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Программа дисциплины

Measurement invariance (Инвариантность измерений)

для направления 040100.68 «Социология» подготовки магистра
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Measurement invariance: Measurement Models and Scale Construction with LAVAAN for comparative social research

Course description

In recent years both a growing number of cross-cultural datasets like the World Value Study or the European Social Survey have been available but also a growing awareness to problems connected with cross-cultural comparisons have been discussed. In particular, researchers have realized that measurement invariance is a necessary precondition for a meaningful comparison of data across cultures or countries. This refers to comparisons of means of items and scales, correlations, and regression coefficients and is also a prerequisite for a multi-level analysis. This course provides an explanation what measurement invariance is and offers a guide to help participants interested in testing for measurement invariance. We deal with six main issues that have to be addressed by researchers while testing for measurement invariance. The first issue concerns the level of measurement invariance to be tested (configural, metric or scalar), the second – the type of data used (continuous or ordinal-categorical), the third – choice of rules to evaluate whether measurement invariance is established, the fourth – decision whether one permits for cross-loadings and correlated measurement errors, the fifth – the scope of measurement invariance (full or partial), and the sixth – the accuracy of invariance that needs to be established (exact or approximate). We describe possibilities to address these issues and formulate recommendations for applied researchers. All topics are dealt with data from the European Social Survey using the attitude toward immigration scale and the value scale. The basic statistical tool is multiple group confirmatory factor analysis for metric and ordinal data. For every topic we will have beside the lecture a practical session, where the participants have to specify and test a model with data from the ESS. As a Computer program we use the freely accessible computer program LAVAAN based on R. The course is expected to be held in computer class.

Course Outline

Day 1

Lecture

Overview and learning goals for the whole course. Causality and empirical research, notation, the generalized latent variable model and different types of models, theory testing, measurement models and confirmatory factor analysis. Scale Construction: composite scores and exploratory factor analysis. Weaknesses of Cronbach's ALPHA. use of the LAVAAN manual, LAVAAN graphical input, example from SEMNET and Discussion of the Course material. Theoretical Exercises 1-3.

Seminar

PRACTICAL SESSION: LAVAAN and the logic of its use including graphical input. Type pe of INPUT FILES. Confirmatory Factor Analysis (CFA) with one measurement model. Preparation of **EXAMPLE 1a:** (Input File: NL2.dat). Congeneric Model of Tradition and Conformity value with four indicators and default identification by first item loading setting to 1. Computation and Output interpretation of model 1a. Model-Modification. **EXAMPLE 1b:** (same Input File) Congeneric Model of Tradition and Conformity value with four indicators and identification by setting the



variance of the latent variable to one. Computation and Output interpretation of Model 1b. Comparison of Model 1a and Model 1b. Model-Modification. Defining own project.

Essential Reading: Brown chapter 3, 2006; Byrne 2012, chapters 1 & 2; Davidov/Schmidt 2007; LAVAAN Manual.
Additional reading: Davidov/Schmidt/Schwartz 2008; Marsh et. al. 2009.

Day 2

Lecture

Foundation of CFA: Process of linear causal modelling, types of input, assumptions, types of constraints including. Equality constraints, exploratory versus confirmatory factor analysis, formative vs. reflective indicators, typology of models, Maximum Likelihood Estimation (ML). Ordinal Indicators and WLSMV Estimator. Treshholds and Intercepts. Restrictions. Identification. Model Modifications, global and detailed Fit Measures. Power analysis. Model Modification with JRULE. Theoretical Exercises 4 – 6.

Seminar

PRACTICAL SESSION: Preparation of CFA. **EXAMPLES 2a (parallel), 2b (tau-equivalent) 2c (congeneric ordinal) & 2d (tau-equivalent ordinal):** (Input File: NL2.dat). Output interpretation and Comparison of Models 1 – 2c. Use of Chi Square Difference Test vs. SRMR difference, CFI difference and information theoretic measures like AIC and CAIC. Comparison of Model Modification by modification indices. Starting own project for testing a comparative measurement model .

