chapter 76 Large Sample Sieve Estimation of Semi-Nonparametric Models." Elsevier, 5549 – 5632. URL `http://www.sciencedirect.com/science/article/pii/S157344120706076X`.

Chernozhukov, Victor, Denis Chetverikov, Mert Demirer, Esther Duflo, Christian Hansen, Whitney Newey, and James Robins. 2018. "Double/debiased machine learning for treatment and structural parameters." *The Econometrics Journal* 21 (1):C1–C68. URL `https://onlinelibrary.wiley.com/doi/abs/10.1111/ectj.12097`.