



Structural Equation Modeling

Mgmt 290
Lecture 6 – LISREL
Oct 31, 2005



LISREL Preparation: Diagram – Equations - Matrix

- One Equation for Each Indicator in Measurement Model
- One Equation for Each Endogenous Variable
- in Matrix, Column affects Row



Suggested approach to estimate your model in LISREL

- From Simple to Complex
- Measurement Model First, then Structure Model
- Make a nested structure – estimate the simplest to start, then more complicated ...
- Create blocks of models – estimate one by one to get to the most complicated one



3 Kinds of LISREL Language

- LISREL
- SIMPLIS – simple version of LISREL
- PRELIS – pre LISREL to handle data



Two Ways to Use Data

- 1) use raw data
- 2) use covariance or correlation matrix
- suggest to start with covariance matrix



Importing Data in LISREL

- File -> Import Data in Free Format
- (similar to that in SPSS and others)
- File -> Import External Data in Other Formats
- (almost in any format – SPSS, SAS, STATA, Excel, JUMP, Minitab, ACCESS, dBase,)
- New data will be named by you as YOURNAME.psf

Simple Manipulation of Data in LISREL

- Delete Variables (just click on the variable to delete)
- Select Cases
- (Data -> Select Variables/Cases)
- Specify output to get Covariance matrix

ABC of LISREL: File Types

- DATA: (1) Raw data file - .psf
- (2) Correlation file - .cor
- (3) Covariance file - .cov
- SYNTAX file - .spl, .ls8
- OUTPUT file - .out

ABC of LISREL: Procedure of Running LISREL

- Step 1: File -> Open **File -> New
To create a file**
to get your syntax file
- Step 2: Click on RUN LISREL PROGRAM
to run
- Step 3: Output File will display
(save OR export OR convert for your use)

Note: please put Syntax File and Your data File in the folder!!!



A Simple Example in SIMPLIS

- Test1
- Raw Data From File: klein.psf
- Paths
- WT IT TT -> CT
- Path Diagram
- End of Problem
- file Example1



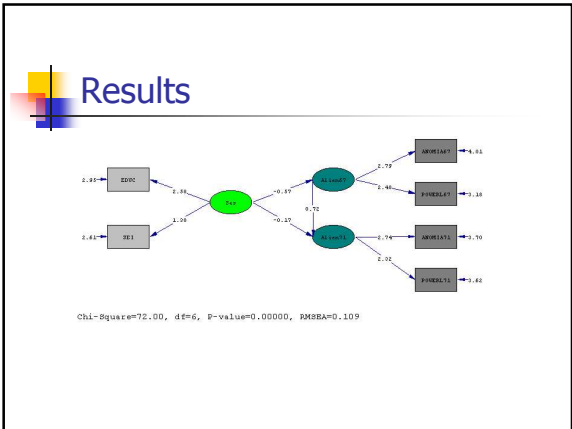
An Example in SIMPLIS - ex6a.spl

- Stability of Alienation
- Observed Variables
- ANOMIA67 POWERL67 ANOMIA71
POWERL71 EDUC SEI
- Covariance Matrix
- 11.834
- 6.947 9.364
- 6.819 5.091 12.532
- 4.783 5.028 7.495 9.986
- -3.839 -3.889 -3.841 -3.625
- 9.610
- -2.190 -1.883 -2.175 -1.878
- 3.552 4.503
- Sample Size 932
- Latent Variables Alien67 Alien71 Ses
- Relationships
- ANOMIA67 POWERL67 = Alien67
- ANOMIA71 POWERL71 = Alien71
- EDUC SEI = Ses
- Alien67 = Ses
- Alien71 = Alien67 Ses
- Let the Errors of ANOMIA67 and ANOMIA71 Correlate
- Let the Errors of POWERL67 and POWERL71 Correlate
- Path Diagram
- End of Problem



Example in LISREL

- TI Stability of Alienation
- DA NI=6 NO=932 NG=1 MA=CM
- LA
- ANOMIA67 POWERL67 ANOMIA71
POWERL71 EDUC SEI
- CM
- 11.83
- 6.95 9.36
- 6.82 5.09 12.53
- 4.78 5.03 7.50 9.99
- -3.84 -3.89 -3.84 -3.63 9.61
- -2.19 -1.88 -2.18 -1.88 3.55 4.50
- ME
- 0.00 0.00 0.00 0.00 0.00 0.00
- SE
- 1 2 3 4 5 6 /
- MO NX=2 NY=4 NK=1 NE=2 LY=FU,FI
LX=FU,FI BE=FU,FI GA=FU,FI
PH=SY,FR PS=DI,FR TE=DI,FR
TD=DI,FR
- LE
- Alien67 Alien71
- LK
- Ses
- FI PH(1,1) PS(1,1) PS(2,2)
- FR LY(1,1) LY(2,1) LY(3,2) LY(4,2)
- LX(1,1) LX(2,1) BE(2,1) GA(1,1)
- GA(2,1)
- VA 1.00 PH(1,1)
- VA 0.68 PS(1,1)
- VA 0.50 PS(2,2)
- PD
- OU ME=ML



