

# Scaling Lab

# Scaling outline

- First add the country filter
- Then we will do Cronbach's Alpha
- Then Factor Analysis

# Starting to make a one-dimensional scale with Cronbach's Alpha

The screenshot shows the SPSS Data Editor interface. The 'Analyze' menu is open, and the 'Scale' option is selected. The background shows a list of variables with their names and types.

| Name      | Type    |
|-----------|---------|
| 1 v1      | Numeric |
| 2 version | Numeric |
| 3 v2      | Numeric |
| 4 v3      | Numeric |
| 5 v3a     | Numeric |
| 6 v4      | Numeric |
| 7 v5      | Numeric |
| 8 v6      | Numeric |
| 9 v7      | Numeric |
| 10 v8     | Numeric |
| 11 v9     | Numeric |
| 12 v10    | Numeric |
| 13 v11    | Numeric |
| 14 v12    | Numeric |
| 15 v13    | Numeric |
| 16 v14    | Numeric |
| 17 v15    | Numeric |
| 18 v15    | Numeric |
| 19 v17    | Numeric |
| 20 v18    | Numeric |
| 21 v19    | Numeric |

The 'Analyze' menu is open, showing the following options:

- Reports
- Descriptive Statistics
- Tables
- Compare Means
- General Linear Model
- Generalized Linear Models
- Mixed Models
- Correlate
- Regression
- Loglinear
- Classify
- Data Reduction
- Scale**
  - Reliability Analysis...
  - Multidimensional Unfolding...
  - Multidimensional Scaling (PROXSCAL)...
  - Multidimensional Scaling (ALSCAL)...
- Nonparametric Tests
- Time Series
- Survival
- Multiple Response
- Missing Value Analysis...
- Complex Samples
- Quality Control
- ROC Curve...



# In the present example the score will be low

- Why?
- I did not RECODE the variables
- They should all go in the same direction so that the most points is either for government intervention or against it



Alpha Score in SPSS. Not so bad since in this example I did not recode the variables, so they all go in the same direction

## Reliability Statistics

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .675             | 16         |

We should delete variables that lower Alpha, which means  $\text{Alpha} > .675$  if Alpha item Deleted. We see that the first question Q5a would increase Alpha if eliminated and that its correlation is negative (perhaps because it was not recoded?)

■ **Item-Total Statistics: Scale ---- if item Deleted**

|  | Mean IID | Var IID | CorrItTotCor | Alpha iIDeleted |
|--|----------|---------|--------------|-----------------|
| ■ Q5a: Gov. and economy: Cuts in gov. spending           | 38.48    | 38.062  | -.037        | .704            |
| ■ Q5b: Gov. and economy: Financing projects for new jobs | 38.79    | 33.260  | .417         | .643            |
| ■ Q5c: Gov. and economy: Less gov. reg. of business      | 38.51    | 36.464  | .103         | .684            |
| ■ Q5d: Gae: Support industry to develop new products     | 38.58    | 33.468  | .376         | .648            |
| ■ Q5e: Gae: Support declining industries to protect jobs | 37.87    | 31.666  | .431         | .637            |
| ■ Q5f: Gov. and economy: Red. working week for more jobs | 37.71    | 34.531  | .226         | .669            |
| ■ Q6a: Government should spend money: Environment        | 38.33    | 34.922  | .328         | .656            |
| ■ Q6b: Government should spend money: Health             | 38.76    | 34.806  | .345         | .654            |
| ■ Q6c: Government should spend money: Law enforcement    | 38.04    | 34.856  | .305         | .658            |
| ■ Q6d: Government should spend money: Education          | 38.66    | 35.122  | .305         | .658            |
| ■ Q6e: Government should spend money: Defence            | 37.39    | 35.746  | .210         | .669            |
| ■ Q6f: Government should spend money: Retirement         | 38.56    | 34.101  | .389         | .648            |
| ■ Q6g: Government should spend money: Unempl. benefits   | 37.56    | 34.475  | .306         | .657            |
| ■ Q6h: Government should spend money: Culture and arts   | 37.78    | 35.236  | .300         | .659            |
| ■ Q7a: Gov. responsibility: Provide job for everyone     | 38.94    | 34.990  | .268         | .662            |
| ■ Q7b: Gov. responsibility: Control prices               | 38.60    | 35.019  | .265         | .662            |



After eliminating we get a better  
score

## Reliability Statistics

| Cronbach's<br>Alpha | N of Items |
|---------------------|------------|
| .704                | 15         |

