TS11: Thematic Session: Advances in Inference and Modeling: formal and computational aspects

Thursday 3 July, 11:00–12:28 • Room 106

Carlos A. Coelho (NOVA University of Lisbon)

Time: 11:00–11:22

A likelihood Ratio Test for High-dimensional Sphericity based on a Dual Approach

What may clearly be taken as a likelihood ratio test for the hypothesis of sphericity and the hypothesis of multiple sphericity, where we test simultaneously the equality of several covariance matrices and their sphericity is obtained using a dual approach, where the roles of variables and observations appear switched. The exact distribution of the test statistic is obtained and sharp near-exact distributions are also developed, with no need for any assumptions on either the sample size (n) or the number of variables (p), other than that n<p. A simulation study shows the perfect adequacy of the test, with a full Type I error control, very good power and its suitability to handle different underlying distributions, even skewed and heavy tailed ones.

Luís M. Grilo (University of Évora)

Time: 11:22–11:44

Estimator-Related Matrix Issues in Structural Equation Modeling with Ordinal Data

Survey questionnaires often include items measured on ordinal scales, such as Likert-type questions, which produce data that do not follow a multivariate normal distribution. Additionally, these surveys are frequently based on small sample sizes, presenting challenges for the estimation of structural equation models (SEM) using the Maximum Likelihood (ML) method, which relies on the Pearson correlation matrix and assumes normality and continuous variables. To address these limitations, the Diagonally Weighted Least Squares (DWLS) estimator is often employed in SEM involving ordinal or nonnormally distributed data. DWLS utilizes polychoric (or polyserial) correlations and simplifies computation by using only the diagonal elements of the weight matrix, thereby improving computational efficiency and numerical stability, especially with small to moderate samples. However, DWLS still has vulnerabilities: it can be sensitive to small samples, model misspecification, and in some implementations, requires large samples for accurate estimation of polychoric correlations. In certain situations, issues such as non-invertibility of the information matrix or a non-positive definite variance-covariance matrix (negative eigenvalues) may arise, potentially indicating problems like model non-identification. An alternative estimator, consistent Partial Least Squares (PLSc), has gained attention for both exploratory and confirmatory research. Although originally designed for continuous data, PLSc has demonstrated strong performance with ordinal data, especially under conditions of small sample sizes and nonnormal distributions. A comparative statistical analysis was conducted using case studies to evaluate the performance of DWLS and PLSc. The findings suggest that PLSc is a viable and sometimes preferable alternative when DWLS proves unsuitable.

Filipe J. Marques (NOVA University of Lisbon)

Time: 11:44–12:06

Tests for Complete Independence under Structured Covariance Assumptions

This work addresses the problem of testing for complete independence under specific covariance assumptions. We consider the likelihood ratio test (LRT) for complete independence, the LRT to test between the sphericity and compound-symmetry structures, and a chi-squared test, the latter of which can be used in high-dimensional scenarios. The properties of these tests are evaluated through a simulation study, with particular emphasis on bias and power. Furthermore, we study the reproducibility probability of these tests using a parametric bootstrap procedure.

Marco André da Silva Costa (University of Aveiro)

Time: 12:06–12:28

Improving Parameter Estimation in State-Space Models via Double-Iterated GMM

This communication presents a new bias-corrected estimation method for state-space models: the double-iterated Generalized Method of Moments (GMM2i). Unlike traditional estimators such as maximum

likelihood (ML), which rely on strong distributional assumptions and may perform poorly in small samples or under model misspecification, GMM2i uses moment conditions and Kalman filter predictors to iteratively reduce bias. Its performance is assessed through simulations, in comparison with ML and a hybrid maximum likelihood method (h-ML). Results indicate that h-ML reduces bias in autoregressive parameter estimates, while GMM2i outperforms ML in small-sample, high-variance scenarios. A real-data application supports these findings, with h-ML achieving the lowest standardized mean squared error (MSSE), and all methods providing similar confidence intervals, confirming their robustness.
