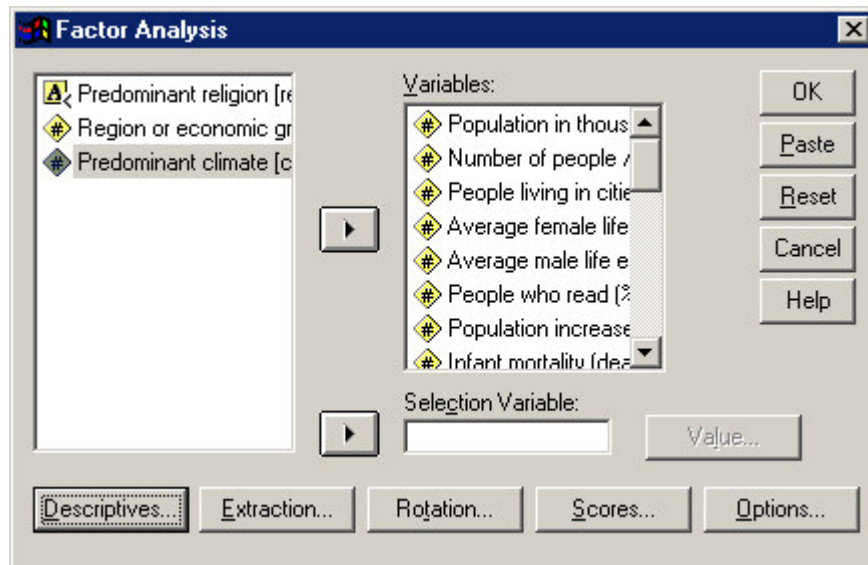


Chapter 7 – Factor Analysis – SPSS

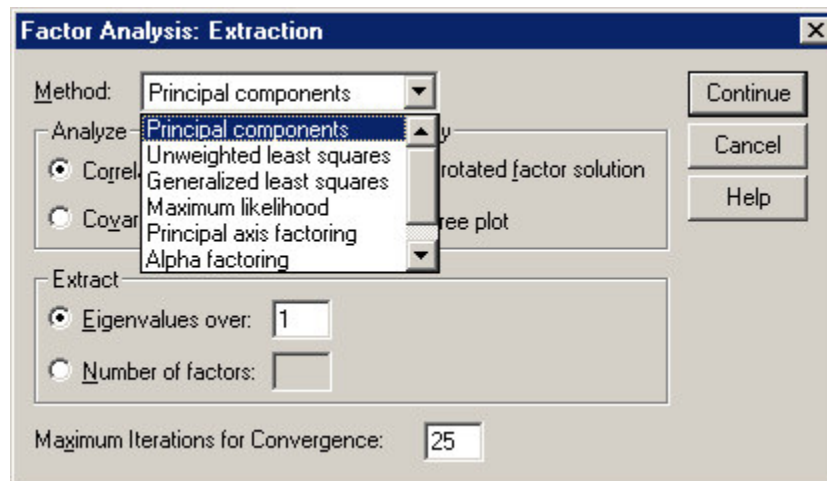
Factor analysis attempts to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables. Factor analysis can also be used to generate hypotheses regarding causal mechanisms or to screen variables for subsequent analysis (for example, to identify collinearity prior to performing a linear regression analysis).



Data. The variables should be quantitative at the interval or ratio level. Categorical data (such as religion or country of origin) are not suitable for factor analysis. Data for which Pearson correlation coefficients can sensibly be calculated should be suitable for factor analysis.

Assumptions. The data should have a bivariate normal distribution for each pair of variables, and observations should be independent.

Extraction method. Allows you to specify the method of factor extraction.



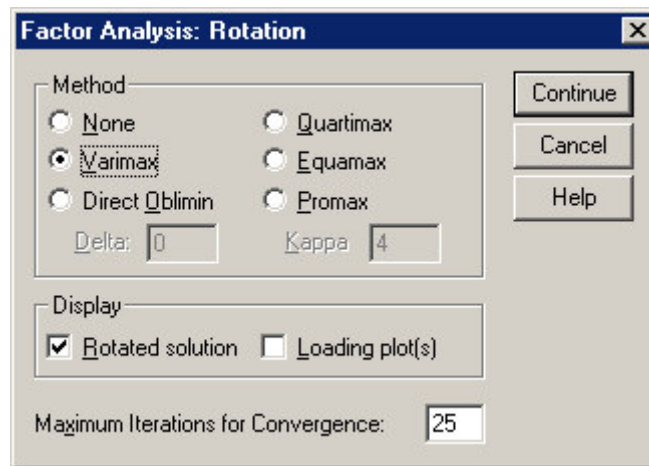
Analyze. Allows you to specify either a correlation matrix or a covariance matrix.

