Meeting of the Working Group on Structural Equation Modeling

March 26-27, 2020

Vienna

1 Venue

Franz Schwackhöfer Haus, seminar room 06
University of Natural Resources and Life Sciences Vienna (BOKU)
1190 Vienna, Peter Jordan Straße 82

2 Contact information local organizers

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3 Registration

Please register before January 24th, 2020 using the online registration form at
https://forms.gle/2Amn3mifVvxbEST48

4 List of Hotels

- Hotel Bellevue, ~20 min to BOKU by bus (40A)
  Prices single double rooms incl. breakfast buffet: 84/89 €
  Book with Code: BOKU2019
- Living Hotels Kaiser Franz Joseph, ~15 min to BOKU by bus (10A) or train (S45)
  Prices single double rooms incl. breakfast buffet: 76/80 €
  Book with Code: BOKU2019
- Hotel Ibis Styles Wien City, ~15 min to BOKU by bus (37A)
  Prices single double rooms incl. breakfast buffet: 81/87 €
  Book with Code: "BOKU/Universität Bodenkultur"
- Motel One Wien Staatsoper, ~35 min by subway (U2) and bus (40A)
  Prices single double rooms incl. breakfast buffet: 95/114 €
  Book with Code: Bund/BOKU
- It might be advisable to also check other options such as AirBnb, booking.com and search for accommodation in proximity or with good accessibility to the meeting venue.

5 Directions to BOKU Vienna

The bus stop very close to the meeting venue is "Dänenstraße" (bus lines 10A, 40A, 37A).

From Vienna Airport

Take the local train S7 to "Wien Traisengasse". Avoid taking the green "CAT", it is much more expensive and only saves about 10 minutes. From there, use the bus 37A until you reach the last stop "Dänenstraße" very close to the meeting venue. You can also take trains from the airport to either "Wien Mitte-Landstraße" or "Wien Hbf" (main station) and use Google Maps for directions from there.

From Bratislava Airport

Some low-cost airlines operate to and from Bratislava Airport (BTS), which is about 1.5 hrs away from central Vienna. Flixbus and other bus companies run on a regular basis between BTS and either the main train station (Wien Hbf) or the main bus terminal (Wien Erdberg VIB).

From the train stations "Wien Meidling" or "Wien Hbf" (main station)

If your train stops in "Wien Meidling", it is easiest to get off there and use the metro U6 (direction Floridsdorf) until "Währinger Straße-Volksoper" and switch there to bus 40A (direction Döblinger Friedhof) until you have reached the stop "Dänenstraße" right in front of BOKU.

If your train only stops at Wien Hbf, check Google Maps for the best route to "Wien Dänenstraße".

By car

Parking spaces are restricted to short term parking in most of Vienna with exemptions for residents only. This is also the case in the area around BOKU. Some hotels might offer parking spaces for an additional fee if you want to travel to Vienna by car. We do not recommend traveling to the meeting by car though.

Tickets to get around Vienna by public transport

Tickets within Vienna can be purchased at all train and metro stations and in all trams (not anymore in the buses though!), or by using the "WienMobil"-App. The ticket from the airport into town is available at the ÖBB ticket machine and costs 4.20 €. Within Vienna, you can get single tickets (2.40 €), daily tickets (5.80 €) as well as 24 or 48 hour-tickets (8.00 / 14.10 €).

6 Framework Programme

Optional: Conference dinner

Date & time: Thursday, March 26th 2020, 7.30 pm

Venue: "Das Schreiberhaus", a typical Viennese Heurigen (winery), Rathstraße 54, 1190 Vienna; https://www.dasschreiberhaus.at/

Fixed price: 50 Euro (includes 3-course menu including beer, wine, water, coffee/tea)

If you wish to join, please sign up using the online registration form before January 24th, 2020. Within the form, you can also specify if you have any special dietary requirements. You will be asked to pay in cash when you arrive at the conference.

Optional: Guided Thematic Vienna Tour

Date & time: Friday March 27th 2020, 3.00 pm

Venue: Hoher Markt, Ankeruhr, Hoher Markt 10-11, 1010 Vienna

Joint travel from the meeting to the starting point of the tour at around 2.15 pm

Fixed price: 16 Euro

What is this about? "Verschlungene Pfade durch Wien" (Ancient (foot-)paths through Vienna)

You can also sign up for the guided tour using the online registration form before January 24th, 2020. You will be asked to pay in cash when you arrive at the conference.

