Abstract:
The papers by Efron (1979, Annals of Statistics) and Rubin (1978, Proceedings of the ASA) are generally regarded as the birth of the bootstrap method and multiple imputation (MI), respectively. The proximity of their births is perhaps not entirely coincidental, and indeed over the years there has been some confusion over their similarities and differences. Both rely on the principle of replications to assess statistical variability, are conceptually deep for specialists yet appealing for users, and require intensive computation (though for different parties). The bootstrap, however, has been used mainly for “one-party inference” and typically requires a large number of joint replications, namely, the entire sample needs to be replicated. In contrast, MI is primarily designed for “two-party inference” in the context of dealing with incomplete data: the imputer being one party and any potential user being the other. Furthermore, MI often only requires a small number of replications (i.e., imputations), because of its reliance on conditional replications (i.e., conditioning on the observed data) and on a key ANOVA-type variance decomposition. The decomposition can be justified from three different perspectives: Bayesian, likelihood, and design-based, when the two parties are congenial to each other. However, when the two parties are uncongenial toward one another, the story becomes considerably more intriguing ...