# Now Alpha could be increased if we take away Q5c

| Item-Total Statistics   |                            |                                |                                  |                                  |
|---|----------------------------|--------------------------------|----------------------------------|----------------------------------|
|   | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
| Q5b: Gov. and economy: Financing projects for new jobs              | 36.42                      | 32.748                         | .402                             | .678                             |
| Q5c: Gov. and economy: Less gov. reg. of business                   | 36.13                      | 35.952                         | .086                             | .717                             |
| Q5d: Gov. and economy: Support industry to develop new products     | 36.20                      | 32.818                         | .373                             | .681                             |
| Q5e: Gov. and economy: Support declining industries to protect jobs | 35.49                      | 30.707                         | .456                             | .668                             |
| Q5f: Gov. and economy: Red. working week for more jobs              | 35.32                      | 33.695                         | .237                             | .700                             |
| Q6a: Government should spend money: Environment                     | 35.94                      | 34.253                         | .325                             | .688                             |
| Q6b: Government should spend money: Health                          | 36.37                      | 34.074                         | .348                             | .685                             |
| Q6c: Government should spend money: Law enforcement                 | 35.66                      | 34.262                         | .294                             | .691                             |
| Q6d: Government should spend money: Education                       | 36.28                      | 34.317                         | .317                             | .689                             |
| Q6e: Government should spend money: Defence                         | 35.00                      | 35.095                         | .206                             | .701                             |
| Q6f: Government should spend money: Retirement                      | 36.18                      | 33.351                         | .395                             | .680                             |
| Q6g: Government should spend money: Unempl. benefits                | 35.17                      | 33.541                         | .328                             | .687                             |
| Q6h: Government should spend money: Culture and arts                | 35.41                      | 34.396                         | .315                             | .689                             |
| Q7a: Gov. responsibility: Provide job for everyone                  | 36.55                      | 34.037                         | .293                             | .691                             |
| Q7b: Gov. responsibility: Control prices                            | 36.22                      | 34.109                         | .285                             | .692                             |

# Alpha increases once more!

## Reliability Statistics

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .716             | 14         |

Now Alpha cannot be increased by removing an item, as it would be less than .716 if any were removed

| Item-Total Statistics   |                            |                                |                                  |                                  |
|---|----------------------------|--------------------------------|----------------------------------|----------------------------------|
|   | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
| Q5b: Gov. and economy: Financing projects for new jobs              | 34.05                      | 31.021                         | .367                             | .696                             |
| Q5d: Gov. and economy: Support industry to develop new products     | 33.82                      | 31.303                         | .320                             | .702                             |
| Q5e: Gov. and economy: Support declining industries to protect jobs | 33.13                      | 28.525                         | .471                             | .680                             |
| Q5f: Gov. and economy: Red. working week for more jobs              | 32.96                      | 31.615                         | .234                             | .715                             |
| Q6a: Government should spend money: Environment                     | 33.57                      | 32.159                         | .318                             | .702                             |
| Q6b: Government should spend money: Health                          | 34.00                      | 31.877                         | .358                             | .698                             |
| Q6c: Government should spend money: Law enforcement                 | 33.29                      | 31.993                         | .307                             | .703                             |
| Q6d: Government should spend money: Education                       | 33.90                      | 32.337                         | .301                             | .704                             |
| Q6e: Government should spend money: Defence                         | 32.64                      | 32.919                         | .207                             | .714                             |
| Q6f: Government should spend money: Retirement                      | 33.82                      | 31.076                         | .415                             | .691                             |
| Q6g: Government should spend money: Unempl. benefits                | 32.81                      | 31.101                         | .358                             | .697                             |
| Q6h: Government should spend money: Culture and arts                | 33.03                      | 32.263                         | .314                             | .702                             |
| Q7a: Gov. responsibility: Provide job for everyone                  | 34.19                      | 31.638                         | .321                             | .701                             |
| Q7b: Gov. responsibility:   |                            |                                |                                  |                                  |

# One little problem....

- If we are comparing several groups, like men and women or Sweden and France, then we could compare the means and say that French score higher than Swedes or Women score higher than men
- Because I was lazy in making this presentation, I did not recode the questions 7a and 7b, but since they are on a scale of 1-4, while the others are on a scale of 1-5, I really should have transformed them by multiply the scores by 1.25, so they too would have the same scale.
- There would still be a problem, because even though they would all have the same maximum value, they would not have the same minimum.
- The best would be to rescale ALL the variables used, so that instead of 1-5 they would be 0, 2,3,4
- Then rescale the 1-4 scale so the scale would be 0, 1.33, 2.67, 4.0

