



Structural Equation Modeling

Mgmt 290
Lecture 4
Model Specification & Data Preparation
Oct. 17, 2005



What we have: 1) National Level Research

- Standard ~ Performance
- Socio-Eco ~ Internet Access
- Trust ~ Risk ~ Stock Performance



2) Firm Level Research

- Supervisor Assessment ~ Citizenship Behavior
- Past performance ~ Aspiration
- Transaction & Profiting
- Organization Success
- Profit ~ Outsourcing
- Tech Adoption



3) Individual Level Research

- CEO Succession
- Intent to smoke
- Risky behavior
- Consumer choice
- Customer satisfaction

A few issues on first assignment:

1) Theory -> Operationalization need to be completed

- Theory & Concepts
 - -> Data & Variables
- Questions -> Hypotheses
- Concepts and Variables linked

2) Confirmative Approach vs. Exploratory Approach need to be clear

- Clear Theory-backed hypotheses
- Strictly confirmative ?
- (maybe some exploratory elements added later are fine)
- Usually start with confirmative if theories are strong.
- OR completely exploratory.



3) Clear Strategies Needed

- Extend
- Replicate previous research
- Test some theories empirically

- Review literature – some critique – are necessary.

- (need to know how important your research is, what your contribution is)



4) Need SEM Type of Questions

(that can NOT be handled by OLS regression)

- Mediation effects
- Latent Variables
- Non-recursive

- Correlated Disturbances (Errors or Residuals)
- - model comparison (15 fit indexes)


SEM Types of Hypotheses



Or Causality Questions


- Time precedence ?
- Direction – (need SEM to rule out other direction)
- Partialled out

- (panel studies,
- disturbance – non-deterministic)




Or Group Comparison Questions

- Measurement Invariance Cross Groups
- Structure Invariance Cross Groups



Example of Literature Review

- Literature review – a lot of research on determinants of economic growth AND determinants of democracy, a few article starting to argue that DEMOCRACY needs to be treated as latent var.
- Lack of empirical study of the feedback loop of economic growth and democracy.
- Indirect impacts of determinants are rare.



Example of SEM Questions

- Democracy is a latent variable with Freedom House indicator, Polity indicator, Polyarchy Indicator and others (FH, ACLP in our data)
- democracy and economic growth may be affected by each other.
- The impacts of economic development on democracy may be indirect.

Example of data and variables

- D&D Data Description
- A table to list
- all the variables.

- See
- <http://www.researchmethods.org/sem-data.htm>
- for the data and codebook.

Democracy	FH	Freedom House Score
	Polity	
	ACLP	
	Polyarchy	
Eco Dev	Econ	
	Openc	
	Edu	
	Gini	
	ELF60	
	Riots	
	ODRP	
	Bricol	

For Second Assignment move to model specification

- Hypotheses or theories
<-> model (to be represented by diagrams)

Hypotheses or Model Spec Generation

- Exploratory way
- use partial correlation
- to generate model spec



An Algorithm

- 1) Link all vars together
- 2) Take out links corresponding to in sig partial correlations
- Repeat 1-2 to take out as many as possible

- 3) use theory or common sense to place directions
- 4) use partial correlation to place more directions
- Repeat 3-4 to change all un-directional links to directed links



Specification Issues

- Avoid Misspecification
 - External (missed variables)
 - Internal (missed links)
- Sufficient number of indicators for each latent variable (2 is fine, 3 is better, 4 is the best, ...)
- Do Your Best to Specify Directions

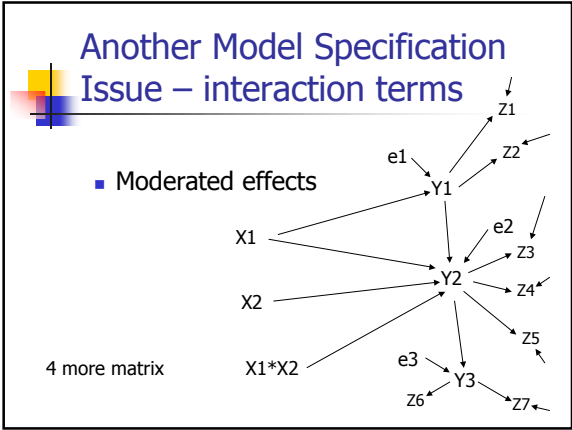
- Parsimony - Important

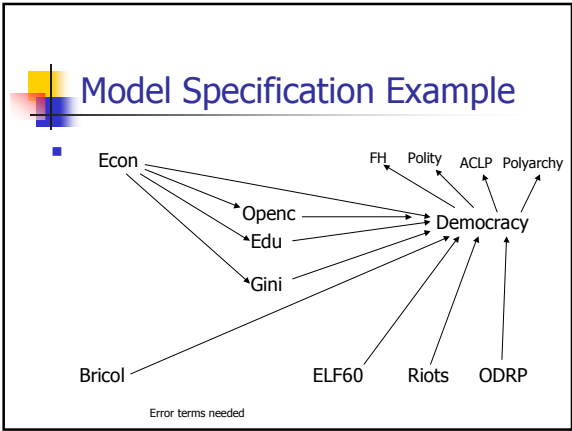


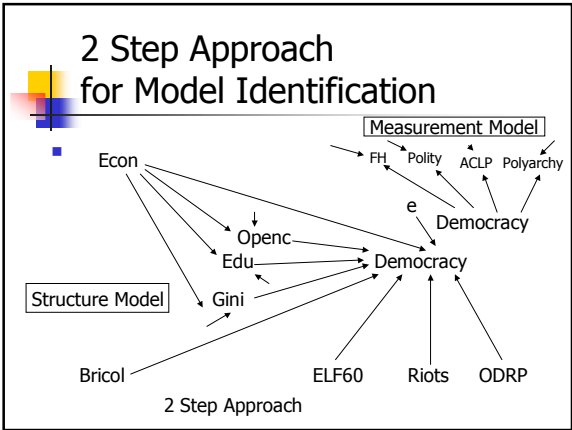
Misspecification Problems -> Biases

Over-estimation
Suppression

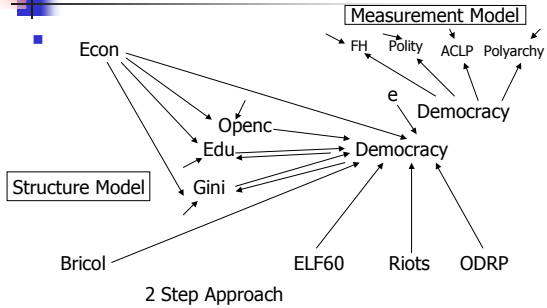
(depends on the correlation between vars in the equation and vars omitted)







Model Identification 2-step Example



Data Preparation

- Missing Values
- Normality
- Multicollinearity
- Linearity

Missing Values

Edt & Gini significant

■ Statistics

- BRITCOL8 ELF80 LEVEL80
- ODRP80 RIOTS80 CCODE80
- CIVLIB90 POLLIB90 REG90
- Missing 7 7 7
- 7 7 7
- 23 23 23

Pairwise
Listwise



Outliers

- outliers can distort the results greatly



Variable Transformation

- Power Function
- Log

For normality, linearity,



Start Thinking about programming

- **B** - beta
- η - eta
- ξ - xi
- ζ - zeta
- Γ - gamma
- Λ - lambda (upper case)
- λ - lambda (lower case)
- δ - delta
- ϵ - epsilon

NY
NX
NK
NE



About the Assignment

- Modify your hypotheses
- 1) Specify **a few** SEM models
- 2) Check their identification issues
- 3) Prepare your data

- Write a 2 page report