7 Locations: meeting venue, dinner, guided tour, and hotel options

8 Preliminary Timetable

Thursday, March 26th

Time	Title & Author(s)
08.30 – 09.15	Registration
09.15 – 09.30	Welcome
09.30 – 10.00	01 *Maria Faust* SEM of Temporal Digital Change in Germany and China
10.00. – 10.30	02 *Katharina Meitinger, Peter Schmidt & Michael Braun* Detecting and explaining measurement inequivalence: the case of patriotic feelings
10.30 – 11.00	03 *David Duran-Rodas, Francisco Camara Pereira & Gebhard Wulfhorst* Exploring causality of built and social environment factors influencing the observed demand of bike-sharing systems
11.00 – 11.30	Coffee break
11.30 – 12.00	04 *Katharina Groskurth* Sensitivity of Fit Indices in Confirmatory and Item Factor Analysis Models with Ordered Categorical Measurements
12.00 – 12.30	05 *Steffen Grønneberg & Njål Foldnes* Nonparametric tetrachoric correlations
12.30 – 13.00	06 *Njål Foldnes & Steffen Grønneberg* Violation of the underlying normality assumption in ordinal SEM
13.00 – 14.30	Lunch break
14.30 – 15.00	07 *Suzanne Jak, Terrence Jorgensen, Mathilde Verdam & Frans Oort* Analytical Power Calculations for Structural Equation Modeling: A Tutorial and Shiny App
15.00 – 15.30	08 *Daniel Seddig & Heinz Leitgöb* Measurement nonequivalence due to systematic panel attrition? An empirical illustration and suggestion of remedies
15.30 – 16.00	09 *Henrik Andersen & Jochen Mayerl* Applying Panel Regression in the Structural Equation Modelling Framework to Assess Relationships between Environmental Values and Attitudes
16.00 – 16.30	Coffee break
16.30 – 17.00	10 *Holger Brandt* Testing measurement invariance in complex data with Bayesian shrinkage priors
17.00 – 17.30	11 *Mariska Barendse & Yves Rosseel* Pairwise maximum likelihood for multilevel data
17.30 – 18.00	Internal meeting of the working group
19.30	Conference Dinner at a Heurigen (winery, location to be announced) (Registration required in the online registration form)

Friday, March 27th

Time	Title & Author(s)
09.30 – 10.00	12 *Yves Rosseel* The structural-after-measurement (SAM) approach for SEM
10.00. – 10.30	13 *Jörg Henseler, Florian Schuberth & Tamara Schamberger* Maximum Likelihood Estimator For Composite Models
10.30 – 11.00	14 *Harry Garst* Growth curve models with estimated changepoints
11.00 – 11.30	Coffee break
11.30 – 12.00	15 *Andrej Srakar & Tjaša Bartolj* Bayesian nonparametric estimation in longitudinal mediation: A Baron-Kenny based estimator for cross-lagged models
12.00 – 12.30	16 *Rolf Steyer* Why Interaction Matters
12.30 – 13.00	17 *Julien Irmer, Jana Gäde & Karin Schermelleh-Engel* When Data are not perfect: Robustness of LMS against violations of the normality assumption due to categorical data, skewed errors or latent constructs for misspecified nonlinear SEM
13.00 – 13.10	Closing
13.10 – 14.15	Lunch & Farewell
14.15	Optional: joint travel to Guided thematic Vienna Tour

9 Abstracts of Presentations – Thursday, March 26th

01 - SEM of Temporal Digital Change in Germany and China

Maria Faust

Institute for Communication and Media Studies, Department for Empirical Communication and Media Research, University of Leipzig