# The scale scores

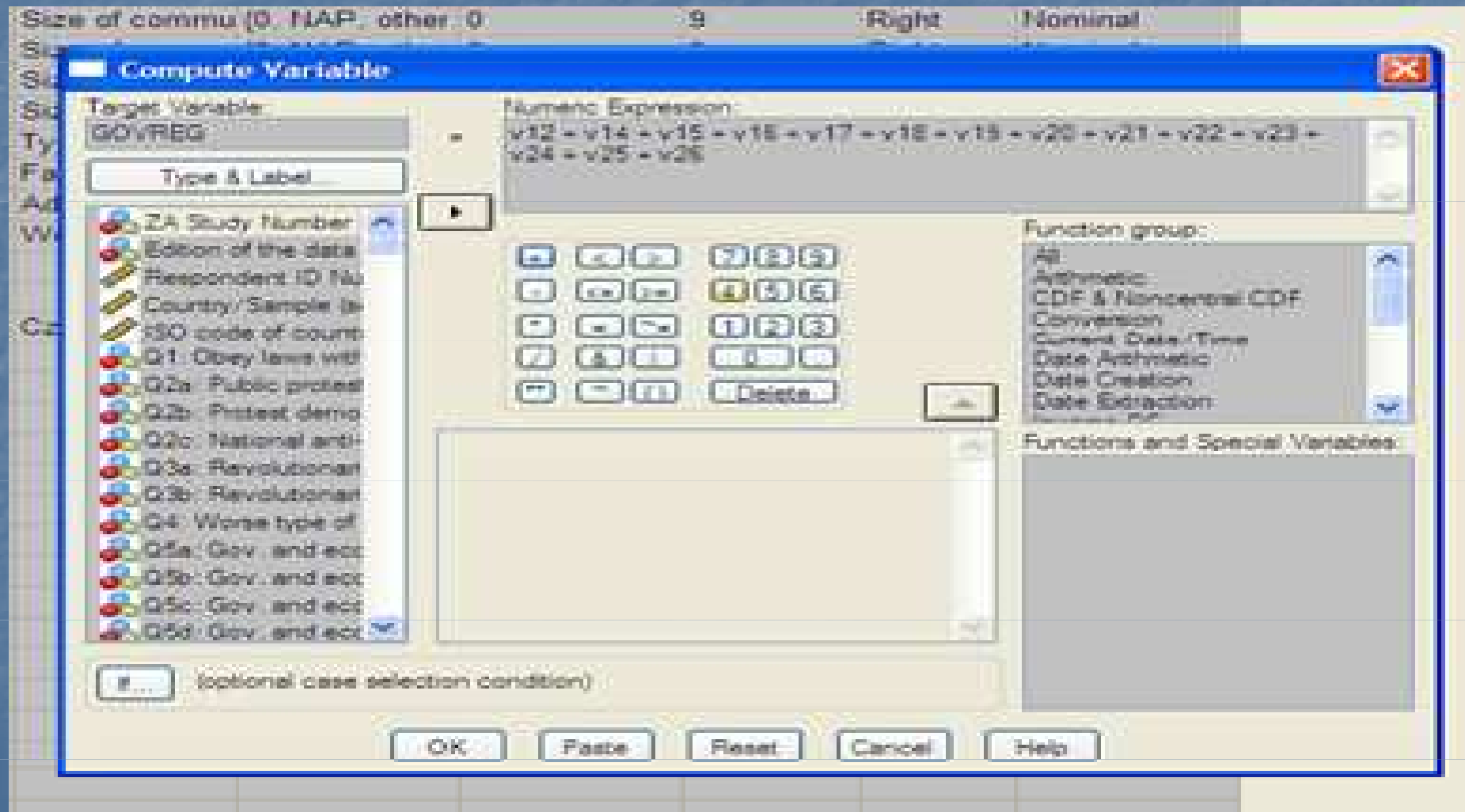
- Once we made these transformations so that all questions have a scale of 0-4
- AND they all go in the same direction, so that 4 for EVERY question either means support for government intervention or opposition to government intervention
- THEN we can compare the average scores among groups
- There are 14 questions in our scale, if all questions are from 0-4, then the scale would be from 0-56

# Making the Scale in SPSS: Go back to compute variable

The screenshot shows the SPSS Data Editor interface. The 'Transform' menu is open, and 'Compute Variable...' is highlighted. The background shows a list of variables and a portion of a data table.

|    | Name     | Type    | Width | Decimals | Label          | Values            |
|----|----------|---------|-------|----------|----------------|-------------------|
| 1  | v1       |         |       |          |                |                   |
| 2  | version1 |         |       |          |                |                   |
| 3  | v2       |         |       |          |                |                   |
| 4  | v3       |         |       |          |                |                   |
| 5  | v3a      |         |       |          |                |                   |
| 6  | v4       |         |       |          |                |                   |
| 7  | v5       |         |       |          |                |                   |
| 8  | v6       |         |       |          |                |                   |
| 9  | v7       |         |       |          |                |                   |
| 10 | v8       |         |       |          |                |                   |
| 11 | v9       | Numeric | 1     | 0        | Q3b: Revolutio | (1) Definitely al |
| 12 | v10      | Numeric | 1     | 0        | Q4: Worse typ  | (1) Corrupt inn   |
| 13 | v11      | Numeric | 1     | 0        | Q5a: Gov and   | (1) Strongly in   |

Make a new variable by adding the items together than comprise the Alpha score (that is minus Q5a and Q5c)





# Your alpha assignment

- Choose the variables that you will want to include in your scale.
- Make sure that you have recoded variables so that each question has the same scale (like 0-4)
- Make sure that each question is also scaled in the same direction. You should have already done this during previous computer labs.
- Run the alpha analysis
- Eliminate variables if you can improve the score
- Create a scale
- Compare the means for two groups, like for Czechs and Swedes or for men and women. You can do this by making a filter for each group (like Czech and Swedes).
- Then apply the filter for one group (Czech) and go to ANALYZE->DESCRIPTIVE STATISTICS -> DESCRIPTIVES

Like this....

The image shows a screenshot of the SPSS Data Editor interface. The title bar reads '\*isp2006steve.sav [DataSet1] - SPSS Data Editor'. The menu bar includes File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Add-ons, Window, and Help. The 'Analyze' menu is open, showing a list of statistical procedures. The 'Descriptive Statistics' option is selected, and its sub-menu is also open, with 'Descriptives...' highlighted. The background shows a data grid with columns for Name and Type, and rows of variables like pt\_size, ru\_size, se\_size, etc.