Essential Reading: Brown 2006 chapter 7, 238-265; Byrne 2012, chapters 3, 4 & 5; LAVAAN Manual; Schmidt/Hermann 2011.
Additional Reading: Davidov/Schmidt 2007; Davidov et al. 2011; Saris et al. 2009.

Day 3

Lecture

Simultaneous Confirmatory Factor Analysis (SCFA). Basic Equations and Estimation. Cross-Loadings and Error Correlations. Multivariate Correction for Attenuation. Types of Errors, Reliability and Validity Estimates in Confirmatory Factor Analysis and Simultaneous Confirmatory Factor Analysis. MTMM Models and Method Factors. Variance Decomposition. Multiple Group Confirmatory Factor Analysis (MGCFA). Configural and metric invariance in comparative and cross-cultural research. Theoretical Exercises 7 – 10.

Seminar

PRACTICAL SESSION: Preparation of **EXAMPLES 3a, b, c & d:** (Input File: NL2.dat). Simultaneous Confirmatory Factor Analysis (SCFA) and its modification: Tradition/Conformity, Universalism and Attitude toward immigration. Examination of detailed and global model fit. Same model using ordinal indicators and its modification (3c, 3d). **EXAMPLE 3e:** Specification of a method factor for all value items in SCFA.



MGSCFA. Preparation of Example 4a & b (BENELUX_noMissing.dat): Configural and metric invariance in the Benelux countries. Continuing own project.

Essential Reading: Brown 2006, chapters 3, 4, 5 & 7; Byrne 2012, chapters 3 & 4; Davidov/Schmidt/Schwartz 2008; Davidov et al. 2014; Mead et al. 2008.LAVAAN MANUAL.

Additional reading: Davidov/Schmidt 2007; Davidov 2008; Marsh/Hau/Wen 2004; Knoppen/Saris 2009; Scherpenzeel/Saris 1997; Sijtsma 2009; Steinmetz et al.2009.

Day 4

Lecture

SCFA with latent means and intercepts. Invariance of intercepts in cross-cultural research. Higher-order Confirmatory Factor Analysis. How to report CFA results. Theoretical Exercises 11- 13.

Seminar

PRACTICAL SESSION: MGSCFA. Preparation of **EXAMPLE 4a, b & c:** (Benelux.dat) Multiple group comparisons with Latent Means (MGCFA) due to BENELUX countries. Test of metric and scalar invariance in comparative research. Classical Approach (4a), Ordinal Approach (4b). Comparison of the approaches. **Example 4d:** Higher Order Factor Analysis (Input File: NL3.dat). Continuation of own project. Preparation of Presentation.

Essential Reading: Brown, chapters 6, 7 & 8; Byrne 2012, chapter 5, 7 & 8; Davidov 2008; Davidov et al. 2008; Steinmetz et al. 2009; van der Schoot et al. 2013; Davidov et al. 2014.LAVAAN MANUAL.

Additional Reading: Byrne/Stewart 2006; Chen 2007; Davidov/De Beuckelaer 2010; Mead et al. 2008; Zick et al. 2008.

Day 5

Lecture

Presentation of the SEM models of the participants using datasets from their projects. 15 minutes Power Point Presentation, 5 – 10 minutes discussion.

Evaluation of the Presentations and Project:

Prerequisites for a certificate: a. Regular presence b. Performing all exercises listed in the program. c. Presentation of results based on 8 -10 Power-Point Slides.

References

1. Methodological References

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2. Substantive References

- Davidov, E. & Schmidt, P. (2007). Working Paper: Are values in the Benelux countries comparable? Testing for equivalence with the European Social Survey, 2004-5.
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3. Relevant internet homepages:

- concerning the LAVAAN software: <http://www.lavaan.ugent.be/>
- concerning the ESS data: <http://ess.nsd.uib.no/>
- concerning joining the SEMNET discussion group: <http://www2.gsu.edu/~mkteer/semnet.html>