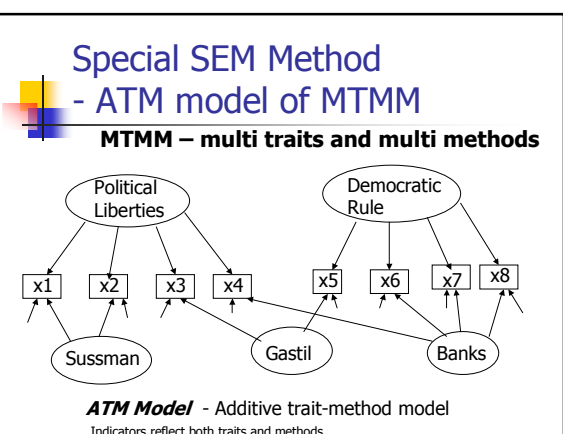


Using SEM to assess the validity and method bias of common-used democracy measures – a tech note

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Summary

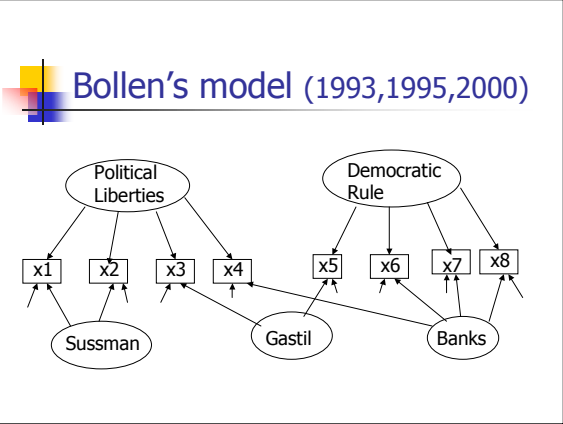
- Using ATM model and CU model, this note demonstrates that equivalent models do exist for democracy bias & validity studies.
- Bollen's research (1993, 1998, 2000) overestimated the method bias of the Freedom House indices.



More on ATM Model for MTMM – Multitrait Multimethod

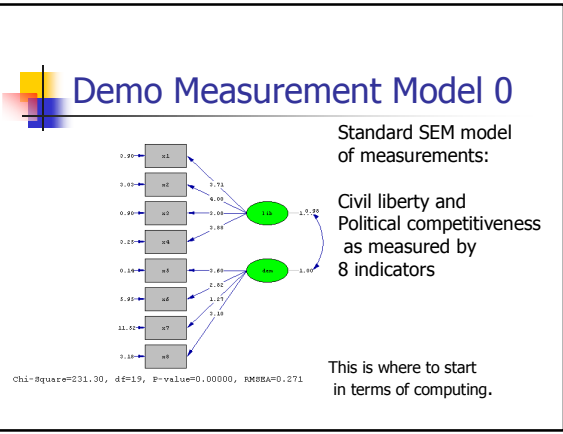
$$I = a T + b M + e$$

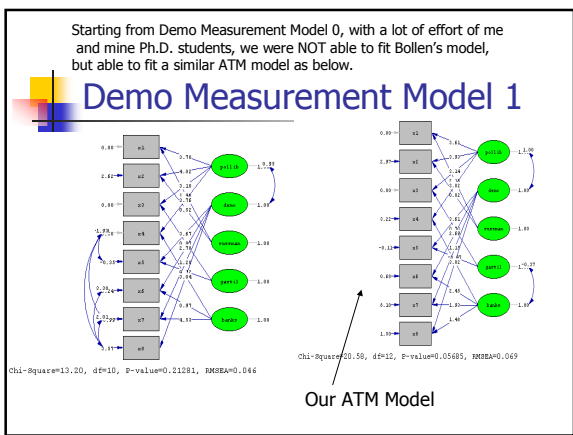
- Indicators are linear combination of latent variables and measure methods.
- I - indicators
- T - traits
- M - method factors
- e - errors