File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

Reports  
Descriptive Statistics  
Tables  
Compare Means  
General Linear Model  
Generalized Linear Models  
Mixed Models  
Correlate  
Regression  
Loglinear  
Classify  
Data Reduction  
Scale  
Nonparametric Tests  
Time Series  
Survival  
Multiple Response  
Missing Value Analysis...  
Complex Samples  
Quality Control  
ROC Curve...

Frequencies...  
Descriptives...  
Explore...  
Crosstabs...  
Ratio...  
P-P Plots...  
Q-Q Plots...

|     | Name     | Type    | Values |
|-----|----------|---------|--------|
| 279 | pt_size  | Numeric |        |
| 280 | ru_size  | Numeric |        |
| 281 | se_size  | Numeric |        |
| 282 | si_size  | Numeric |        |
| 283 | tw_size  | Numeric |        |
| 284 | us_size  | Numeric |        |
| 285 | uy_size  | Numeric |        |
| 286 | ve_size  | Numeric |        |
| 287 | za_size  | Numeric |        |
| 288 | urbural  | Numeric |        |
| 289 | ethnic   | Numeric |        |
| 290 | mode     | Numeric |        |
| 291 | weight   | Numeric |        |
| 292 | LESSREG  | Numeric |        |
| 293 | Czech    | Numeric |        |
| 294 | filter_3 | Numeric |        |

# Click on OK

The image shows a screenshot of the SPSS 'Descriptives' dialog box. The dialog box is titled 'Descriptives' and has a close button (X) in the top right corner. On the left side, there is a list of variables with a scroll bar. The variables listed are: 'ZA Study Number', 'Edition of the data', 'Respondent ID Num', 'Country: Sample (se', 'ISO code of country', 'Q1: Obey laws with', 'Q2a: Public protest', and 'Q2b: Protest demor'. A right-pointing arrow button is located between the variable list and the 'Variable(s)' list. The 'Variable(s)' list on the right contains the variable 'GOVREG'. Below the variable lists, there is a checkbox labeled 'Save standardized values as variables' which is currently unchecked. On the right side of the dialog box, there are five buttons: 'OK', 'Paste', 'Reset', 'Cancel', and 'Help'. At the bottom right, there is an 'Options...' button. The background of the image shows a portion of the SPSS data view, with columns for 'Size of commu (0 NAP other (0', 'Right', and 'Nominal'. The data rows show values like '13', '10', and '10' in the 'Right' column, and 'Scale' in the 'Nominal' column.

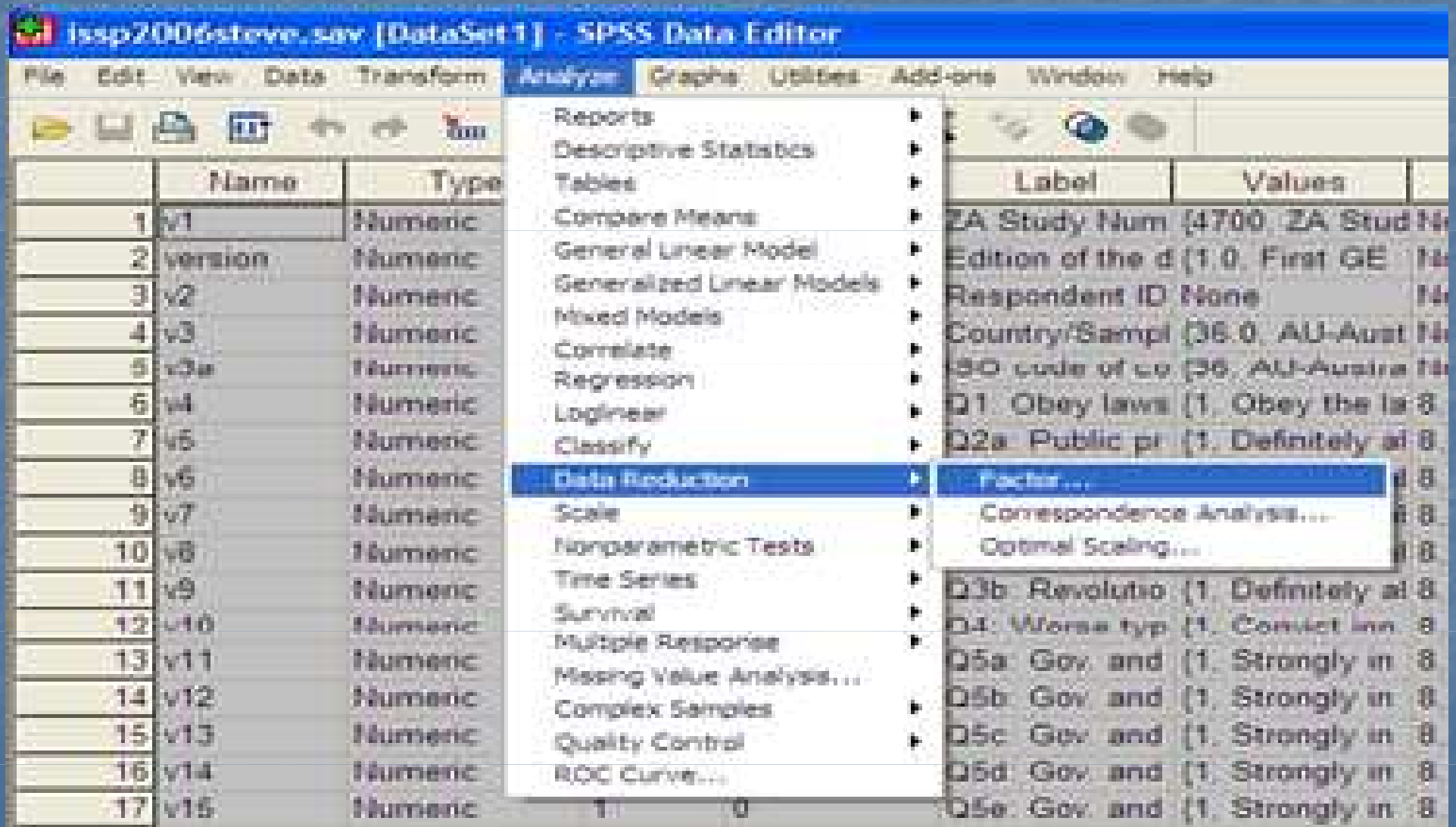
You can see the average score now  
(the mean)