Former research has shown that internet-mediated communication leads to a change in which we deal with time in everyday life and plan differently. This process is part of a cultural change in time. Such change is due to increasing social interaction on the internet and also because the routines of journalism have changed (Neuberger, 2010). However, this change was described on a theoretical level only (e.g. Castells, 2010; Eriksen, 2001; Hassan, 2003; Innis, 2004; Krotz, 2001; Neverla, 2010; Nowotny, 1995; Rosa, 2005etc.) There is a clear research desiderate in quantitative empirical analysis. This paper seeks to fill this gap and therefore suggests a structural equation model. The novelty of this approach lies in the first multivariate quantitative analysis of mediatized processes of temporal change on a societal level. Hereby a de-westernized (Gunaratne, 2010) most-different systems design is applied (Anckar, 2008) where German and Chinese Cultural Contexts are picked. Temporal understanding as the dependent variable is an eight-dimensional construct (Faust, 2016) and consists of Western and Chinese notions (Chinese Culture Connection, 1987). It integrates the anthropological constructs of past, polychronicity and monochronicity (Bluedorn, Kalliath, Strube, & Martin, 1999; Hall, 1984; Lindquist & Kaufman-Scarborough, 2007), fatalism, pace of life (Levine, 1998), temporal horizon (Klapproth, 2011) and a Chinese future sub-dimension (Chinese Culture Connection, 1987). All of these eight temporal sub-dimensions are subject to change with the overarching hypothesis:

> *Societal norms and values shift towards a more fatalistic, short-term, more multi-tasking oriented and less monochronic, yet accelerated lifestyle through internet-mediated communication.*

02 - Detecting and explaining measurement inequivalence: the case of patriotic feelings

Katharina Meitinger [1], Peter Schmidt [2], Michael Braun [3]

[1] Department of Methodology and Statistics, Utrecht University, Netherlands

[2] Institute of Politcal Science, University of Gießen, Germany

[3] GESIS – Leibniz Institute for the Social Sciences, Mannheim, Germany

Testing for measurement invariance is an important precondition to draw substantive conclusions from cross-national data. However, the traditional approach of multigroup confirmatory factor analysis (MGCFA) has been criticized as too strict and more liberal approaches have recently been proposed, such as alignment. Mixed-methods approaches combining quantitative measurement invariance tests and qualitative insights from web probing provide a powerful tool to address this issue. For this study, we selected the substantive example of the item battery on "Political Effects of Nationalism" from the 2013 ISSP Module on National Identity.

With MGCFA, measurement invariance tests failed to show metric and scalar invariance indicating that structural coefficients and latent means should not be compared across countries. With

alignment, scalar measurement invariance was confirmed. However, the web probing results point to several problematic issues that potentially question the comparability of results. The qualitative findings are mirrored in the MGCFA results but not in the alignment outcome.

This study underlines the value of mixed methods approaches in the toolkit of cross-national researchers and generally those studying multiple groups since it provides the opportunity to detect and address issues of item and construct bias with qualitative insights.

03 - Exploring causality of built and social environment factors influencing the observed demand of bike-sharing systems

David Duran-Rodas [1], Francisco Camara Pereira [2], Gebhard Wulfhorst [1]

Chair of Urban Structure and Transport Planning, Department of Civil, Geo and Environmental Engineering, Technical University of Munich

Department of Management Engineering, Technical University of Denmark

Keywords: *bike-sharing, spatial analysis, built environment, lifestyle, causality*

Bike-sharing systems (BSSs) have been implemented in around 2000 cities worldwide and are still growing. For the optimal expansion of the systems, previous work has identified spatial factors associated with observed demand such as land use, transport infrastructure, points of interest and sociodemographic. However, some of these factors do not have a causal relationship with the observed demand.

Therefore, the main objective of this research is to develop a theoretical framework to identify the causality of the most influencing factors on BSS using built and social environmental factors with structural equation models (SEM).

First, we developed our theoretical framework by merging the transport and land-use interaction model with the concept of urban mobility culture (see Figure 1). Then, we collected observed demand data from a BSS and built and social environment variables. We selected the most associated spatial factors to the observed demand based on linear and non-linear models. Finally, we built SEM based on the theoretical framework with the most influencing spatial factors.

The method was applied to the hybrid BSS in Munich. Built environment variables included land use, transportation infrastructure, points of interest, and the social environment (sociodemographic, lifestyle milieus and social media usage).

As an outcome, we expect to have a deeper understanding of the causality of the most influential spatial factors from the built and social environment on the observed demand in the BSS.

