

MKT 791--Research II
R. Kleine
Spring '96

SESSION 5:

Measure Quality Assessment (MQA) I:
Exploratory Factor Analysis

READINGS

Hair, Joseph F., Jr., Rolph E. Anderson, Ronald L. Tatham, and William C. Black (1995), *Multivariate Data Analysis with Readings*, 4th ed., Englewood Cliffs, NJ: Prentice-Hall.

- ◆ Chapter 7: Factor Analysis

Nunnally, Jum C. and Ira H. Bernstein (1994), *Psychometric Theory*, 3rd ed., New York: McGraw Hill.

- ◆ Chapter 11: Factor Analysis I: The General Model and Variance Condensation
- ◆ Chapter 12: Exploratory Factor Analysis II: Rotation and Other Topics

Hatcher, Larry (1994), *A Step-by-Step Approach to Using the SAS System for Factor Analysis and Structural Equation Modeling*, Cary, NC: The SAS Institute.

- ◆ Review Appendices A.1-A.5 as needed
- ◆ Chapter 3: Assessing Scale Reliability with coefficient Alpha
- ◆ Chapter 1: Principal Components Analysis
- ◆ Chapter 2: Exploratory Factor Analysis

Stewart, David W. (1981), "The Application and Misapplication of Factor Analysis in Marketing Research," *Journal of Marketing Research*, 18 (February), 51-62.

Highly Recommended:

Stevens, James (1992), "Chapter 11: Principal Components," in *Applied Multivariate Statistics for the Social Sciences*, 2nd ed., Hillsdale, NJ: Lawrence Erlbaum, 374-407.

YOUR TURN

This exercise requires two data sets (the HATCO data, and some of your own), and SAS. Strap on your computing shoes and let's go . . .

1. Select from your data set several variables that you believe measure (a) three different latent constructs (more if you're daring) *or* (b) three (or more) facets of a construct. Each construct (facet) should have *at least* three *effect* indicators. Do the same thing with the HATCO data set. Do all of the following (except the written exercise) twice, once for each data set:
2. Assess the quality of the items as indicators of their respective constructs. Do the following:
 - a. Use PROC CORR to produce a zero-order correlation matrix of the *entire* set of variables identified in part 1. Examine the correlation matrix for evidence of item quality. Which items are good indicators of each construct? poor indicators? What criteria guide your assessments of item quality?
 - b. Examine item-total correlations for each construct. Use PROC CORR and specify the **alpha option** (i.e., PROC CORR ALPHA;). **Run a separate analysis for the items affiliated with each construct.** (Include in this analysis all of a construct's possible indicators--even those suggested to be "bad" in the preceding analysis.) What items are "good" indicators based on this approach? What criteria guide your assessments of item quality? Are your conclusions any different from above?
 - c. Now for some heavier artillery. Put PROC FACTOR *and* a thinking scientist to work:
 - (1) Submit the entire set of variables to an (unrotated) exploratory factor analysis (PROC FACTOR--of course). Specify this option: PRIORS=SMC. (QUESTION: What does this option do? What is the implication of running the analysis **without** the PRIORS option specified?).
 - (a) How many factors do you anticipate *a priori*? Is this supported by your analysis? What criteria guide your selection of the number of factors to "keep"? Can you interpret the factors that emerged?
 - (b) Do the items load on the "right" factors? What guides your answers here? (Note: the REORDER option--RE for short--if included in your PROC FACTOR statement improves readability of the output. Try it, you'll like it!)
 - (c) Which items are the "best" indicators of each construct? What criteria guides these decisions?
 - (d) A brain teaser: What is the reliability of each *item* as a measure of its construct? How do you obtain this?
 - (2) Now, rerun the factor analysis using a Varimax rotation. Compare the

interpretability of this solution with that of the unrotated solution you examined above. Any differences? Re-evaluate item quality. Any differences here?

- (3) Do you have reason to believe that your constructs are correlated rather than orthogonal? If so (or even if you don't), rerun the analysis using an oblique rotation.
 - (a) Compare this oblique solution with the orthogonal factor analyses you ran. How does it differ?
 - (b) What are the correlations between the latent constructs (factors)?
- (4) Based on the series of factor analyses you performed, which items should be used as indicators of each construct?
- (5) Draw a path diagram depicting the model underlying the oblique factor analysis you performed. Include on your diagram the parameter estimates you obtained from PROC FACTOR.
- (6) Brain Teaser II: Choose two pairs of manifest variables. For each pair, use the parameter estimates obtained by the factor analysis to calculate their correlation. Compare your calculated correlation with the actual correlation between the two variables.
- (7) Write out the structural equations for your factor analysis.

d. Bring the preceding analyses and Brain Teasers to class so we can discuss them.

3. Prepare a written summary describing the quality of the measures culled from your data set. Write this as though it is the method, results, and conclusion/discussion section for a national level conference proceedings paper. You may include an 'introduction' section that includes general information about the study. A suggested outline follows. **Your summary is due to me by February 21.**

a. Method

- i. Define each construct;
- ii. List each construct's indicators and describe how they are scaled (e.g., 7-point bipolar adjective scales);
- iii. Describe the sample (e.g., who are they and how many);
- iv. Describe the data collection procedures;

b. Analysis

- i. Describe the analyses you performed, explain what you can get out of that type of analysis, and present the "best" indicators for each construct, as suggested by each analysis you performed. (A summary table might be a useful device.)

c. Conclusions

- i. All things considered, what are the "best overall" indicators for each construct? (You might include these items in your summary table.) Explain/justify why you selected these items as the "best overall" indicators.
- ii. In light of your analyses, discuss the quality of your measures.