



SATURDAY, MARCH 3, 2007

## Comparative Model Testing and Nested Models

As we've discussed, part of the latest assignment requires you to engage in comparative model testing. Specifically, you will run your model both with and without directed paths from three university properties (public/private status, years of existence, and endowment [square-root transformed]) to their Undergraduate Quality (UQ).

The more parsimonious model is, of course, the one without the additional paths. To override the preference for parsimony, therefore, you will have to show that the additional paths, as a set, *significantly* reduce the overall model chi-square, thus improving model fit. As you move along in your careers, you may wish to adopt additional criteria, such as whether the reduction in chi-square appears substantively large in addition to being statistically significant, but for now, we'll use statistically significant change as our criterion.

You can display your results in a table, as follows:

Model.....	X2.....	df....
Model w/ fewer parameters.....	-----	-----
Model w/ added parameters.....	-----	-----
Delta (change).....	-----	-----

The chi-square change score (the top chi-square minus the bottom one) can be treated like any other chi-square value and be referred to a chi-square table, with degrees of freedom equal to

DR. REIFMAN'S...

[Faculty Webpage](#)

[Intro Stats Page](#)

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### SEM OVERVIEW PAGES

[U. Kentucky/PIRE](#)

[Kenny \(UConn\)](#)

[Newsom \(Portland State\)](#)

[Rigdon \(Georgia State\)](#)

[StructuralEquations.org](#)

[SEM Pros and Cons](#)

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### SPECIFIC SEM ISSUES

[CFA -- Use of Different Programs](#)

[Causality and SEM \(Bollen & Pearl Working Paper\)](#)

[Bharmal Medication article -- Good for reviewing how to count up degrees of freedom](#)

[Model Fit \(Kenny\)](#)

[Correlating Residual Variances](#)

[Non-Positive Definite \(Error Message\)](#)

[Sample Size \(Muthen & Muthen\)](#)

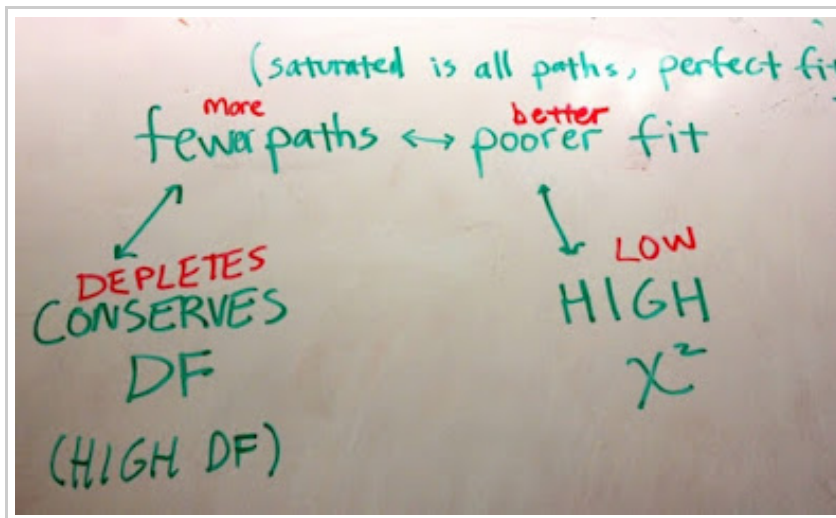
[Sample Size \(Westland\)](#)

[Sample Size \(Wolf et al.\)](#)

[Missing Data in SEM \(Enders\)](#)

delta df (top df minus bottom df).

**UPDATE, March 11, 2012:** Xiaohui photographed the explanation I diagrammed on the board, linking number of paths in a model, goodness of fit, chi-square, and degrees of freedom. A key point was to demonstrate that if one model has a higher chi-square than another model, it will also have a higher number of degrees of freedom. **All of the green phrases go together: a model with fewer paths (which preserves a higher df) will have a poorer fit and thus a higher chi-square.** The red terms represent the opposite of the green terms, and thus **the red terms go together, as well: a model with more paths (which depletes the df) will lead to a better fit and thus a lower chi-square.**



**UPDATE, March 5, 2008:** Kristina photographed the decision-tree I drew on the board, to augment our discussion of comparative model testing. Here it is (you can click on the image to enlarge it).