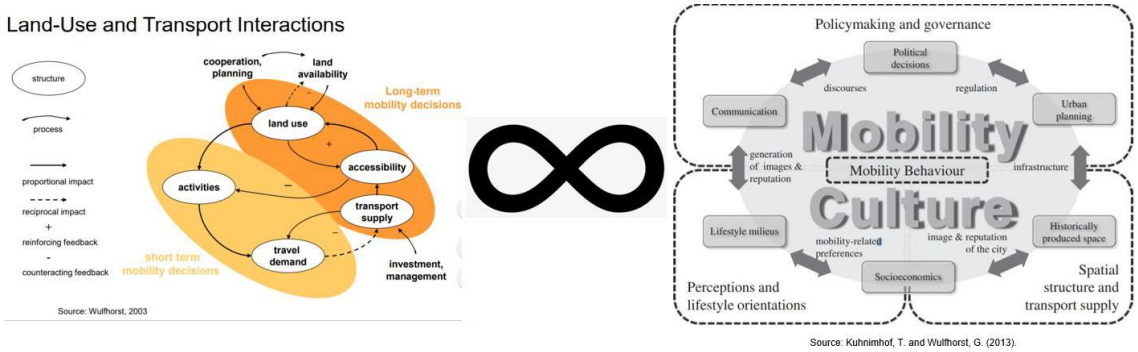

Figure 1: Theoretical framework

04 - Sensitivity of Fit Indices in Confirmatory and Item Factor Analysis Models with Ordered Categorical Measurements

Katharina Groskurth [1, 2]

[1] *GESIS – Leibniz Institute for the Social Sciences, Mannheim, Germany*

[2] *Graduate School of Economic and Social Sciences, University of Mannheim, Germany*

Keywords: *fit index, ordered categorical data, diagonally weighted least squares, structural equation modeling*

Does my proposed model fit the data? This question is essential for applied researchers who use structural equation modeling to answer substantive research questions. To decide on whether a given model fits the data, researchers commonly consult fit indices such as CFI, RMSEA, or SRMR and employ rules of thumb (i.e., cutoffs for acceptance/rejection) to evaluate the fit of the implied model to the data at hand. Such cutoffs result through simulations by varying characteristics typically used in empirical investigations. Problematically, cutoffs for fit indices are mainly derived using maximum likelihood estimation with continuous and multivariate normal data. Researchers, however, primarily work with Likert scales, which are, in essence, ordered categorical and often non-normal. Estimation methods allowing for ordered categorical and non-normal data generally suit better. The aim of this paper is, therefore, to probe the relative sensitivity of fit indices to the type of estimator (ML/MLR, DWLS/WLSMV) and other often neglected characteristics such as the number of response categories through simulation studies. Based on the sensitivity of fit indices to systematic variations of these characteristics, flexible cutoffs suited for the researcher's model and data at hand are proposed.

05 - Nonparametric tetrachoric correlations

Steffen Grønneberg, Njål Foldnes

Department of Economics, BI Norwegian Business School

When sampling from a continuous distribution, the empirical covariance matrix is always a consistent estimator of the population covariance matrix. For ordinal distributions, e.g. results from Likert scales, data is often thought to be generated by discretizing ("chopping up into ordinal pieces") a continuous random vector. In this case, the empirical covariance matrix of the observed ordinal observations will not consistently estimate the covariance matrix of the underlying continuous random vector. A solution when the underlying continuous random vector is assumed to be normal is the so-called polychoric correlations, which reduces to the so-called tetrachoric correlations in the case when the ordinal scale is binary. However, these estimators are not consistent when the underlying continuous random vector is non-normal. We here investigate what can be said about the covariance matrix of the underlying continuous random vector when we do not assume that it is multivariate normal, and derive bounds for the values of the underlying correlation matrix.

06 - Violation of the underlying normality assumption in ordinal SEM

Njål Foldnes, Steffen Grønneberg

Department of Economics, BI Norwegian Business School

We review the framework of discretized normality and polychoric correlations. We present our findings that well-cited simulation papers aimed at investigating the robustness of poychorics and ordinal SEM have used improper simulation methods. Proper simulation of ordinal data for covariance models is presented. We use these methods to investigate how robust ordinal SEM is to violation of underlying non-normality. Also, a new bootstrap test of the normality assumption is discussed.