- ## SIMPLIS Structure
- Title
 - Observed Variables
 - Covariance Matrix
 - Sample Size
 - Relationships
 - Methods
 - LISREL Output
 - Path Diagram
 - End of Problem

- ## (1) Specify Data in SIMPLIS
- Raw data
 - Covariance matrix from File *filename*
 - Covariance matrix and means
 - Correlation matrix
 - Correlation matrix and standard deviations
 - Correlation matrix, standard deviations and means

(2) Specify Relationships In SIMPLIS

- Dependent variables (To variables) on the LEFT
- (when using =)
- Independent variables (FROM variables) on the RIGHT
 - Relationships
 - ANOMIA67 POWERL67 = Alien67
 - ANOMIA71 POWERL71 = Alien71
 - EDUC SEI = Ses
 - Alien67 = Ses
 - Alien71 = Alien67 Ses

(3) Specify Est Methods, Latent Variable Scaling and Others

- Method: Two-Stage Least-Squares
- $READING = 1 * Verbal$ ← Scaling the Latent Variable
- Let the Errors between VarA and VarB Correlate

LISREL Structure

- DA NI = ? NO = ? MA = ?
- LA - variable names
- SE - reorder variables ← Endogenous first followed by exogenous
- MO - NY NX NE NK FI FR EQ VA
- OU

LISREL Matrix

Matrix	Order	Name	Content
LY	NY x NE	<i>Lambda Y</i> - Λ_y	Factor loadings (Ys to Es)
LX	NX x NK	<i>Lambda X</i> - Λ_x	Factor loadings (Xs to Ks)
BE	NE x NE	<i>Beta</i> β	Paths (Es to Es)
GA	NE x NK	<i>Gamma</i> - Γ	Paths (Es to Ks)
PH	NK x NK	<i>Phi</i> - ϕ	Covariances (Ks to Ks)
PS	NE x NE	<i>Psi</i> - ξ	Residuals of Es
TE	NY x NY	<i>Theta-Delta</i> - ζ_δ	Residuals of Ys
TD	NX x NX	<i>Theta-Epsilon</i> - ζ_ϵ	Residuals of Xs

Diff Matrix (tables)

- ZE – zero matrix
- ID – identity matrix (ZE with 1s in diagonal)
- DI – diagonal matrix (only the diagonal elements are stored)
- SD – sub diagonal matrix (elements below the diagonal)
- SY – symmetric matrix that is not diagonal
- ST – symmetric matrix with 1s in the diagonal
- FU – rectangular or square nonsymmetric matrix

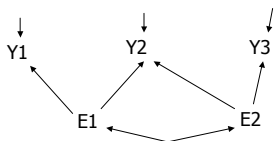
A few more points on LISREL

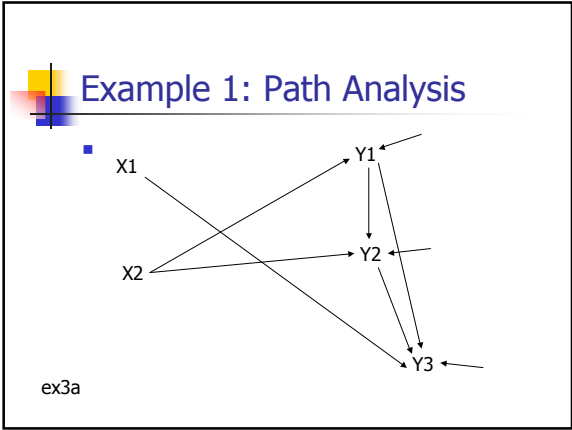
	E1	E2
Y1	1	0
Y2	1	1
Y3	0	1

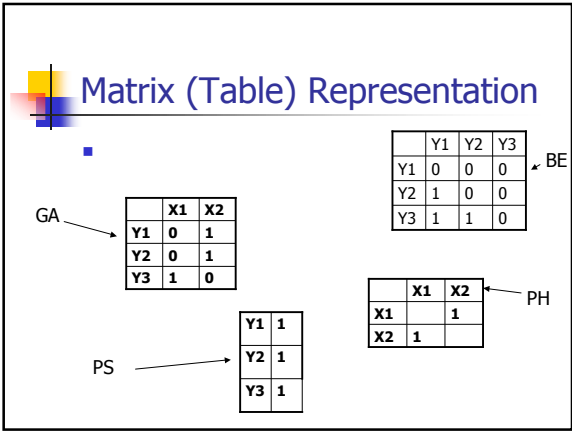
- Always columns causes rows
- (row #, column #)
- FREE means an arrow or 1
- FIXED means no path or 0