Missing Data in SEM (Newsom)  
Meta-Analytic SEM  
YouTube Videos on Many SEM Topics (Gaskin)

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OPTIONAL BOOKS FOR STUDENTS SEEKING ADDITIONAL PERSPECTIVE

Farbrigar & Wegener (EFA)  
Barbara Byrne (SEM/AMOS)  
Rex Kline (SEM)  
Schumacker & Lomax (SEM)  
Handbook of SEM (multiple contributors; R. Hoyle, editor)

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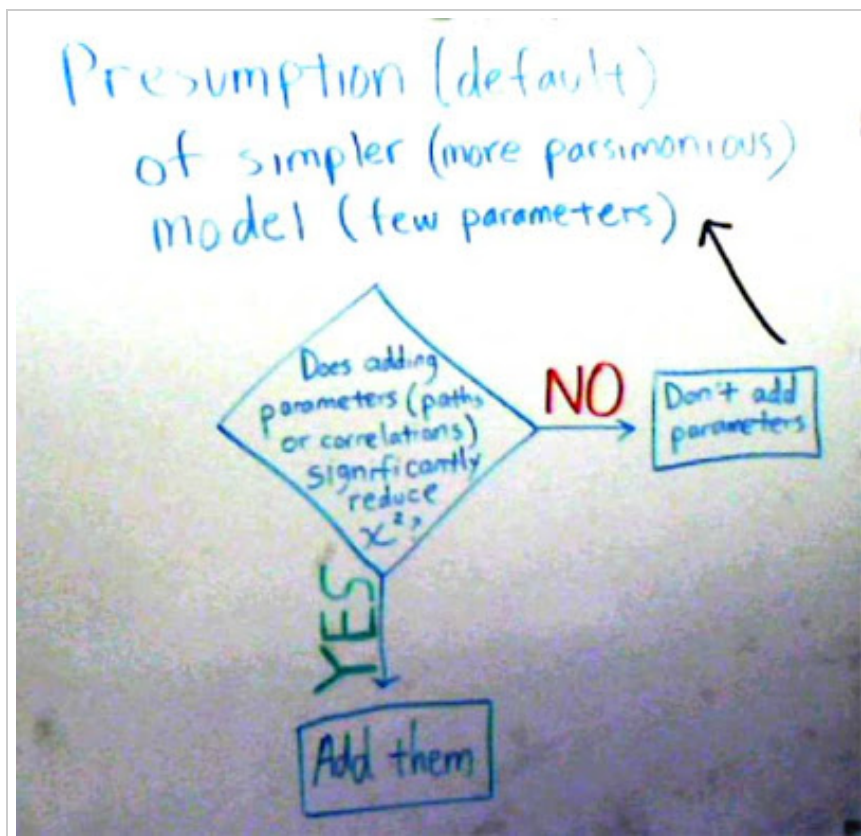
SEM-BASED DISSERTATIONS/THESES FROM FORMER STUDENTS OF THE CLASS (SOME HAVE TTU RESTRICTED VIEWING)

Joy Cheng  
Yoona Chin  
Sothy Eng  
Kyle Gillett  
Stephanie Haygood  
Branden Henline  
Kristina Keyton  
NaYeon Lee  
Andrea McCourt  
Adam Munk  
Megan Oka  
Damon Rappleyea  
Hye-Sun Ro  
Brittney Schrick  
Xiaohui Tang  
Shera Thomas-Jackson  
Mitsue Uchida

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AMOS INFORMATION

AMOS Development Corp.  
AMOS Tutorial (U. Texas)  
Citing AMOS in Your Papers  
On the Hub (Student Software Discounts)  
Videos on Using AMOS for Advanced Applications



And now, back to our regular programming...