07 - Analytical Power Calculations for Structural Equation Modeling: A Tutorial and Shiny App

Suzanne Jak [1], Terrence D. Jorgensen [1], Mathilde G.E. Verdam [2] , Frans J. Oort [1]

[1] Methods and Statistics, Child Development and Education, University of Amsterdam

[2] Methodology and Statistics, Institute of Psychology, Leiden University

Conducting a power analysis may be challenging for researchers who plan to analyze their data using structural equation models, particularly Monte Carlo methods. In this tutorial, we explain how power calculations for the chi-squared test and the RMSEA-tests of (not-)close fit can be conducted using our Shiny app 'SEMpower'. SEMpower facilitates power calculations using two methods that are not computationally intensive, and that focus on model fit instead of the statistical significance of (functions of) parameters: the method of Satorra, and Saris (1985) for power calculations of the likelihood ratio test, and the method of MacCallum, Browne, and Sugawara (1996) for RMSEA-based power calculations. We present examples of power analyses for path models, latent growth models, and factor models.

08 - Measurement nonequivalence due to systematic panel attrition? An empirical illustration and suggestion of remedies

Daniel Seddig [1], Heinz Leitgöb [2]

[1] University of Cologne, Germany)

[2] University of Eichstätt-Ingolstadt, Germany

Keywords: *panel attrition, CFA panel model, measurement nonequivalence, cognitive model of survey response*

We discuss systematic panel attrition as a source of measurement nonequivalence in latent constructs across time. The systematic dropout of respondents, for example due to poorer health in medical studies or social and economic characteristics in social science studies, is a potential threat to the internal validity of panel studies. Amongst others, comparability of constructs across time cannot be maintained when dropouts differ systematically from stayers regarding the cognitive processing of survey items. According to the cognitive model of survey response, this includes (i) comprehending the content of the underlying manifest indicators, (ii) retrieving the required information from the long-term memory, (iii) processing the retrieved information to generate answers, and (iv) reporting answers that fit the pre-determined response format. Thus, respective differences between the two groups may alter the response patterns from one panel wave to another, leading researchers to interpret systematic biases in the psychometric properties of the measurements across time (e.g., intercept parameters) as real differences or change in the constructs (e.g., latent means). We use data from a German panel study with a considerable dropout rate after the first wave to illustrate the problem and suggest possible remedies.

09 - Applying Panel Regression in the Structural Equation Modelling Framework to Assess Relationships between Environmental Values and Attitudes

Henrik Andersen & Jochen Mayerl

Faculty of Behavioural and Social Sciences, Institute of Sociology, Chemnitz University of Technology

Keywords: Environmental values and attitudes, reciprocal effects, unobserved heterogeneity, panel data analysis, cross-lagged panel models

Recently, two distinct modeling strategies have been suggested to control for time-invariant heterogeneity in a cross-lagged panel model framework: the technique suggested by Allison et al. (2017) is a slight variation on the decades-old lagged bivariate autoregressive latent trajectory model; the ones suggested by Curran et al. (2014) and Hamaker et al. (2015) work by modeling the regressions on essentially demeaned (or detrended) versions of the variables. We compare the two approaches analytically and show that Allison et al.'s approach is the superior one. We demonstrate the application of such a model by investigating the relationship between environmental values and attitudes towards the German Transition to Renewable Energies ("Energiewende"). It uses three waves of data (2014 – 2016) taken from the GESIS Panel survey. The constructs are modelled as latent variables to account and correct for measurement error and establish temporal measurement invariance to ensure observed changes are due solely to changes in the latent constructs. The paper finds, in accordance with attitude theory, that one's own environmental values do indeed seem to influence their attitudes towards the Energiewende at a later point in time. A positive change in environmental values later leads to more positive attitudes.

10 - Testing measurement invariance in complex data with Bayesian shrinkage priors

Holger Brandt

Department of Psychology, University of Zürich

Keywords: *Measurement invariance, Differential item functioning, Shrinkage priors*

When tests are applied to heterogeneous populations, it is necessary to ensure that measurement invariance (MI) holds. MI holds if all items measure similarly the underlying construct across groups (e.g., gender) or for persons that have different scores in a continuous covariate (e.g., age). If MI does not hold for all items (i.e., partial MI), it is necessary to identify problematic items that show differential item functioning (DIF). Testing DIF has received a lot of attention, but most methods focused on simple two-group scenarios. New methods to collect data such as online tests (e.g., via Amazon's Mturk), or international large-scale assessments create new challenges. Especially, new DIF detection methods are needed that can take several correlated groups and/or covariates into account while providing sufficient power. In this talk, I will discuss an alternative approach to testing DIF in complex data with many covariates and/or groups simultaneously. The new approach is a Bayesian extension of the moderated nonlinear latent factor analysis (MNFLA; Bauer, 2017). Different types of shrinkage priors such as the horseshoe and spike-and-slab priors will be introduced that can be used to test DIF. In a simulation study, their performance will be investigated. Guidelines will be provided.

