FACTOR MODELS: AN ANNOTATED BIBLIOGRAPHY by Hedibert Lopes

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Factor models is certainly one of the most used (useful) statistical techniques. Factor models are mainly applied in two major situations: (i) data reduction and (ii) identifying underlying structures. I would like to start this section by quoting Bartholomew (1995) (Spearman and the origin and development of factor analysis, British Journal of Mathematical and Statistical Psychology, 48, 211-220), who starts his paper's abstract by saying that

Spearman [Charles Edward Spearman F.R.S. 1863-1945] invented factor analysis but his almost exclusive concern with the notion of a general factor prevented him from realizing its full potential.

Fortunately, factor models potentials have been discovered and are still being discovered, even after almost a century has passed since Spearman wrote his seminal paper ('General Inteligente' objectively determined and measured, American Journal of Psychology, 5, 201-293, 1904.)

I organized this annotated bibliography with the idea of providing the reader with a modest (and subjective) set of papers and books that would lead him/her to the realm of (latent) factor models.

Factor analysis: estimation

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- Lawley (1941) Further investigations in factor estimation, Proceedings of the Royal Society of Edinburgh, 61, 176-185. Introduces maximum likelihood factor model.
- Anderson, T.W. (1963) The Use of factor analysis in the statistical analysis of multiple time series. Psychometrika, 28, 1-25.
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- Martin, J.K. and McDonald, R.P. (1975) Bayesian estimation in unrestricted factor analysis: a treatment for Heywood cases, Psychometrika, 40, 505-517. Treatment of the Heywood case (zero variances) by proper specification of the prior distributions.
- 7. Geweke, J.F. and Singleton, K.J. (1980) Interpreting the likelihood ratio statistic in factor models when sample size is small, Journal of the American Statistical Association, 75, 133-137. From Monte Carlo simulations and under certain regularity conditions, asymptotic theory is appropriate when sample size is greater than 30. The same is not true when the regularity conditions fail.
- 8. Bartholomew, D.J. (1981) Posterior analysis of the factor model, British Journal of Mathematical and Statistical Psychology, 34, 93-99. The posterior analysis is restricted to the common factors upon previous estimation of the model parameters (loadings and idiosyncrasies).
- 9. Lee, S-Y (1981) A Bayesian approach to confirmatory factor analysis, Psychometrika, 46, 153-160. A Newton-Raphson algorithm is implemented to find the posterior mode for four different prior specifications.
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- 12. Rubin, D.B. and Thayer D.T. (1983) More on EM for factor analysis, Psychometrika, 48, 253-257. The EM algorithm is introduced as an alternative optimization algorithm to Jöreskog's (1967,1969) maximum likelihood scheme.
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and idiosyncratic variances. Three step procedured: (1) estimation of the common factors, (2) estimation of the factor loadings given the common factors estimate, and (3) estimation of the idiosyncratic variances given both the common factors and factor loadings estimates.

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- Bartholomew, D.J. (1995) Spearman and the origin and development of factor analysis, British Journal of Mathematical and Statistical Psychology, 48, 211-220. Historical account of the development of factor models.
- Ihara, M. and Kano, Y. (1995) Identifiability of full, marginal, and conditional factor analysis models, Statistics and Probability Letters, 23, 343-350. Conditions for full, marginal and conditional model identification are discussed.
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Factor analysis: model selection

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- West, M. (2003) Bayesian factor regression models in the "Large p, Small n" paradigm Bayesian Statistics, 7, 723-732. Bernardo, J.M, Bayarri, M.J., Berger, J.O., Dawid, A.P., Heckerman, D., Smith, A.F.M and West, M. (Eds.). Oxford University Press. Factor models where the number of variables is extremely larger than the number of observations, a situation commonly present in studies of gene expression.
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