Structural Equation Models (PSY 60130)
Spring 2010, Time: MW 1:30–2:45, Place: Haggar Hall 212
Ke-Hai Yuan (email: kyuan@nd.edu, phone: 631-4619)
Stephen Tueller (email: stueller@nd.edu)
Office hours (Ke-Hai Yuan, Haggar 123a) Monday 10:00-12:00 and Thursday 1:00 to 3:00 or
(Stephen Tueller) by appointment

Topics:

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


4. Multitrait multimethod model, multiple indicator multiple cause model, growth curve
model, LISREL model, Bentler-Weeks model, mean and covariance structure model.

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 covari-
ances 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:


Confirmatory factor model. Estimation method. Estimation of effect size measures. Effect size is crucial for quantifying differences and a key concept behind Type I errors and power, but measures of effect size are seldom studied in structural equation modeling (SEM). While t indices such as the root mean square error of approximation may address the severity of model misspecification, they are not a direct generalization of commonly used effect size measures such as Cohen’s d. Moreover, with violations of normality and when a test statistic does not follow a noncentral chi-square distribution, measures of mist that are dened through the assumed. This model is asserting that at least part of the effect of Exercise on Illness is that Exercise affects Fitness, and Fitness, in turn affects Illness. (click any of the following graphics to see them larger). Confirmatory Factor Analysis. Here is a simple path diagram of a two-factor CFA: CFA is also known within SEM as the measurement model because is the step taken to determine how the factors (Iμ1 and Iμ1) are measured by the indicators (x1 to x8). Latent Variable Structural Model. The next step is to fit the structural model, which is what you probably think of when you hear about SEM. First Steps in Structural Equation Modeling: Confirmatory Factor Analysis. Member Training: Reporting Structural Equation Modeling Results.