Extract. You can either retain all factors whose eigenvalues exceed a specified value or retain a specific number of factors.

Display. Allows you to request the unrotated factor solution and a scree plot of the eigenvalues.

Maximum Iterations for Convergence. Allows you to specify the maximum number of steps the algorithm can take to estimate the solution.

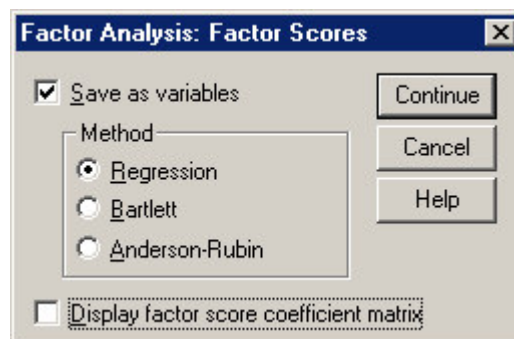
Rotation method. Allows you to select the method of factor rotation.



Display. Allows you to include output on the rotated solution, as well as loading plots for the first two or three factors.

Maximum Iterations for Convergence. Allows you to specify the maximum number of steps the algorithm can take to perform the rotation.

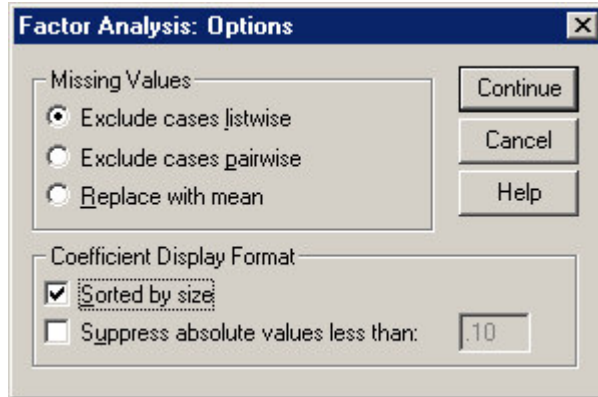
Save scores as variables. Creates one new variable for each factor in the final solution. Select one of the following alternative methods for calculating the factor scores: regression, Bartlett, or Anderson-Rubin.



Display factor score coefficient matrix. Shows the coefficients by which variables are multiplied to obtain factor scores. Also shows the correlations between factor scores.

Missing Values. Allows you to specify how missing values are handled. The available alternatives are to exclude cases listwise, exclude cases pairwise, or replace with mean.

Coefficient Display Format. Allows you to control aspects of the output matrices. You sort coefficients by size and suppress coefficients with absolute values less than the specified value.



Factor analysis results

Communalities indicate the amount of variance in each variable that is accounted for.

Communalities

	Initial	Extraction
Age of Respondent	1.000	.566
Highest Year of School Completed	1.000	.809
Total Family Income	1.000	.867
Job Satisfaction	1.000	.876
Is life exciting or dull	1.000	.633
Importance to R of Having a Fulfilling Job	1.000	.549
Number of Hours Worked Last Week	1.000	.829
RS Highest Degree	1.000	.787
Lot of average man getting worse	1.000	.556
Highest Year of School Completed, Mother	1.000	.616
Highest Year of School Completed, Father	1.000	.647
Job Satisfaction	1.000	.843
Age When First Married	1.000	.411
NUMBER OF HRS SPOUSE WORKED LAST WEEK	1.000	.870
NUMBER OF BROTHERS AND SISTERS	1.000	.537
HIGHEST YEAR SCHOOL COMPLETED, SPOUSE	1.000	.847
SPOUSES HIGHEST DEGREE	1.000	.732
GENERAL HAPPINESS	1.000	.672
HAPPINESS OF MARRIAGE	1.000	.709
How important is a HIGH INCOME	1.000	.600
LIKE OR DISLIKE CLASSICAL MUSIC	1.000	.739
LIKE OR DISLIKE OPERA	1.000	.674
LIKE OR DISLIKE COUNTRY WESTERN MUSIC	1.000	.486
RESPONDENTS INCOME	1.000	.840
HOURS PER DAY WATCHING TV	1.000	.704
OPINION OF FAMILY INCOME	1.000	.635
WIFEDUC	1.000	.792
HUSBEDUC	1.000	.815
family Income recoded to dollars	1.000	.861
respondent's income recoded to dollars	1.000	.817
hrs worked last week by husband	1.000	.764
hrs worked last week by wife	1.000	.826