**Descriptive Statistics**

|                    | N   | Minimum | Maximum | Mean    | Std. Deviation |
|--------------------|-----|---------|---------|---------|----------------|
| GOVREG             | 993 | 19.00   | 63.00   | 36.0806 | 5.98280        |
| Valid N (listwise) | 993 |         |         |         |                |

After checking the alpha scale you  
can run multiple regressions on it

# Factor Analysis



The screenshot shows the SPSS Data Editor interface with the 'Analyze' menu open. The 'Data Reduction' option is selected, and the 'Factor...' option is highlighted. The background shows a data table with 17 variables, all of which are numeric.

|    | Name    | Type    |
|----|---------|---------|
| 1  | v1      | Numeric |
| 2  | version | Numeric |
| 3  | v2      | Numeric |
| 4  | v3      | Numeric |
| 5  | v3a     | Numeric |
| 6  | v4      | Numeric |
| 7  | v5      | Numeric |
| 8  | v6      | Numeric |
| 9  | v7      | Numeric |
| 10 | v8      | Numeric |
| 11 | v9      | Numeric |
| 12 | v10     | Numeric |
| 13 | v11     | Numeric |
| 14 | v12     | Numeric |
| 15 | v13     | Numeric |
| 16 | v14     | Numeric |
| 17 | v15     | Numeric |

The 'Analyze' menu path is: Analyze > Data Reduction > Factor...

Choose the same variables that you chose for the first Cronbach Alpha calculation



|   |               |    |           |   |   |   |       |
|---|---------------|----|-----------|---|---|---|-------|
| 0 | Q6a: Governmm | (1 | Spend muc | 8 | 9 | 5 | Right |
| 0 | Q6b: Governmm | (1 | Spend muc | 8 | 9 | 4 | Right |

# Choose the following in DESCRIPTIVES

The screenshot displays the SPSS Factor Analysis dialog box and its Descriptives sub-dialog box. The background shows a variable list table with columns: Name, Type, Width, Decimals, Label, Values, Missing, Columns, Align, and Measure.

| Name      | Type    | Width | Decimals | Label                           | Values | Missing | Columns | Align | Measure |
|-----------|---------|-------|----------|---------------------------------|--------|---------|---------|-------|---------|
| 1 v1      | Numeric | 4     | 0        | ZA Study Num (4700 ZA Stud      | None   |         | 6       | Right | Nominal |
| 2 version | Numeric | 3     | 1        | Edition of the d (1.0, First GE | None   |         | 9       | Right | Nominal |
| 3 v2      | Numeric | 8     |          |                                 |        |         |         | Right | Scale   |
| 4 v3      | Numeric | 5     |          |                                 |        |         |         | Right | Scale   |
| 5 v3a     | Numeric | 3     |          |                                 |        |         |         | Right | Scale   |
| 6 v4      | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 7 v5      | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 8 v6      | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 9 v7      | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 10 v8     | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 11 v9     | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 12 v10    | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 13 v11    | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 14 v12    | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 15 v13    | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 16 v14    | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 17 v15    | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 18 v16    | Numeric | 1     |          |                                 |        |         |         | Right | Nominal |
| 19 v17    | Numeric | 1     | 0        |                                 |        |         |         | Right | Nominal |
| 20 v18    | Numeric | 2     | 0        |                                 |        |         |         | Right | Nominal |
| 21 v19    | Numeric | 1     | 0        | Q5c: Governm (1. Spend muc      | 8, 9   |         | 5       | Right | Nominal |

**Factor Analysis** dialog box:

- Variables: Q5b: Government..., Q5c: Government...
- Descriptives... button is highlighted.

