Course Syllabus
USP 655 Advanced Data Analysis: Structural Equation Modeling
Winter 2012, Thurs 1:00-3:50 pm

Instructor
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Text

Optional Text

Also Recommended (not in bookstore)


Prerequisites
I assume that students have taken a graduate statistics course that covers simple and multiple regression analysis.

Overview
This course is intended to introduce students to structural equation modeling. Structural equation modeling (sometimes referred to as covariance structural analysis) is a regression-based technique that incorporates elements of path analysis and confirmatory factor analysis. The general goal is to provide a thorough background in the conceptual aspects, statistical underpinnings, and application of this method, rather than a tutorial on a specific software package. At the end of the course, I expect students to have a solid, conceptual foundation of structural modeling issues, be able to analyze data using any SEM package, critically evaluate professional articles, and write-up SEM results.

Readings and Commentaries
There will be several readings assigned each week taken from the text and other sources. The readings will usually include an example article that applies SEM (readings will be available for download from the class website). Please read the material prior to class and be prepared for discussion. Students will be required to turn in a one-page commentary on the readings for that week on each Thurs by 10 am. The commentaries should be an informal set of questions, comments, or summary information (summarize only if you cannot think of anything else to say) about the articles. The purpose of the commentaries is to make sure the class is prepared for discussion and to help the instructor identify discussion topics and sources of confusion in the readings.

Homeworks
There will be three homework assignments which will primarily consist of data analysis and write-ups of SEM problems using the student version of the statistical package, Mplus (Muthen & Muthen, 2007). Mplus is an extremely simple program to use, and therefore will allow us to focus more on statistical and applied issues rather than debugging programs and data conversion headaches. I will also provide examples using Amos in class. Some data preparation and
descriptive analysis using SPSS may be required (let me know if this will be an inconvenience for some reason). The student (“demo”) version of Mplus Version 6.12 can be downloaded from the following internet site: http://www.statmodel.com/demo.shtml. The demo version has no limitations on analysis types but allows no more than six dependent variables and two independent variables. Several copies will also be installed in the computer lab on the second floor of the Urban Center. Although you should not need it, the Mplus users guide can also be downloaded from the Mplus website (http://www.statmodel.com).

**Homework due dates are:** 2/2/12, 2/23/12, 3/22/12

**Grades**
Grades are based on an average of the three homework assignments, completion of weekly commentaries, and satisfactory class attendance and participation.

**Other Resources**
There are several internet sites devoted to SEM that may be of use. Dave Kenny has a great website with introductory material on most SEM topics at http://davidakenny.net/cm/causalm.htm (including a free pdf copy of his book, *Correlation and Causation*). Ed Rigdon has an excellent site that serves as a gateway to most of the SEM sites on the web at http://www.gsu.edu/~mkteer/. There is a SEM discussion list called SEMNET which you can subscribe to (I think it would be a great idea if everyone would subscribe during this term) through the following site http://www.gsu.edu/~mkteer/semnet.html. The Mplus website has lots of example programs and a Mplus discussion section http://www.statmodel.com/. Finally, I have compiled a list of hundreds of articles and books on SEM organized by topic at my website http://www.upa.pdx.edu/IOA/newsom/.

**Disabilities**
If you have a disability and are in need of academic accommodations, please notify me immediately to arrange needed supports.

**Comments on Learning Statistics**
Statistics of any kind is very difficult topic to learn. However, keeping in mind the following points learning statistics should greatly facilitate your learning in this course.

- **It's not like math, it is like math.** Statistics is considerably different from mathematics. In fact, the math required for this course is no more complex than what is needed to balance a check book. Statistics is like mathematics, however, in that it must be practiced to be learned. One has to work on exercises, analyze different problems, and get experience with different analytic situations in order to absorb the information. Do not think that you can just read through the material and remember everything. You may need to reread and apply the material several times. So, *don't wait until the last minute!*

- **It's like a foreign language.** Statistics does, however, use a lot of symbols like Greek letters, and for this reason it is a bit like learning a foreign language. Think of the symbols as a foreign language vocabulary that has to be learned in order to understand the sentences.

- **It's like other courses.** In this course, there will also be a great deal of practical, conceptual, and other substantive information that will have to be learned; so, you will also have to read the text material, study concepts, and do some memorization like other substantive courses.

- **It's progressive.** Everything builds on everything else. Don't let any misunderstandings slip through the cracks, or it will snowball on you.

- **It's weird.** Statistics is a unique and unusual topic involving some very abstract and weird ideas. The peculiar nature of the subject makes the material very difficult to learn and retain. Despite its seemingly abstract nature, statistics are extremely useful tools that will make you a highly skilled and valued researcher.
Course Readings
USP 655 Advanced Statistics: Structural Equation Modeling
Winter 2012


1/19 Overview and History of SEM
Maruyama, Chapter 2, “History and logic of structural equation modeling”

Matrix Algebra


1/26 Path Analysis
Maruyama, Chapter 3, “The basics: Path analysis and partitioning of variance.”


Maruyama, Chapter 5, “Effects of random and nonrandom error on path models.”


2/2 Confirmatory Factor Analysis I: Theory, Model Fitting Concepts, and Software
Maruyama, Chapter 7, “Introducing the logic of factor analysis and multiple indicators to path modeling”

Chamberlain, Chapter 8, “Putting it all together: Latent variable structural equation modeling”


2/9 Confirmatory Factor Analysis II: Model Comparisons and Fit indices
Maruyama, Chapter 10, “Logic of alternative models and significance tests”


2/16 Full Structural Models I: Practical Issues, Model Modifications, & Missing Data


2/23 Full Structural Models II: Nonnormality & Categorical Variables

3/1 Multigroup Structural Models and Second-Order Factor Models
Maruyama, Chapter 11, “Variations on the basic latent variable structural equation model”.


3/9 Issues of Causality and Longitudinal Modeling

Maruyama, Chapter 6, “Recursive and longitudinal models: Where causality goes in more than one direction and where data are collected over time”

Maruyama, Chapter 9, “Using latent variable structural equation modeling to examine plausibility of models”


3/16 Growth Curve Models


3/23 Reporting Results and Limitations of SEM Finals Day (class meets, no exam)
