Einladung zum Biometrischen Kolloqium

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THE MECHANICS OF OMITTED VARIABLE BIAS: BIAS AMPLIFICATION AND CANCELLATION OF OFFSETTING BIASES

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ABSTRACT:

Causal inference with observational data frequently requires researchers to estimate treatment effects conditional on a set of observed covariates, hoping that they remove or at least reduce the confounding bias. Using a simple linear (regression) setting with two confounders – one observed (X), the other unobserved (U) – we demonstrate that conditioning on the observed confounder X does not necessarily imply that the confounding bias decreases, even if X is highly correlated with U. That is, adjusting for X may increase instead of reduce the omitted variable bias (OVB). Two phenomena can cause an increasing OVB: (i) bias amplification and (ii) cancellation of offsetting biases. Bias amplification occurs because conditioning on X amplifies any remaining bias due to the omitted confounder U. Cancellation of offsetting biases is an issue whenever X and U induce biases in opposite directions such that they perfectly or partially offset each other, in which case adjusting for X inadvertently cancels the bias-offsetting effect. In this article we discuss the conditions under which adjusting for X increases OVB, and demonstrate that conditioning on X increases the imbalance in U, which turns U into an even stronger confounder. We also show that conditioning on an unreliably measured confounder can remove more bias than the corresponding reliable measure. Practical implications for causal inference will be discussed.