Topics:

1. Introduction (correlation, regression, measurement error, confirmatory factor models, structural equation models, path diagrams and direct and indirect effects, causal and effect indicators).


5. Model evaluation and fit indices, Lagrange multiplier and Wald tests.

6. Multiple groups and mean structures.

7. Multilevel models.

8. Estimation methods, test statistics, and power.


10. Outliers, model diagnosis and robust methods.


12. Cross validation, simulation and bootstrap.

Objectives: The primary objective is to develop skills in using SEM and related techniques. This includes: (1) the ability to recognize situations where SEM may be useful in research; (2) an understanding of rules in making these techniques useful; (3) being aware of limitations of different methods; (4) being able to use available software in conducting research; and (5) the ability to critically evaluate others’ modeling research reports.

Reading materials: The material of the lectures will be based on Structural equations with latent variables by Bollen (1989), Latent variable models by Loehlin (2004), Modeling covariances and latent variables using EQS by Dunn et al. (1993), and EQS 6 structural equations program manual by Bentler (2006). Certain lectures will be based on articles as listed below. Loehlin (2004) aims for a broad audience while Bollen (1989) involves more equations and is
intended for readers familiar with matrices. Dunn et al. (1993) contains many examples of practical modeling while Bentler (2006) contains instructions for using advanced methodology in EQS. We will also learn Mplus and SAS Calis.

Homework (Book of Dunn, Everitt, & Pickles, 1993): Exercises 1.3, 1.5, 1.6; 2.1, 2.2, 2.3, 2.5; 3.1, 3.3, 3.4, 3.6; 4.1, 4.2, 4.3; 5.1, 5.3; 6.2, 6.3; 6.6; 7.2, 7.4. I will distribute data sets for extra exercises.

Final project: The final is a paper or a project in which you use SEM to analyze some data sets, on a topic you have a real interest. The paper should be written like a typical publication in your research area. Ideally, it is a first time modeling report on a data set (perhaps your own data) that has been analyzed by another methods, but for which SEM seems especially appropriate. If you have no interest in real data, by letting me know, you can also choose to do a mathematical or simulation study.

Grades: If all the homework are well done, you will get a B- for this course. Grades above B depend on your final project.

Reading material and references

Books:


Articles:


Structural models with LVs. Thurstone’s Common Factor Model. The aim of factor analysis is to find parameters of latent variable(s), which explain all covariances between indicators via splitting variance of each indicator to the common and unique. Conceptual. Regression models always have df=0, so are always identified. Recursive path models are always identified. CFA models have their own rules of identification (below). Degrees of freedom. In CFA and other structural equation models the counted information is a number of unique elements in variance-covariance matrix of observed variables. number of unique elements in variance-covariance matrix of observed variables: \[ N_{\text{obs}} = \frac{k(k+1)}{2}, \] where \( k \) is a number of observed variables. Exploratory Factor Analysis, Confirmatory Factor Analysis, And Structural Equation. Modeling For Continuous Outcomes. Linda K. Muthén Bengt Muth. Used to study relationships among a set of observed variables. Estimate and test direct and indirect effects in a system of regression equations. Estimate and test theories about the absence of relationships. In confirmatory regressions modeling which The assumptions for multiple regression includes suitable specification of the model, linear relationships, near interval or interval data with limited range and the same level or relation through the range of independent variables. In current research meeting such a strict assumption of difficult but the general message remains unchanged. Multivariate regression are not possible or practical, Which means by study of variance a Introduction Structural Equation Modeling 2. parameters, such as factor loadings and regression coefficients. A recent development is. software that allows the researchers to specify the model directly as a path diagram. This. works well with simple problems, but may get tedious with more complicated models. Path Model with Latent Factors. Structural equations models can be quite complex, and incorporate both latent factors and. observed variables, with either directed or undirected paths among them. Figure 4 is a. Introduction Structural Equation Modeling 7. diagram for a model on the quality of sleep. It contains two factor models. The first.