**Factor Analysis: Descriptives** dialog box:

- Statistics:
  - Univariate descriptives
  - Initial solution
- Correlation Matrix:
  - Coefficients
  - Inverse
  - Significance levels
  - Reproduced
  - Determinant
  - Anti-image
  - KMO and Bartlett's test of sphericity



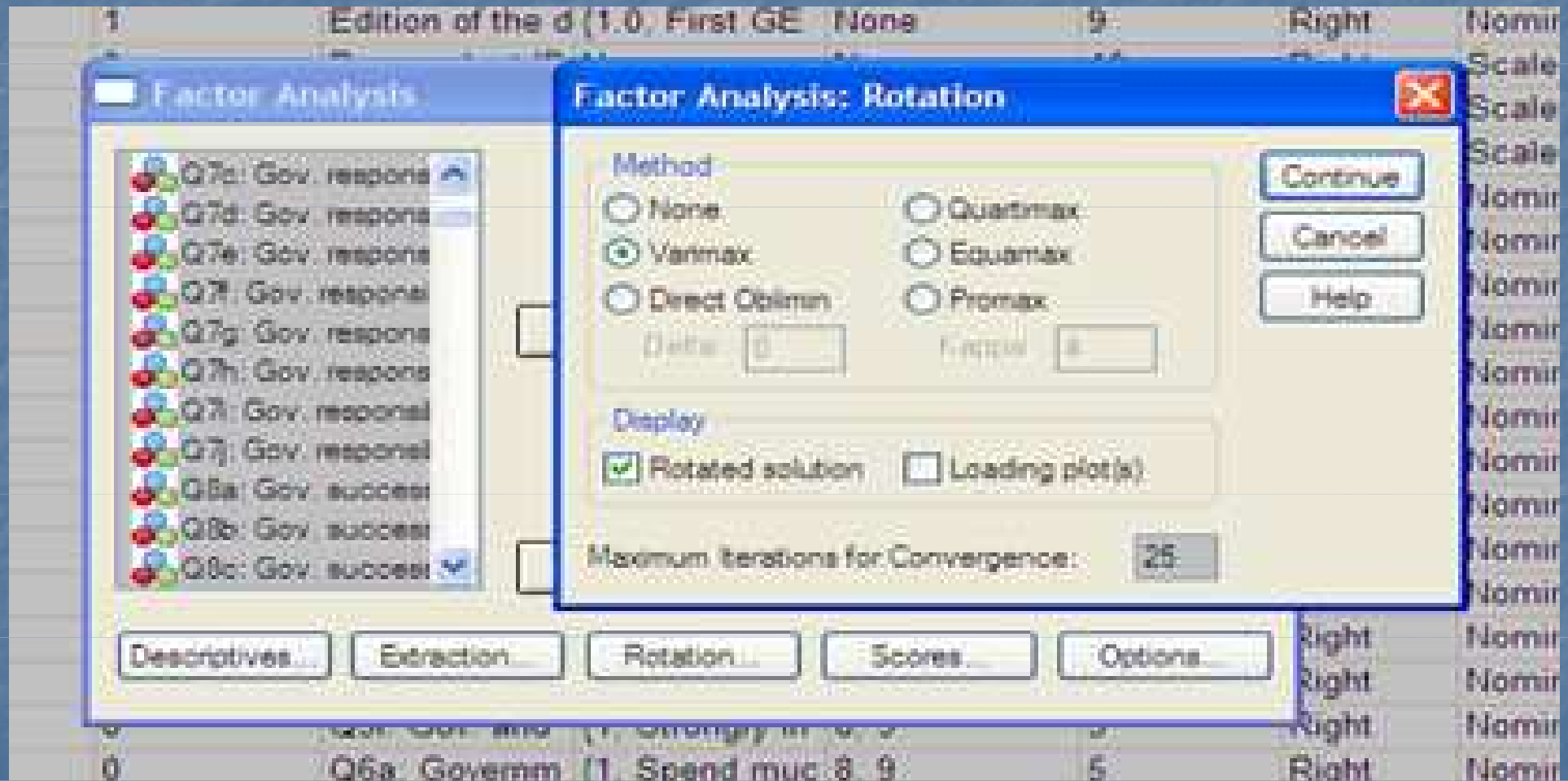
Go to EXTRACTION and click on SCREE PLOT

The image shows two overlapping dialog boxes from the SPSS software. The background dialog is the 'Factor Analysis' dialog, which has a list of variables on the left and a 'Variables:' list on the right. The 'Extraction...' button is highlighted. The foreground dialog is the 'Factor Analysis: Extraction' dialog, which has the following settings:

- Method: Principal components
- Analyze:  Correlation matrix,  Covariance matrix
- Display:  Unrotated factor solution,  Scree plot
- Extract:  Eigenvalues over: 1,  Number of factors: [ ]
- Maximum iterations for Convergence: 25

Buttons in the 'Factor Analysis: Extraction' dialog include 'Continue', 'Cancel', and 'Help'.

