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Standard Error Estimation in the Local Structural-After-Measurement (LSAM) Approach

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Abstract

Accurate estimation of standard errors (SEs) is essential in structural equation modeling (SEM) as it quantifies the uncertainty of parameter estimates, plays a critical role in computing test statistics and p-values, and ensures robust inferences about population parameters. While standard SEM typically relies on a joint or "system-wide"estimation approach, the Local Structural-After-Measurement (LSAM) framework separates the estimation of the measurement and structural parts. Despite the increasing attention to LSAM's potential in SEM, prior studies have primarily focused on point estimates, leaving the behavior and accuracy of SEs within this framework underexplored. This study addresses this gap by evaluating SE estimation in the LSAM framework under challenging research conditions, including nonnormal data, smaller sample sizes, and model misspecification.

Two simulation studies were conducted to assess the performance of various SE estimation methods within the LSAM framework. The methods included analytic approaches, such as two-step estimation, and resampling-based methods, including parametric and nonparametric bootstrapping. Study 1 investigated a two-factor SEM, focusing on misspecification in the measurement model, while Study 2 expanded the model by incorporating observed exogenous and endogenous variables and introducing misspecification in the structural model. The simulations varied conditions such as normality versus nonnormality, correctly specified versus misspecified models, and sample sizes ranging from small to large.

The results showed that the nonparametric bootstrap excelled under nonnormal data, providing near-unbiased SE estimates regardless of model specification. The parametric bootstrap produced minimal bias under normal conditions across all sample sizes, even when models were misspecified. Analytic two-step method was effective under normal conditions but exhibited higher variability under nonnormal data, particularly in smaller samples and misspecified models.

By incorporating both parametric and nonparametric bootstrapping, this study offers new insights into the potential benefits and limitations of resampling-based SE methods within LSAM. Our findings emphasize the robustness of LSAM methods for SE estimation, particularly in research contexts characterized by data nonnormality, small sample, and potential model misspecification. Furthermore, this study expands LSAM' s utility beyond point estimates to SE estimation, offering valuable implications for researchers working in less-than-ideal conditions.

Keywords

standard errors, local structural-after-measurement approach

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