

R. Clifton Bailey Statistics Seminar Series

Instrumental Variable Estimation of Mann--Whitney Causal Effect in Randomized Trials With Non-Compliance

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Abstract: The instrumental variable (IV) approach is a popular and ingenious way of drawing causal inference under non-ignorable treatment. The existing literature on IV estimation has been centered around the (local) average causal effect (ACE), the difference between the expectations of potential outcomes. An alternative causal estimand, called the Mann--Whitney causal effect (MWCE), concerns the probabilities for the relative magnitude of randomly chosen potential outcomes, and has recently aroused much interest for its robustness and interpretability. Estimation of the MWCE has been studied in settings with ignorable treatment. In this talk, we consider inference of local MWCE for compliers in randomized trials with non-compliance using binary randomization status as IV. An estimator is constructed based on the estimators for the marginal distribution functions of potential outcomes and its asymptotic variance derived via the functional delta method. We also develop sensitivity bounds for the estimand when key IV assumptions, such as exclusion restriction and monotonicity, are at fault. Furthermore, we derive and compare the asymptotic relative efficiencies of hypothesis tests based on the local MWCE and local ACE and those based on intention-to-treatment analysis under simplifying conditions. The proposed methods are demonstrated through extensive simulation studies and analysis of real data from a job training program.