

Instrumental variable estimation of a Cox marginal structural model with time-varying endogenous treatments

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Abstract: Robins (1998) introduced marginal structural models (MSMs), a general class of counterfactual models for the joint effects of time-varying treatment regimes in complex longitudinal studies subject to time-varying confounding. He established the identification of MSM parameters under a sequential randomization assumption (SRA), which rules out unmeasured confounding of treatment assignment over time. The Cox marginal structural model, in particular, is one of the most popular MSMs for evaluating the causal effect of a binary exposure with a censored failure time outcome. In this paper, we consider sufficient conditions for identification of Cox MSM parameters with the aid of a time-varying instrumental variable, when sequential randomization fails to hold due to unmeasured confounding. Our identification conditions essentially require that no interactions between unmeasured confoundings and the instrumental variable in its additive effects on the treatment, the longitudinal generalization of the identifying condition of Wang et al. (2018). Our approach is illustrated via extensive simulation studies and real data example.