What is the annotated output for the Factor Analysis command in Stata?

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The annotated output for the Factor Analysis command in Stata is a comprehensive summary of the results obtained from performing a factor analysis on a dataset. It includes various tables and graphs that display the factor loadings, communalities, eigenvalues, and other relevant statistics for each variable in the dataset. The output also provides information on the number of factors extracted, the factor rotation method used, and the overall fit of the model. Additionally, it includes a detailed interpretation of the results and the implications for the underlying factors in the dataset. This annotated output serves as a valuable resource for understanding and interpreting the results of a factor analysis in Stata.

Factor Analysis | Stata Annotated Output

This page shows an example factor analysis with footnotes explaining the output. We will do an iterated principal axes (ipf option) with SMC as initial communalities retaining three factors (factor(3) option) followed by varimax and promax rotations.

These data were collected on 1428 college students (complete data on 1365 observations) and are responses to items on a survey. We will use item13 through item24 in our analysis.

use https://stats.idre.ucla.edu/stat/stata/output/m255, clearfactor item13-item24, ipf factor(3)
(obs=1365)

(iterated principal factors; 3 factors retained)

Factor Eigenvaluea Differenceb Proportionc Cumulatived

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1 5.85150 5.04464 0.8336 0.8336

2 0.80687 0.44540 0.1149 0.9485

3 0.36146 0.23001 0.0515 1.0000

4 0.13146 0.07619 0.0187 1.0187

5 0.05527 0.02362 0.0079 1.0266

6 0.03164 0.02946 0.0045 1.0311

7 0.00218 0.00658 0.0003 1.0314

8 -0.00440 0.01466 -0.0006 1.0308

9 -0.01906 0.02688 -0.0027 1.0281

10 -0.04594 0.01440 -0.0065 1.0215

11 -0.06035 0.03050 -0.0086 1.0129

12 -0.09084 . -0.0129 1.0000

a. Eigenvalue: An eigenvalue is the variance of the factor. In the initial factor solution,
the first factor will account for the most variance, the second will account for the next highest
amount of variance, and so on. Some of the eigenvalues are negative because the matrix is not of
full rank, that is, although there are 12 variables the

dimensionality of the factor space
is much less There are at most seven factors possible.

b. Difference: Gives the differences between the current and
following eigenvalue.

c. Proportion: Gives the proportion of variance accounted for by the factor.

d. Cumulative: Gives the cumulative proportion of variance accounted for by this factor
plus all of the previous ones.

Factor Loadingse
Variable | 1 2 3 Uniquenessf
-------------+--------------------------------------
item13 | 0.71339 -0.39873 0.09231 0.32356
item14 | 0.70320 -0.33908 0.09782 0.38097
item15 | 0.72122 -0.24499 0.10575 0.40864
item16 | 0.64779 -0.18905 0.11144 0.53220
item17 | 0.78307 -0.07337 0.06670 0.37698
item18 | 0.73947 0.34478 0.11291 0.32157
item19 | 0.61655 0.41588 0.15515 0.42284
item20 | 0.55009 0.23916 0.09318 0.63152

item21 | 0.73173 0.11683 0.00067 0.45093
item22 | 0.61281 0.26089 -0.02282 0.55588
item23 | 0.81937 -0.02620 -0.34543 0.20863
item24 | 0.69515 0.01825 -0.38727 0.36646

e. Factor Loadings: The factor loadings for this orthogonal solution represent both how the variables are weighted for each factor but also the correlation between the variables and the factor.

f. Uniqueness: Gives the proportion of the common variance of the variable not associated
with the factors. Uniqueness is equal to 1 - communality.

rotate, varimax horst

Factor analysis/correlation Number of obs = 1365
Method: iterated principal factors Retained factors = 3
Rotation: orthogonal varimax (Horst on) Number of params = 33

Factor | Variance Difference Proportion Cumulative
-------------+--

Factor1 | 2.94943 0.29428 0.4202 0.4202

Factor2 | 2.65516 1.23992 0.3782 0.7984

Factor3 | 1.41524 . 0.2016 1.0000

LR test: independent vs. saturated: chi2(66) = 8683.10 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variancesg

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Variable | Factor1 Factor2 Factor3 | Uniquenessh