An important condition for being able to conduct comparative model tests is that the two models being compared to each other must possess the property of **nestedness**. Two models are nested if they can be converted from one to the other either by *only adding parameters* to one to obtain the other, or *only removing parameters* from one to obtain the other. By *parameters*, we mean anything that is freely estimated in SEM (e.g., structural paths, non-directional correlations). If you start with one model and convert it to a new, second model by both *adding and subtracting* parameters from the initial model, the two models will *not* fulfill the criteria for nestedness and thus cannot be compared via the delta chi-square test.

The following two diagrams provide examples of nested and non-nested models.

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#### PATH ANALYSIS

Ants in Argentina

U. of Exeter (UK)

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BIDIRECTIONAL ARROWS, 2SLS,  
INSTRUMENTAL VARIABLES

Chang & Chen

John Fox

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#### FACTOR ANALYSIS (EXPLORATORY)

Statsoft Electronic Textbook

Garson (NC State)

MacCallum (UNC)

Parallel Analysis, for Determining  
No. of Factors (O'Connor)

Factor Rotation (Mathworks)

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#### LONGITUDINAL/CAUSALITY

Longitudinal Notes (Reifman  
Methods Class)

Causality Notes (Reifman Methods  
Class)

Correlation & Causality Blog

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#### JOURNALS, ARTICLES

SEM (the journal)

Special SEM Issue of Personality &  
Individual Differences (May  
2007)

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#### MISCELLANEOUS

SEMNET Discussion Forum

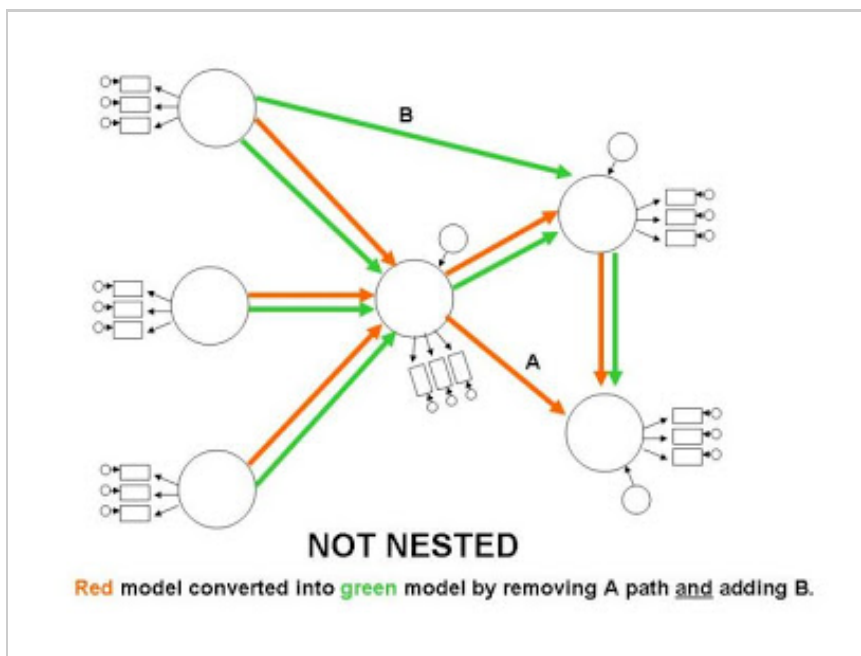
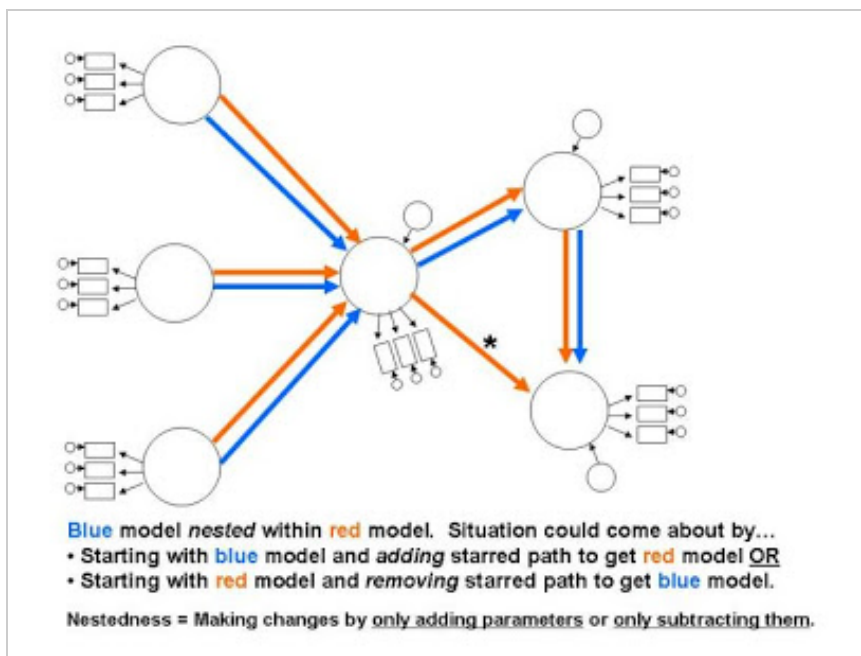
Dataset Archive (ICPSR)

