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Factor Rotation and Standard Errors in Exploratory Factor Analysis: Supporting

Materials

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Factor Analysis: Supporting Materials

The file contains two tables and three figures that support the manuscript "Factor Rotation and Standard Errors in Exploratory Factor Analysis".

Table 1 compares the border information matrix method and the delta method of computing standard errors with Model I and the mixed level of factor correlation. The factor rotation method is CF-varimax. The two methods produced essentially identical standard errors. Their differences are at the fourth decimal place.

Table 2 compares the border information matrix method and the delta method of computing standard errors with Model II and the mixed level of factor correlation. The factor rotation method is CF-varimax. This example represents the largest difference between the two methods. The two types of standard errors agree to the second decimal place; some differences occur at the third decimal place.

Figures 1, 2, and 3 display the asymptotic standard errors of Model I, Model II, and Model III, respectively. Zero loadings are exactly zero when the three manifest variable correlation matrices were computed.

Table 1

Two methods of computing EFA standard errors: the bordered information matrix method and the delta theorem

	F1	F2	F3
MV1	0.593(0.930,0.930)	0.003(0.993,0.993)	0.027(1.325,1.325)
MV2	0.692(0.903,0.903)	0.004(0.811,0.811)	0.031(1.088,1.088)
MV3	0.790(0.894,0.894)	0.004(0.611,0.611)	0.036(0.815,0.815)
MV4	0.005(0.787,0.787)	0.672(0.848,0.848)	0.060(1.143,1.143)
MV5	0.006(0.614,0.614)	0.768(0.745,0.745)	0.069(0.914,0.914)
MV6	0.007(0.451,0.451)	0.864(0.680,0.680)	0.078(0.715,0.715)
MV7	0.008(0.949,0.949)	0.001(1.186,1.186)	0.497(1.920,1.920)
MV8	-0.008(0.949,0.949)	0.001(1.186,1.186)	0.497(1.920,1.920)
MV9	-0.008(0.949,0.949)	0.001(1.186,1.186)	0.497(1.920,1.920)

Note. The bordered information matrix method and the delta method are used to compute asymptotic standard errors for rotated factor loadings. The rotation criterion is oblique CF-varimax. Each entry includes a factor loading and its asymptotic standard errors. Standard errors are in the parentheses: standard errors computed using the bordered information method are presented first.

Table 2

Two methods of computing EFA standard errors: the bordered information matrix method and the delta theorem

	F1	F2	F3
MV1	0.475(1.477,1.478)	-0.074(0.755,0.755)	0.618(1.412,1.413)
MV2	0.678(0.796,0.796)	0.013(0.954,0.954)	0.054(1.116,1.117)
MV3	0.774(0.676,0.676)	0.015(0.762,0.762)	0.061(0.947,0.948)
MV4	0.871(0.597,0.598)	0.017(0.577,0.577)	0.069(0.842,0.844)
MV5	0.018(0.693,0.693)	0.751(0.844,0.844)	0.089(0.995,0.996)
MV6	0.021(0.535,0.535)	0.845(0.783,0.783)	0.100(0.923,0.923)
MV7	0.016(0.849,0.849)	0.657(0.951,0.951)	0.078(1.121,1.123)
MV8	-0.092(0.673,0.673)	0.478(1.676,1.679)	0.639(1.564,1.566)
MV9	-0.106(1.058,1.059)	-0.085(1.088,1.089)	0.572(1.027,1.027)

Note. The bordered information matrix method and the delta method are used to compute asymptotic standard errors for rotated factor loadings. The rotation criterion is oblique CF-varimax. Each entry includes a factor loading and its asymptotic standard errors. Standard errors are in the parentheses: standard errors computed using the bordered information method are presented first.

Figure Captions

Figure 1. Asymptotic Standard Errors For Maximum Likelihood Rotated Factor Loadings of Model I. The factor loadings on Factor 1, Factor 2, and Factor 3 are in the left shaded area (λ_{11}, λ_{21}, ..., λ_{91}), the middle unshaded area (λ_{12}, λ_{22}, ..., λ_{92}), and the right shaded area (λ_{13}, λ_{23}, ..., λ_{93}), respectively.

Figure 2. Asymptotic Standard Errors For Maximum Likelihood Rotated Factor Loadings of Model II. The factor loadings on Factor 1, Factor 2, and Factor 3 are in the left shaded area (λ_{11}, λ_{21}, ..., λ_{91}), the middle unshaded area (λ_{12}, λ_{22}, ..., λ_{92}), and the right shaded area (λ_{13}, λ_{23}, ..., λ_{93}), respectively.

Figure 3. Asymptotic Standard Errors For Maximum Likelihood Rotated Factor Loadings of Model III. The factor loadings on Factor 1, Factor 2, and Factor 3 are in the left shaded area (λ_{11}, λ_{21}, ..., λ_{91}), the middle unshaded area (λ_{12}, λ_{22}, ..., λ_{92}), and the right shaded area (λ_{13}, λ_{23}, ..., λ_{93}), respectively.