11 - Pairwise maximum likelihood for multilevel data

Mariska T. Barendse [1], Yves Rosseel [2]

[1] Department of Psychology, Education & Child Studies, Erasmus University Rotterdam, Netherlands

[2] Department of Data Analysis, Ghent University, Belgium

Keywords: structural equation modeling, multilevel, discrete data, random slopes

The pairwise maximum likelihood (PML) estimation method seems very promising to estimate complex multilevel structural equation models (SEM) with discrete data. With multilevel models we take into account that observations within a cluster tend to be more alike than observations from different clusters. The pairwise likelihood with multilevel models is obtained as the product of bivariate likelihoods for within-cluster pairs of observations (see Renard et al., 2004; Bellio and Varin, 2005; Cho and RabeHesketh, 2011). As casewise bivariate likelihoods can be calculated, the PML estimation method is able to estimate models with random slopes. In this presentation, we will discuss the possibilities of the PML estimation method with complex multilevel SEM models. We also investigate the PML estimation method in a simulation study, where we vary the type of response scale (binary, four response options) and the number of random slopes (one, two).

10 Abstracts of Presentations – Friday, March 27th

12 - The structural-after-measurement (SAM) approach for SEM

Yves Rosseel

Department of Data Analysis, Ghent University, Belgium

Keywords: *two-step approaches, estimation, small-samples*

In the structural-after-measurement (SAM) approach, estimation proceeds in several steps. In a first step, only parameters related to the measurement part of the model are estimated. In a second step, parameters related to the structural part (only) are estimated. Several implementations of this old idea will be presented. A distinction will be made between local and global SAM, and it will be suggested that various alternative estimators (including non-iterative estimators) could be used for the different model parts. It turns out that this approach is not only effective in small samples, but it is also robust against many types of model misspecification. Many existing alternatives (factor score regression with Croon corrections, sum scores with fixed reliabilities, model-implied instrumental variables estimation, Fuller's method, …) turn out to be special cases of this general framework.

13 - Maximum Likelihood Estimator For Composite Models

Jörg Henseler [1, 2], Florian Schuberth [1], Tamara Schamberger [1,3]

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[2] NOVA Information Management School, Universidade Nova de Lisboa

[3] Faculty of Business Management and Economics, University of Würzburg

Keywords: *composite modeling, estimation, structural equation modeling, maximum likelihood estimator*

The composite model has gained more and more attention over the last years. Several estimators have been developed to estimate composite models, e.g., partial least squares path modeling and generalized structured component analysis. Somewhat surprisingly, the estimation by typical estimators applied in the context of SEM such as the maximum likelihood estimator is currently limited to models containing composites in an exogenous position in the structural model. To address this issue, we introduce an alternative presentation of the composite model which allows for their estimation by typical estimators applied in the context of SEM. In doing so, besides the composite formed by a block of indicators, a set of excrescent variables is introduced. This allows for estimating composite models by commonly used software packages in the context of SEM such as lavaan, Mplus, and AMOS.

14 - Growth curve models with estimated changepoints

Harry G.J.A. Garst

Faculty of Social and Behavioural Sciences, University of Amsterdam

The use of intensive longitudinal datasets requires specific analysis techniques. In the SEM framework, growth curve models may not be appropriate for long series of longitudinal data. For linear growth curve models the limits may have already been reached by data sets extending more than five measurement occasions. Nonlinear growth curve models will clearly extend the range of

datasets that can be described reasonably well even in studies with extended timeframes and consisting of many measurement occasions. However, in case there is one or more theoretical changepoints to be expected in the trajectories there is need for models that include change parameters. Using traditional SEM models changepoints can be estimated in piecewise growth curve models, but only for fixed changepoints. This a severe limitation because the timing of changepoints varies in most applications between individuals.

Another complication is that as the number of measurement occasions grows, it is often difficult to have multiple indicators for the same construct at each measurement occasion and therefore models for growth curves for latent variables are out of reach. The alternative to go outside the SEM framework and use estimation techniques for the parameters for each trajectory individually may become an attractive alternative. In this presentation piecewise growth models with unknown changepoint models in the SEM framework will be compared with ALS estimators (alternating least squares) aimed at estimating changepoints in each trajectory separately.