Initial communalities are estimates of the variance in each variable accounted for by all components or factors. Extraction communalities are estimates of the variance in each variable accounted for by the factors (or components) in the factor solution. Small values (red) indicate variables that do not fit well with the factor solution, and should possibly be dropped from the analysis.

Factor matrix. This table reports the factor loadings for each variable on the unrotated components or factors.

Component Matrix

	Component								
	1	2	3	4	5	6	7	8	9
Highest Year of School Completed	0.85	0.19	-0.04	-0.11	0.16	0.01	-0.05	-0.12	0.09
Total Family Income	0.69	-0.44	0.19	0.06	-0.16	0.34	-0.03	0.09	-0.12
Job Satisfaction	-0.18	0.51	0.68	0.03	-0.12	0.14	-0.23	0.20	0.18
Is life exciting or dull	0.37	-0.16	-0.40	0.06	-0.18	-0.11	0.02	-0.04	0.35
Number of Hours Worked Last Week	0.31	-0.34	0.36	0.22	0.40	-0.51	-0.09	0.05	0.10
RS Highest Degree	0.79	0.20	-0.03	-0.20	0.14	0.01	0.03	-0.09	0.05
Highest Year of School Completed, Mother	0.49	0.32	0.13	-0.04	0.23	0.03	-0.14	-0.04	-0.11
Highest Year of School Completed, Father	0.51	0.47	-0.09	-0.09	0.08	-0.10	-0.10	0.08	-0.04
Job Satisfaction	-0.20	0.46	0.67	0.13	-0.11	0.11	-0.26	0.24	0.13
NUMBER OF HRS SPOUSE WORKED LAST WEEK	0.01	0.11	-0.06	0.84	-0.03	0.30	0.29	0.05	-0.07
HIGHEST YEAR SCHOOL COMPLETED, SPOUSE	0.78	0.41	-0.11	0.07	-0.01	0.00	0.17	0.00	-0.06
SPOUSES HIGHEST DEGREE	0.72	0.36	-0.07	0.07	-0.04	0.06	0.21	-0.02	-0.05
GENERAL HAPPINESS	-0.22	0.09	0.56	-0.26	0.08	0.05	0.35	-0.36	-0.14
HAPPINESS OF MARRIAGE	-0.33	-0.02	0.37	-0.37	0.17	0.03	0.51	-0.01	-0.25
How important is a HIGH INCOME	0.02	0.04	-0.17	-0.26	-0.15	0.08	0.21	0.68	0.31
LIKE OR DISLIKE CLASSICAL MUSIC	-0.39	-0.03	-0.16	-0.05	0.57	0.46	-0.14	-0.04	0.07
LIKE OR DISLIKE OPERA	-0.29	0.00	-0.18	-0.05	0.63	0.46	-0.07	0.10	0.16
RESPONDENTS INCOME	0.66	-0.49	0.32	-0.17	0.12	0.03	-0.14	-0.05	0.20
HOURS PER DAY WATCHING TV	-0.22	0.14	-0.06	0.20	-0.20	0.10	-0.52	-0.49	0.03
OPINION OF FAMILY INCOME	0.48	-0.25	-0.02	-0.07	-0.24	0.38	-0.17	0.12	-0.40
WIFEDUC	0.79	0.30	-0.14	-0.06	0.14	0.11	0.10	-0.12	0.05
HUSBEDUC	0.83	0.29	-0.01	0.02	0.02	-0.09	0.01	-0.01	-0.02
family Income recoded to dollars	0.72	-0.42	0.20	0.04	-0.21	0.29	-0.02	0.08	-0.10
respondent's income recoded to dollars	0.69	-0.47	0.27	-0.15	0.10	-0.06	-0.11	0.00	0.16
hrs worked last week by husband	0.18	-0.08	0.02	0.55	0.39	-0.30	-0.15	0.34	-0.41
hrs worked last week by wife	0.15	-0.15	0.28	0.64	0.01	0.11	0.38	-0.21	0.40

Extraction Method: Principal Component Analysis. 9 components extracted.