Garson Overall Stats Page

Least-Squares Visualizer

Correlation-Covariance Conversion  
Formula

Award Statement for "SEM The  
Musical"



## TTU RESOURCES

[Online Syllabi for All Courses](#)[Academic Calendars](#)[Final Exam Schedules](#)

## BLOG ARCHIVE

[► 2014 \(2\)](#)[► 2013 \(1\)](#)[► 2012 \(3\)](#)[► 2011 \(1\)](#)[► 2010 \(5\)](#)[► 2009 \(5\)](#)[► 2008 \(8\)](#)[▼ 2007 \(16\)](#)[► April \(4\)](#)[▼ March \(2\)](#)[Comparative Model Testing  
and Nested Models](#)[Negative Variances \(Heywood  
Cases\)](#)[► February \(5\)](#)[► January \(5\)](#)

WHAT SONGS FROM PREVIOUS  
YEARS DO YOU WANT TO SING AT  
SEM THE MUSICAL 6? (YOU MAY  
VOTE FOR UP TO FIVE.)

An analogous situation exists in multiple regression. You can do a delta R-square test to see, for example, if a model with predictor set A, B, C, D, and E accounts for significantly more variance in the dependent variable than does predictor set A, B, and C. ABC is contained -- that is nested -- within ABCDE, thus permitting the statistical comparison. You could not, however, test whether predictor set ABCDE accounts for more variance than set ABCDE, because the change in models would have required both dropping a predictor and adding one. If ABCDE was the starting point, we would have dropped E and added F.

We'll use the following article to delve more deeply into comparative model testing:

Bryant, A. L., Schulenberg, J., Bachman, J. G., O'Malley, P. M., & Johnston, L. D. (2000). Understanding the links among school misbehavior, academic achievement, and cigarette use: A national

panel study of adolescents. *Prevention Science*, 1, 71-87.

POSTED BY ALAN AT 7:29 PM

Newer Post

Home

Older Post

At Least Three  
Gotta Fix it to One (It Ain't Free)  
Constrain, 'strain, 'strain  
You've Got to Check Your R-M-S-E-  
You've Had a Bad Fit  
Your Model's Only One  
It Do Run Run  
Count 'em Up  
AMOS is Ideal  
Equal (You've Got Me Constrained t  
Once You Work in AMOS  
Pyramid of Success  
Hey Hey Heywood Cases  
Nestedness  
Maximum Likelihood

Votes so far: 0

Ball closed