Then for ROTATION choose VARIMAX

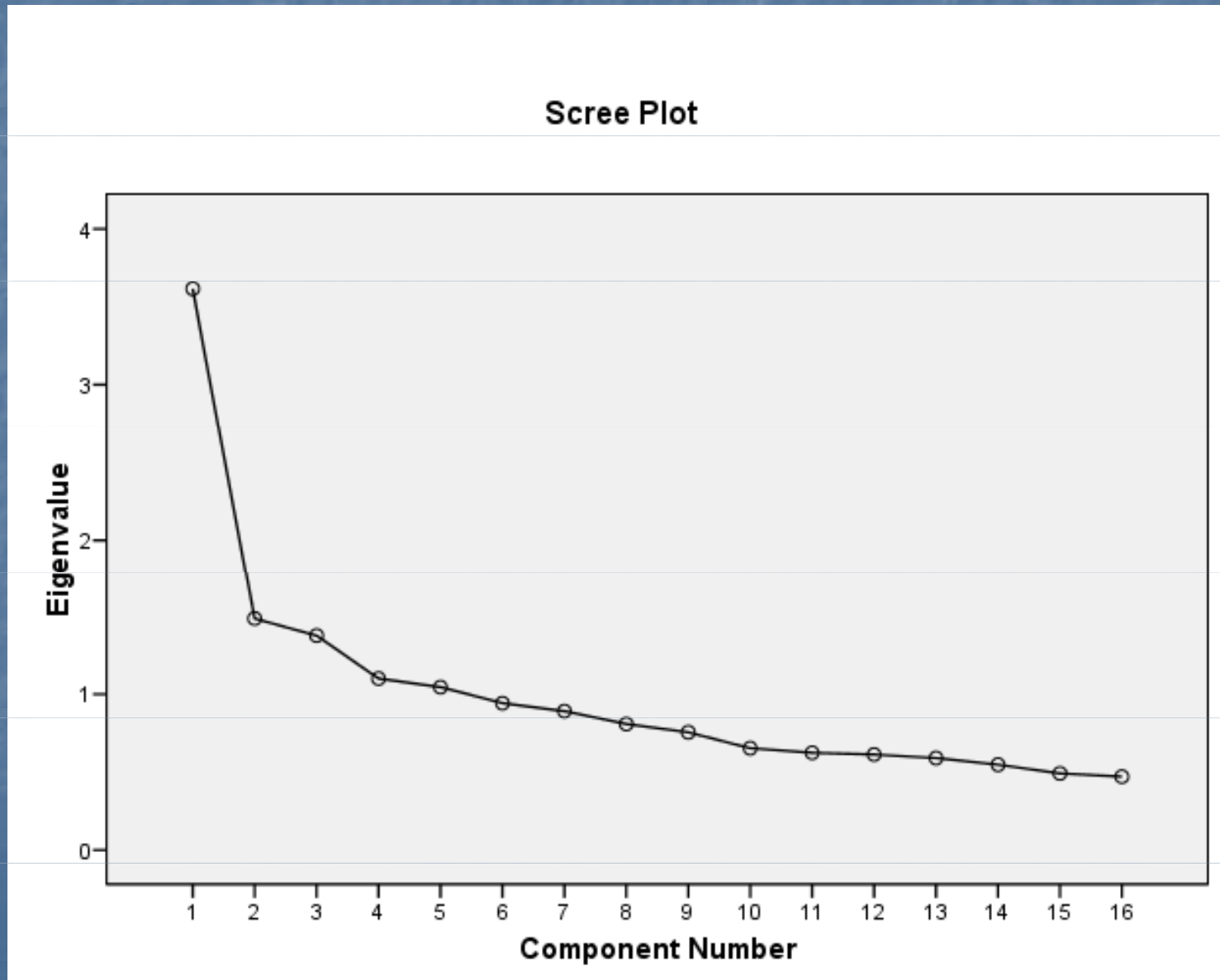


Go to OPTIONS and choose SORTED BY SIZE and under SUPPRESS ABOLUTE VALUES change it to .30

The image shows two overlapping dialog boxes from the SPSS software. The background window is the 'Factor Analysis' dialog, which has a list of variables on the left and a 'Variables:' list on the right. The foreground window is the 'Factor Analysis: Options' dialog, which is currently open. In the 'Options' dialog, the 'Missing Values' section has 'Exclude cases listwise' selected. In the 'Coefficient Display Format' section, 'Sorted by size' and 'Suppress absolute values less than:' are both checked. The 'Suppress absolute values less than:' field is set to '.30'. Buttons for 'Continue', 'Cancel', and 'Help' are visible in the 'Options' dialog.

Click on OK and you get your first  
result

# First let's look at the scree plot



# Analyzing the Scree plot

- 4 have values above 1
- But there seems to be a big dip after two components, which indicates that perhaps there are two dimensions

Let's Look at the explained variance: the first two components explain the most, although the next three do have Eigen values slightly more than 1. However, the third component does have a relatively high eigenvalue. Whether or not to keep the third factor depends partially on whether it makes theoretical sense.