Each number represents the correlation between the item and the unrotated factor (e.g. the correlation between 'Total Family Income' and factor 1 is 0.69). These correlations can help you formulate an interpretation of the factors or components. This is done by looking for a common thread among the variables that have large loadings for a particular factor or component.

It is possible to see items with large loadings on several of the unrotated factors, which can make interpretation difficult. In these cases, it can be helpful to examine a rotated solution.

Rotation is a method used to simplify interpretation of a factor analysis.

Rotated Component Matrix

	Component								
	1	2	3	4	5	6	7	8	9
Highest Year of School Completed	0.82	0.20	0.28	-0.08	0.12	-0.03	-0.01	-0.07	-0.03
Total Family Income	0.24	0.83	0.28	-0.07	0.06	0.16	-0.09	0.01	0.06
Job Satisfaction	0.02	-0.09	-0.03	0.94	-0.13	0.02	-0.02	-0.07	0.00
Is life exciting or dull	0.20	0.03	0.15	-0.34	0.46	0.12	-0.15	-0.22	0.11
Number of Hours Worked Last Week	0.06	-0.06	0.78	-0.01	-0.02	0.10	-0.11	0.44	-0.02
RS Highest Degree	0.79	0.18	0.23	-0.10	0.02	-0.07	-0.03	-0.09	0.04
Highest Year of School Completed, Mother	0.60	0.09	0.10	0.16	-0.04	-0.09	0.07	0.14	-0.11
Highest Year of School Completed, Father	0.68	-0.05	-0.04	0.11	0.13	-0.17	-0.07	0.09	0.05
Job Satisfaction	-0.03	-0.08	-0.03	0.93	-0.08	0.05	-0.03	0.03	-0.02
NUMBER OF HRS SPOUSE WORKED LAST WEEK	0.02	0.09	-0.35	0.03	0.12	0.81	0.06	0.32	-0.05
HIGHEST YEAR SCHOOL COMPLETED, SPOUSE	0.86	0.13	-0.06	-0.05	0.08	0.14	-0.18	0.06	0.08
SPOUSES HIGHEST DEGREE	0.78	0.16	-0.07	-0.05	0.03	0.18	-0.17	0.01	0.09
GENERAL HAPPINESS	-0.06	-0.08	0.07	0.17	-0.77	0.05	-0.04	-0.20	-0.16
HAPPINESS OF MARRIAGE	-0.19	-0.08	-0.04	0.00	-0.80	-0.07	0.05	-0.04	0.20
How important is a HIGH INCOME	-0.01	0.01	-0.09	0.09	0.20	-0.10	0.02	-0.16	0.80
LIKE OR DISLIKE CLASSICAL MUSIC	-0.20	-0.10	-0.08	-0.02	-0.04	-0.03	0.82	-0.01	-0.09
LIKE OR DISLIKE OPERA	-0.09	-0.11	-0.04	-0.01	-0.01	0.01	0.86	0.01	0.09
RESPONDENTS INCOME	0.25	0.50	0.74	-0.05	0.02	-0.02	-0.01	-0.11	0.02
HOURS PER DAY WATCHING TV	-0.14	-0.06	-0.16	0.16	0.29	-0.02	0.02	-0.18	-0.70
OPINION OF FAMILY INCOME	0.19	0.79	-0.10	-0.07	0.07	-0.14	-0.05	0.07	-0.03
WIFEDUC	0.86	0.16	0.08	-0.13	0.07	0.08	0.03	-0.09	0.02
HUSBEDUC	0.82	0.17	0.15	-0.01	0.12	0.03	-0.21	0.07	0.03
family Income recoded to dollars	0.26	0.81	0.30	-0.06	0.06	0.15	-0.16	-0.02	0.06
respondent's income recoded to dollars	0.28	0.47	0.72	-0.09	0.04	-0.03	-0.09	-0.04	0.06
hrs worked last week by husband	0.08	0.04	0.12	-0.02	0.13	0.11	0.01	0.92	-0.02
hrs worked last week by wife	0.00	0.00	0.27	0.05	-0.01	0.90	-0.06	-0.06	-0.06

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser normalization.

When trying to interpret the first factor, we can see that all variables that measure education in one way or another (red) are highly correlated with this factor.