-------------+-------------------------------+--------------

item13 | 0.7714 0.1740 0.2260 | 0.3236

item14 | 0.7256 0.2130 0.2171 | 0.3810

item15 | 0.6756 0.2950 0.2187 | 0.4086

item16 | 0.5908 0.2926 0.1820 | 0.5322

item17 | 0.5867 0.4461 0.2825 | 0.3770

item18 | 0.2865 0.7386 0.2255 | 0.3216

item19 | 0.1702 0.7281 0.1343 | 0.4228

item20 | 0.2278 0.5396 0.1594 | 0.6315

item21 | 0.4020 0.5333 0.3210 | 0.4509

item22 | 0.2178 0.5584 0.2913 | 0.5559

item23 | 0.4488 0.3769 0.6692 | 0.2086

item24 | 0.3235 0.3205 0.6528 | 0.3665

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Factor rotation matrix

| Factor1 Factor2 Factor3

-------------+--------------------------

Factor1 | 0.6584 0.6121 0.4381

Factor2 | -0.6840 0.7294 0.0088

Factor3 | 0.3141 0.3055 -0.8989

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g. Rotated Factor Loadings: The factor loadings for the varimax orthogonal rotation represent both how the variables are weighted for each factor but also the correlation between the variables and the factor. A varimax rotation attempts to maximize the squared loadings of the columns.

h. Uniqueness: Same values as in e. above because it is still a three factor solution.

The blanks option displays only factor loading greater

than
a specific value (say 0.3).

rotate, varimax horst blanks(.3)

Factor analysis/correlation Number of obs = 1365
Method: iterated principal factors Retained factors = 3
Rotation: orthogonal varimax (Horst on) Number of params = 33

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Factor | Variance Difference Proportion Cumulative

-------------+--

Factor1 | 2.94943 0.29428 0.4202 0.4202
Factor2 | 2.65516 1.23992 0.3782 0.7984
Factor3 | 1.41524 . 0.2016 1.0000

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LR test: independent vs. saturated: chi2(66) = 8683.10 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

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Variable | Factor1 Factor2 Factor3 | Uniqueness

-------------+----------------------------+-------------

item13 | 0.7714 | 0.3236

item14 | 0.7256 | 0.3810

item15 | 0.6756 | 0.4086

item16 | 0.5908 | 0.5322

item17 | 0.5867 0.4461 | 0.3770

item18 | 0.7386 | 0.3216

item19 | 0.7281 | 0.4228

item20 | 0.5396 | 0.6315

item21 | 0.4020 0.5333 0.3210 | 0.4509

item22 | 0.5584 | 0.5559

item23 | 0.4488 0.3769 0.6692 | 0.2086

item24 | 0.3235 0.3205 0.6528 | 0.3665

(blanks represent abs(loading)rotate, promax horst blanks(.3)

Factor analysis/correlation Number of obs = 1365
Method: iterated principal factors Retained factors = 3
Rotation: oblique promax (Horst on) Number of params = 33

Factor | Variance Proportion Rotated factors are

correlated

-------------+--

Factor1 | 4.86265 0.6927

Factor2 | 4.52052 0.6440

Factor3 | 4.30842 0.6138

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LR test: independent vs. saturated: chi2(66) = 8683.10 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variancesi

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Variable | Factor1 Factor2 Factor3 | Uniquenessj

-------------+-----------------------------+-------------

item13 | 0.8518 | 0.3236

item14 | 0.7855 | 0.3810

item15 | 0.6969 | 0.4086

item16 | 0.6044 | 0.5322

item17 | 0.5087 | 0.3770

item18 | 0.7626 | 0.3216

item19 | 0.8200 | 0.4228

item20 | 0.5541 | 0.6315

item21 | 0.4298 | 0.4509

item22 | 0.5265 | 0.5559

item23 | 0.7187 | 0.2086

item24 | 0.7502 | 0.3665

(blanks represent abs(loading)

i. Rotated Factor Loadings: The factor loadings for the promax oblique rotation represent
how the each of the variables are weighted for each factor. Note: these are not correlations between
variables and factors. The promax rotation allows the factors to be correlated in an attempt to
better approximate simple structure.

i. Uniqueness: Same values as in e. and h. above because it is still
a three factor solution.

The estat common command is a postestimation command that displays the correlation
among the factors of an oblique rotation.

estat common

Correlation matrix of the promax(3) rotated common

factors

Factors | Factor1 Factor2 Factor3

-------------+----------------------------

Factor1 | 1

Factor2 | .5923 1

Factor3 | .6807 .6482 1
