Contribution ID: **128** Type: **Oral Presentation**

What Do We Not Know About Small Sample Performance of AR(1) Models?

Friday 25 July 2025 09:30 (15 minutes)

Oral presentation

What Do We Not Know About Small Sample Performance of AR(1) Models?

Author

Zhiwei Dou (zhiwei.dou@kuleuven.be), Sigert Ariens (sigert.ariens@kuleuven.be), Eva Ceulemans (eva.ceulemans@kuleuven.be), Ginette Lafit (ginette.lafit@kuleuven.be)

Affiliation

Quantitative Psychology and Individual Differences, Department of Psychology and Education Sciences, KU Leuven, Leuven, Belgium; Methodology of Educational Sciences, Department of Psychology and Education Sciences, KU Leuven, Leuven, Belgium

Abstract

Single case experimental designs and experience sampling methods are state-of-the-art designs to study psychological processes. These designs yield time series of data, which are commonly analyzed using first-order autoregressive [AR(1)] modeling. In the AR(1) model, a variable is a function of its own value at the previous time point (i.e., autoregressive effect). It is crucial that researchers estimate the model parameters accurately. Nevertheless, estimating and performing inference on AR effects is not straightforward in small-sample settings. This is important for psychological scientists, who are faced with a number of constraints which make small-sample issues particularly relevant for the field. The Ordinary Least Square (OLS) estimator is the conventional and one of the most popular methods for estimating the autoregressive effect. In this talk, we will start with showing that OLS estimator is asymptotically consistent but downward biased due to the violation of the strict exogeneity assumption (Hamilton, 1994). We argue that alternative estimation methods do not resolve the exogeneity issue and thus fail to address small-sample bias. In addition, we demonstrate that in the AR(1) model, estimators of the intercept \hat{\alpha} and the AR effect \hat{\rho} are correlated, leading to bias in the intercept estimator when \alpha\neq0.

Consequently, small sample bias in the AR effect estimator can inflate power and increase Type I error in intervention studies, particularly when the study design is imbalanced. To help with a better power/Type I error rate, we propose two correction methods for improving the accuracy of OLS estimators in such settings.

Keywords

small sample bias;autoregressive models;

Primary authors: DOU, Zhiwei; Dr ARIENS, Sigert (KU Leuven); LAFIT, Ginette (KU Leuven); Prof. CEULEMANS, Eva (KU Leuven)

Presenters: DOU, Zhiwei; Dr ARIENS, Sigert (KU Leuven); LAFIT, Ginette (KU Leuven); Prof. CEULEMANS, Eva (KU Leuven)

Session Classification: Session 5 : ”Bayesian methods in Psychology and Statistics”

Track Classification: Statistical analyses: Statistical analyses