Национальный исследовательский университет «Высшая школа экономики»
Программа дисциплины «Introduction to Structural Equation Modeling» для направления
040100.68 "Социология" подготовки магистра

Правительство Российской Федерации

Федеральное государственное автономное образовательное

учреждение высшего профессионального образования

"Национальный исследовательский университет

"Высшая школа экономики"

Факультет Социологии

Программа дисциплины

Introduction to Structural Equation Modeling

(Введение в моделирование структурными уравнениями)

для направления 040100.68 «Социология» подготовки магистра

для магистерской программы «Сравнительные социальные исследования»

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Одобрена на заседании совета магистерской программы «Сравнительные социальные
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Рекомендована секцией УМС: Профессиональной коллегией по направлению

«Социология» «___»_____ 20 г
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Утверждена УС факультета Социологии «___»_____20 г.
Ученый секретарь _____

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Course description

The course will introduce students to a number of methods under the label 'Structural Equation Modeling'. A student will get familiar with path analysis, confirmatory factor analysis, and structural models with latent variables. Theory-driven confirmatory approach to modeling will be an emphasis of the course. Practice-oriented lectures will include real-life examples that facilitate understanding of the methods. Practical sessions will involve exercises with substantive data from European Social Survey. The sessions will bring skills of advanced statistical modeling in popular software Mplus. By the end of the course, a student will be able to create complex models with causal relations between multiple latent variables.

The course assumes the student's knowledge of linear regression modeling and basic statistical and reporting skills.

Examination and grading

In order to receive the credit, the student has to complete 4 assignments in time (each contributes 15% to the final grade, missing the deadline shrinks a grade by 50%) and the two tests after topic 1 and 2 (20% each).

Scheduling

Course involves 4 lectures and 5 practical sessions.

COURSE OUTLINE

TOPIC 1. BASICS OF STRUCTURAL EQUATION MODELING

Recall of the basic statistical constructs: correlation coefficients, zero-order, partial and multiple correlations, variance, covariance, standard deviation, linear regressions.

Path analysis. Path diagrams. Path coefficient. Mediation and moderation. Recursive and non-recursive models. Parameters and parameter constraints. Definition and conditions of causality.

Identification of model. Over- and underidentified models, just-identified models. Residuals and correlation of residuals.

Model fit indices. Chi-square of model. Information criteria. Comparative fit indices. Model selection in SEM. Sample size concerns.

Estimation of parameters. Bias of ordinary least squares. Two-step OLS. Maximum likelihood estimation. Standardizations of parameters in SEM.

Respecification of models. Modification indices.

Missing data. MAR and MCAR. Censored and non-normal data. Bootstrapping.

Essential readings:

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1. Schumacker, R. E., Lomax, R. G. (2010). A Beginner's Guide to Structural Equation Modelling. 2nd edition, Erlbaum. Ch. 4-7.

2. Kline R. Principles and Practice of Structural Equation Modeling. Ch.5-7.

3. Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of personality and social psychology, 51(6), 1173.

4. Muthén, L. K., Muthén, B. O. MPLUS - Statistical Analysis with Latent Variables User's Guide. Muthén & Muthén. 2012. Ch. 2-3.

5. Geiser C. Data Analysis with Mplus. Guilford Press. New York, London. 2013.

Practical sessions #1 and #2: Data input and syntax in Mplus. Linear regression and path model building with a guide. Step-by-step mediation analysis.

Assignment #1. Choose country and topic from ESS round 5 data. Prepare data in SPSS. Create a model of linear regression with no less than 6 observed variables. Report the results in an essay.

Assignment #2. Using selected data create a mediation model, test full, partial and double mediation. Explain direct, indirect effects and model selection. Report the results in an essay.

TOPIC 2. CONFIRMATORY FACTOR ANALYSIS

Measurement models for latent variables. Exploratory versus confirmatory factor analysis (CFA). Principal component analysis. Formative and reflective measurement models.

Steps of building and modifications of measurement model. Fundamental CFA equations. Identification of CFA model. Parameter constraints in CFA.

Multiple group confirmatory factor analysis. MTMM models. Mean structures in CFA. Second-order factors. Extensions of CFA for modeling multilevel and longitudinal data.

Non-linear structural equation models for ordinal and nominal observed variables. Ordinal and nominal latent variables.

Essential readings:

1.   Bollen, K. A. Latent Variables in Psychology and the Social Sciences. // Annual Review of Psychology, 2002. Vol. 53. P. 605-634.

2.   Muthén, L. K., Muthén, B. O. MPLUS - Statistical Analysis With Latent Variables User's Guide. Muthén & Muthén. 2012. Ch. 4-5.

3.   Brown, Timothy. Confirmatory Factor Analysis in Applied Research. 2006.

4.   Hoogland, J. J., Boomsma, A. Robustness studies in covariance structure modeling. An overview and a meta-analysis. // Sociological Methods & Research, 1998. Vol. 26, No. 3. No. 329-367.

Practical session #3: Exploratory factor analysis in Mplus. Confirmatory factor analysis model building with a guide. Step-by-step building of a multiple group CFA.

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Assignment #3. Using selected data create measurement factor model with at least 5 observed variables. Report all the steps, including theoretical hypotheses, statistical hypotheses, exploratory and confirmatory FAs, model selection, discuss parameter estimates, make statistical and substantive conclusions.

TOPIC 3. STRUCTURAL MODELS WITH LATENT VARIABLES

From measurement model to causal relations between latent variables: opportunities, steps, rules, pitfalls.

Structural models in multiple groups. Structural models with mean structures. Second-order factors in structural models. Dummy factors.

Overview of SEM extensions: multilevel structural models with latent variables, latent grow curves, latent class analysis with covariates.

Complex issues in SEM: non-convergence, non-positive definite matrix, Heywood cases.

Generalized latent variable modeling – a framework for connecting theory with empirical evidence.

Essential readings:

1. Skrondal, Anders, and Sophia Rabe-Hesketh. Generalized latent variable modeling: Multilevel, longitudinal, and structural equation models. CRC Press, 2004. Chapter 4.

2. Muthén, L. K., Muthén, B. O. MPLUS - Statistical Analysis With Latent Variables User's Guide. Muthén & Muthén. 2012. Ch. 5, 7.

3. Saris, W. E., Satorra, A., van der Veld, W. M. Testing Structural Equation Models or detection of Misspecifications? // Structural Equation Modeling, 2009. Vol. 16, No.4. P. 561- 582.

4. Wothke, W. Nonpositive definite matrices in structural modeling. / In K. A. Bollen & J. S. Long (Eds.), Testing structural equation models. 1993. Newbury Park, CA: Sage. P. 256-93.

5. Ganuza E., Frances F.J. Rethinking the Sources of Participation: A Case Study of Spain // European Sociological Review, 24(4) 2008 479–493.

Practical session #4: Step-by-step building of a structural model with latent variables using simulated data.

Practical session #5: Step-by-step building of a structural model with latent variables, real-life data, example from Ganuza & Frances, 2008.

Assignment #4. Within your topic, develop a measurement and causal theories, formalize substantive hypotheses, convert them to statistical hypotheses. Using selected data create measurement factor model with at least 5 observed variables and then structural model with paths between at least two latent variables. Report all the steps, make statistical and substantive conclusions.