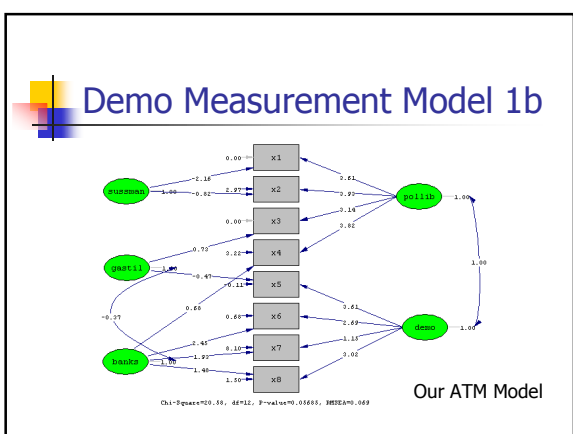


References for Bollen's model

- Kenneth Bollen 1993 Liberal Democracy: Validity and Method Factors in Cross-National Measures. American Journal of Political Science, Vol 37 (November) 1207-1230
- Kenneth Bollen & Pamela Paxton 1998 Detection and Determinants of Bias in Subjective Measures. American Sociological Review, Vol. 63 (June) 465-478
- Kenneth Bollen and Pamela Paxton 2000 Subjective Measures of Liberal Democracy. Comparative Political Studies, Vol. 33 (February) 58-86







Results of Bollen's Model (1993)



	Method Factor Error in Bollen Model	Random Error in Bollen Model	Validity in Bollen Model
X1	14%	18	68
X2	22	7	71
X3	16	6	78
X4	0	8	92
X5	7	0	93
X6	38	0	62
X7	22	64	14
X8	9	12	79

Chi-square = 14.2
 Df = 13
 P-value = .36
 GFI = .98
 AGFI = .94

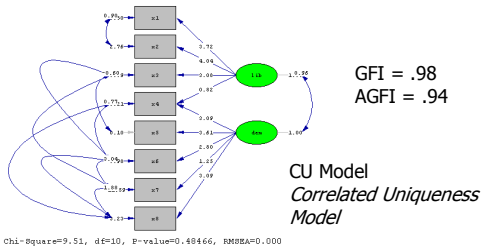
Method Factor Error
Random Error

$$\text{Var}(I) = a^2 \text{Var}(\text{Trait}) + b^2 \text{Var}(\text{Method}) + \text{Var}(e)$$

With the same data, we can fit a CU model very well.



Demo Measurement Model 2

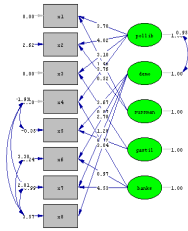


Equivalent models

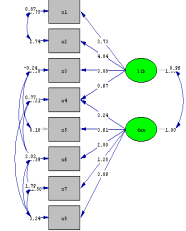
- 2 models are equivalent if they are equally well compatible with the statistical evidence
- 2 models are equivalent if they imply the same set of probability distribution for the observable vector (Koopmans and Reiersol)
- If they reproduce the same set of positive definite covariance matrices (Joreskog and Sorbom)

Our ATM and CU models are equivalent to each other, in terms of fitting our data.

2 Equivalent Models



Chi-Square=13.20, df=10, P-value=0.21281, RMSEA=0.046



Chi-Square=14.31, df=11, P-value=0.21628, RMSEA=0.046

Common Equivalent Models for MTMM – ATM and CU (2 Approaches)

- Method Factor CFA (ATM Model)
- Correlated Uniqueness Model

Sometimes, logics and intuition are needed to justify the preference of one model over another equivalent model.

Model Fit Indices of Bollen's Model and Ours

	Chi Square	df	P-value	RMSEA	GFI	AGFI
Bollen Model	9.2	8	.33	.024	.99	.93
Our ATM Model	9.5	10	.48	<.001	.98	.94
Our CU Model	20.58	12	.57	.069	.97	.90

Validity Estimation by two models

	Bollen Model	Our CU Model
x1	68	78
x2	71	86
x3	78	91
x4	92	82
x5	93	99
x6	62	57
x7	14	12
x8	79	75

Error Estimation by Two Models

	Method Errors in Bollen Model	Random Error in Bollen Model	Random Error in our CU Model
x1	14	18	22
x2	22	7	14
x3	16	6	9
x4	0	8	18
x5	7	0	1
x6	38	0	43
x7	22	64	88
x8	9	12	25

Comments

- Bollen's model gives 0 method errors to X4, and 0 random error to X5 and X6 that seems unreasonable.
- Our models present better results and demonstrate that to select among equivalent models, we need more assumptions or data.
- However, assessing method bias and random errors of democracy measures are possible by using our techniques.
