FACTOR ANALYSIS ADVANCED TOPICS

Chapter 3

Topics

- 1. 3-factor example.
- 2. Adjusting eigen values.
- 3. Chain of evidence.
- 4. Reliability analysis.

1. A Three-Factor Example

Now we use all 15 indicators.



Assessment

- Sample size 315 good.
- Correlations good.
- KMO .938 good.
- Anti-image all over .89 good.
- Communalities lowest .427 hmm?
- Cumulative explained variance 64% OK.
- Two factors hmm?

Communalities

Communalities

	Initial	Extraction
CO	.708	.730
CO	.738	.752
CO	.743	.772
CO	.764	.765
CO	.694	.720
RT	.602	.603
RT	.692	.718
RT	.707	.717
RT	.736	.762
RT	.683	.698
IS	.562	.525
IS	.531	.461
IS	.593	.434
IS	.569	.456
IS	.481	.427

Extraction Method: Maximum Likelihood.

2. Eigen values & Explained Variance

	Ini	Extraction Sums of Squared		Rotation Sums of Squared		Squared				
Factor	Total	% of Variance	Cumula tive %	Total	% of Variance	Cumula tive %	Total	% of Variance	Cumula tive %	
1	8.456	56.376	56.376	8.036	53.574	53.574	5.499	36.662	36.662	
2	1.761	11.741	68.117	1.505	10.036	63.610	4.042	26.948	63.610	
3	.933~	6.219	74.336							
4	.609	4.00	70 396							
5	.473	3.152	81.5	Almost a 3 factor solution						
6	.403	2.684	84.232	(what we want). The						
7	.397	2.650	86.882							
8	.364	2.427	89.309	explained variance will also						
9	.312	2.081	91.389		rise.					
10	.280	1.869	93.259							
11	.257	1.710	94.969							
12	.225	1.498	96.467							
13	.211	1.408	97.874							
14	.179	1.192	99.066							
15	.140	.934	100.000							

Total Variance Explained

Extraction Method: Maximum Likelihood.

Rotated Solution: Eigen at .9

Rotated Factor Matrix

		Factor		This variable loads higher.
	1	2	3	and significantly on the
CO	.290	.753	.273	and significantly, on the
со	.244	.793	.249	wrong factor.
со	.196	.859	.119	
СО	.335	.786	.207	Remedy
со	.220	.773	.266	Romody
RT	.667	.264	.296	
RT	.751	.253	.310	Drop the variable.
RT	.789	.253	.246	
RT	.789	.271	.291	
RT	.757	.273	.260	
IS	.531	.254	.442	
IS	.424	.288	.502	Cross-loading
IS	.272	.267	.768	
IS	.357	.254	.661	
IS	.428	.188	.531	

Extraction Method: Maxim um Likelihood.

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 5 iterations.

Rotated Solution: Eigen at .9; 4IS

Rotated Factor Matrix



Extraction Method: Maxim um Likelihood.

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 5 iterations.

Rotated Solution: Eigen at .9; 3IS

Rotated Factor Matrix

	Factor					
	1		2	3		
CO		.758	.281	.275		
СО		.797	.251	.235		
СО		.862	.207	9.145E-02		
со		.788	.335	.194		
со		.777	.204	.286		
RT		.253	.663	.312		
RT		.258	.762	.290		
RT		.246	.787	.250		
RT		.262	.802	.274		
RT		.286	.746	.242		
IS		.278	.321	.654		
IS		.262	.334	.721		
IS		.197	.412	.556		

This variable is still questionable.

Remedy

Drop the variable?

Extraction Method: Maxim um Likelihood.

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 5 iterations.

3. Rotated Solution: Eigen at .9; 2IS

Rotated Factor Matrix^a

	Factor				
	1	2			
CO	.346	.784			
CO	.307	.815			
CO	.220	.846			
CO	.373	.787			
CO	.277	.806			
RT	.726	.270			
RT	.815	.265			
RT	.820	.249			
RT	.846	.263			
RT	.781	.286			
IS	.507	.362			
IS	.539	.357			

Two factors?

We need to consider evidence for and evidence against whatever choices we make.

Extraction Method: Maximum Likelihood. Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 3 iterations.

4. Reliability Analysis

- Coefficient Alpha (Cronbach's Alpha) is one of the most accepted methods to test reliability.
- In general, the cutoff to accept that a measure is reliable is .7 (Nunnally 1978).

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5	2	2	Reliabilit	v Analysis						
2	5	7								
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3	1	2								
7	5	4								
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3	5	4	Model:	Alpha					_	
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Alpha if Item Deleted

Reliability Statistics

Cronbach's	
Alpha	N of Items
.660	5

Item-Total Statistics

Possible

improvement

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item -Total Correlation	Cronbach's Alpha if Item Deleted
complex1	15.54	22.275	.356	.637
complex2	16.04	21.982	.423	.604 /
complex3	15.52	25.067	.215	.694 ′
complex4	16.22	19.890	.584	.526
complex5	16.21	20.875	.520	.559

Still too low.

Reliability Statistics

Cronbach's	
Alpha	N of Items
.694	4

Item-Total Statistics

Possible

improvement

		Scale	Corrected	Cronbach's
	Scale Mean if	Variance if	ltem - Total	Alpha if Item
	Item Deleted	Item Deleted	Correlation	Deleted
com plex1	11.18	16.630	.345	.716
com plex2	11.68	16.445	.409	.672
complex4	11.86	14.304	.607	.546
complex5	11.85	14.767	.576	.568

Final Solution

Reliability Statistics

Cronbach's	N of Items
Арпа	IN UTILETITS
.726	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item -Total Correlation	Cronbach's Alpha if Item Deleted
complex2	7.38	9.840	.398	.809
complex4	7.56	7.986	.634	.529
com plex5	7.55	8.153	.628	.540

Multidimensionality versus reliability. How good is good? What is good?

Possible

improvement