	E1	E2
Y1	Fr	Fi
Y2	Fr	Fr
Y3	Fi	Fr

LY,TE







SIMPLIS Syntax File

- Title
- Union Sentiment of Textile Workers
- Observed Variables: Y1 - Y3 X1 X2
- Covariance matrix:
- 14.610
- -5.250 11.017
- -8.057 11.087 31.971
- -0.482 0.677 1.559 1.021
- -18.857 17.861 28.250 7.139 215.662
- Sample Size 173
- Relationships
- Y1 = X2
- Y2 = X2 Y1
- Y3 = X1 Y1 Y2
- Path Diagram
- End of problem



LISREL Syntax File

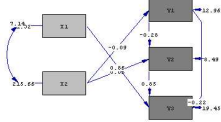
```

TI Union Sentiment of Textile Workers
DA NI=5 NO=173 NG=1 MA=CM
LA
Y1 Y2 Y3 X1 X2
CM
14.61
-5.25 11.02
-8.06 11.09 31.97
-0.48 0.68 1.56 1.02
-18.86 17.86 28.25 7.14 215.66
ME
0.00 0.00 0.00 0.00 0.00
SE
1 2 3 4 5 /
MO NX=2 NY=3 BE=FU,FI GA=FU,FI PH=SY,FR PS=DI,FR
FR BE(2,1) BE(3,1) BE(3,2) GA(1,2) GA(2,2) GA(3,1)
PD
OU ME=ML

```



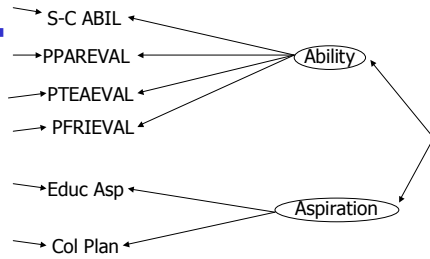
Results



Chi-Square=1.28, df=3, P-value=0.73316, RMSEA=0.000



Example 2: Measurement Model



Matrix (Table) Rep

	Ab	As	
Ab		1	
As	1		

	SC	1	
SC	1		
PP	1		
PT	1		
PF	1		
Ed	1		
Co	1		

	Ab	As	
SC	1	0	
PP	1	0	
PT	1	0	
PF	1	0	
Ed	0	1	
Co	0	1	

SIMPLIS Syntax

- Ability and Aspiration
- Observed Variables
- 'S-C ABIL' 'PPAREVAL PTEAEVAL PFRIEVAL 'EDUC ASP'
- 'COL PLAN'
- Correlation Matrix From File: EX4.COR
- Sample Size: 556
- Latent Variables: Ability Aspiratr
- Paths
- Ability -> 'S-C ABIL' 'PPAREVAL PTEAEVAL PFRIEVAL
- Aspiratr -> 'EDUC ASP' 'COL PLAN'
- Print Residuals
- Path Diagram
- End of Problem

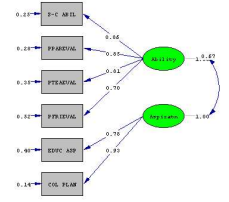
LISREL Syntax

```

TI Ability and Aspiration
DA N=6 NO=556 NG=1 MA=CM
LA
'S-C ABIL' 'PPAREVAL PTEAEVAL PFRIEVAL 'EDUC ASP' 'COL PLAN'
CM
1.00
0.73 1.00
0.70 0.68 1.00
0.58 0.61 0.57 1.00
0.46 0.43 0.40 0.37 1.00
0.56 0.52 0.48 0.41 0.72 1.00
ME
0.00 0.00 0.00 0.00 0.00 0.00
SE
1 2 3 4 5 6 /
MO NX=6 NK=2 LX=FU,FI PH=SY,FR TD=DI,FR
LK
Ability Aspiratr
FI PH(1, 1) PH(2, 2)
FR LX(1, 1) LX(2, 1) LX(3, 1) LX(4, 1) LX(5, 2) LX(6, 2)
VA 1.00 PH(1, 1) PH(2, 2)
PD
OU ME=ML RS

```

Results



Chi-square=9.33, df=8, P-value=0.31491, RMSEA=0.017