15 - Bayesian nonparametric estimation in longitudinal mediation: A Baron-Kenny based estimator for cross-lagged models

Andrej Srakar, Tjaša Bartolj

Institute for Economic Research (IER) and School of Economic and Business, University of Ljubljana, Slovenia

Keywords: *longitudinal mediation analysis, cross-lagged panel models, Bayesian nonparametrics, dynamic dependent Dirichlet process*

Mediation analysis has its roots in linear and nonlinear structural equation modelling. Limitations of cross-sectional models to analyze mediation can be overcome by longitudinal modelling which is particular reason for studying longitudinal mediation (LMA), being an uncommon and underresearched methodology. Existing models for LMA are estimated under strong parametric assumptions. We derive both nonparametric and Bayesian nonparametric (BNP) estimators for cross-lagged LMA models (based on standard Baron-Kenny approach to mediation). As LMA for cross-lagged models demands a dynamic panel modelling, we follow Su and Lu (2013) using iterative local kernel-based approach with sieves as initial estimators to derive a nonparametric estimator. To map to a BNP "space" we use dynamic dependent Dirichlet processes which are extensions of dependent Dirichlet processes introduced by Rodríguez and Ter Horst (2008). We show the constructed BNP estimator attains optimal information rate (Alaa and van der Schaar, 2018). We explore the properties of the estimators in a Monte Carlo simulation study, comparing performance to parametric estimators for cross-sectional and longitudinal mediation. In a short application, we study the mediated effects of cultural policy funding on the performance of nascent cultural firms using Amadeus firm-level data in the period 2007-2016.

16 - Why Interaction Matters

Rolf Steyer

Institute of Psychology, Department of Methodology and Evaluation Research, Friedrich-Schiller-University Jena

Keywords: *Analysis of pre-post designs, ANCOVA, conditional effects, average effects, multi-group SEM analysis, analysis of change scores*

I present a simulated data example in which there are three relevant variables, a continuous pretest Z, a dichotomous treatment (or intervention) variable X, and a continuous outcome variable Y. The outcome variable Y depends on the pretest Z and on the treatment variable X, but the treatment effect of X on Y linearly depends on the pretest Z, that is, there is an interaction between X and Z. Most often data from such a pretest-posttest intervention, often called a nonequivalent control group design, is analyzed by an analysis of covariance (ANCOVA), that is, a linear regression of Y on X and Z, ignoring the interaction term X Z. In the example presented, the 'treatment effect' estimated via ANCOVA is negative although the true average treatment effect is positive. This reversal of effects also occurs in this example if we analyze the change scores. In contrast, if the interaction term is included in the list of regressors – which is the standard procedure, for example in EffectLiteR – then conditional and average treatment effects are estimated correctly. Hence, this example shows that considering the interaction is not only important in order to learn about differential (conditional) treatment effects but also about the average treatment effect.

17 - When Data are not perfect: Robustness of LMS against violations of the normality assumption due to categorical data, skewed errors or latent constructs for misspecified nonlinear SEM

Julien P. Irmer, Jana C. Gäde, Karin Schermelleh-Engel

Goethe University, Institute of Psychology, Frankfurt, Germany

Keywords: *Nonlinear SEM, categorical variables, LMS, skewed data, model misspecification*

One of the most often used methods to analyze nonlinear structural equation models (SEM) is latent moderated structural equations (LMS; Klein & Moosbrugger, 2000). This method and several other methods assume that all variables are continuous, normally distributed and that the model at hand generated the data. However, in empirical research indicator variables are generally item responses with ordered categorical data that are often also asymmetric. For linear models, Rhemtulla, Brosseau-Liard, and Savalei (2012) suggested that at least five categories are needed in order to treat indicators as continuous. For nonlinear models, this suggestion might not be valid as higher moment information is necessary. Furthermore, structural models are often misspecified due to an incorrect number of nonlinear terms.

Using a Monte Carlo study, we investigated the performance of LMS for the analysis of nonlinear effects using categorical data that were treated as if they were continuous. Data were generated with different numbers of categories, with different patterns of category thresholds, hence different skewness and kurtosis. For different population and analysis models, bias of parameter estimates, power rates to detect existing nonlinear effects and Type I error rates to detect spurious nonlinear effects were assessed. First results will be presented.