**Total Variance Explained**

| Component | Initial Eigenvalues |               |              | Extraction Sums of Squared Loadings |               |              | Rotation Sums of Squared Loadings |               |              |
|-----------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|-----------------------------------|---------------|--------------|
|           | Total               | % of Variance | Cumulative % | Total                               | % of Variance | Cumulative % | Total                             | % of Variance | Cumulative % |
| 1         | 3.612               | 22.574        | 22.574       | 3.612                               | 22.574        | 22.574       | 2.289                             | 14.307        | 14.307       |
| 2         | 1.483               | 9.267         | 31.842       | 1.483                               | 9.267         | 31.842       | 1.965                             | 12.283        | 26.590       |
| 3         | 1.374               | 8.587         | 40.429       | 1.374                               | 8.587         | 40.429       | 1.581                             | 9.879         | 36.470       |
| 4         | 1.100               | 6.872         | 47.301       | 1.100                               | 6.872         | 47.301       | 1.523                             | 9.516         | 45.986       |
| 5         | 1.045               | 6.528         | 53.830       | 1.045                               | 6.528         | 53.830       | 1.255                             | 7.844         | 53.830       |
| 6         | .943                | 5.892         | 59.721       |                                     |               |              |                                   |               |              |
| 7         | .892                | 5.574         | 65.296       |                                     |               |              |                                   |               |              |
| 8         | .808                | 5.052         | 70.348       |                                     |               |              |                                   |               |              |
| 9         | .756                | 4.722         | 75.070       |                                     |               |              |                                   |               |              |
| 10        | .653                | 4.083         | 79.153       |                                     |               |              |                                   |               |              |
| 11        | .624                | 3.898         | 83.050       |                                     |               |              |                                   |               |              |
| 12        | .613                | 3.829         | 86.879       |                                     |               |              |                                   |               |              |
| 13        | .590                | 3.686         | 90.565       |                                     |               |              |                                   |               |              |
| 14        | .547                | 3.422         | 93.987       |                                     |               |              |                                   |               |              |
| 15        | .492                | 3.072         | 97.059       |                                     |               |              |                                   |               |              |
| 16        | .471                | 2.941         | 100.000      |                                     |               |              |                                   |               |              |

Extraction Method: Principal Component Analysis.

# In the unrotated matrix many items are highly correlated to several factors

| Component Matrix <sup>a</sup>                                       |           |       |      |       |       |
|---|-----------|-------|------|-------|-------|
|   | Component |       |      |       |       |
|   | 1         | 2     | 3    | 4     | 5     |
| Q6f: Government should spend money: Retirement                      | .645      |       |      |       |       |
| Q6g: Government should spend money: Unempl. benefits                | .631      |       |      |       | .311  |
| Q6b: Government should spend money: Health                          | .610      |       |      |       |       |
| Q6d: Government should spend money: Education                       | .581      | -.335 |      |       |       |
| Q5e: Gov. and economy: Support declining industries to protect jobs | .545      | .442  |      |       |       |
| Q7a: Gov. responsibility: Provide job for everyone                  | .536      | .389  |      |       |       |
| Q6h: Government should spend money: Culture and arts                | .531      |       |      | -.364 | .388  |
| Q5b: Gov. and economy: Financing projects for new jobs              | .530      | .318  |      |       |       |
| Q7b: Gov. responsibility: Control prices                            | .475      | .351  |      |       |       |
| Q6c: Government should spend money: Law enforcement                 | .410      | -.389 |      | .352  |       |
| Q5f: Gov. and economy: Red. working week for more jobs              | .393      | .303  |      |       | .351  |
| Q5c: Gov. and economy: Less gov. reg. of business                   |           |       | .662 |       | .336  |
| Q5d: Gov. and economy: Support industry to develop new products     | .353      |       | .524 |       | -.359 |
| Q5a: Gov. and economy: Cuts in gov. spending                        |           |       | .510 |       | .410  |
| Q6a: Government should spend money: Environment                     | .386      | -.404 |      | -.533 |       |
| Q6e: Government should spend money: Defence                         | .344      | -.307 |      | .465  |       |

Extraction Method: Principal Component Analysis.  
<sup>a</sup>. 5 components extracted.



# But in the rotated matrix there are only a few overlaps

| Rotated Component Matrix <sup>a</sup>                                     |           |      |      |      |      |
|---|-----------|------|------|------|------|
|   | Component |      |      |      |      |
|   | 1         | 2    | 3    | 4    | 5    |
| Q7a: Gov. responsibility:<br>Provide job for everyone                     | .714      |      |      |      |      |
| Q6g: Government should<br>spend money: Unempl.<br>benefits                | .608      |      | .326 |      |      |
| Q7b: Gov. responsibility:<br>Control prices                               | .589      |      |      |      |      |
| Q5e: Gov. and economy:<br>Support declining<br>industries to protect jobs | .562      |      |      | .423 |      |
| Q5f: Gov. and economy:<br>Red. working week for<br>more jobs              | .558      |      |      |      |      |
| Q6c: Government should<br>spend money: Law<br>enforcement                 |           | .728 |      |      |      |
| Q6e: Government should<br>spend money: Defence                            |           | .637 |      |      |      |
| Q6b: Government should<br>spend money: Health                             |           | .569 |      |      |      |
| Q6f: Government should<br>spend money: Retirement                         | .453      | .541 |      |      |      |
| Q6d: Government should<br>spend money: Education                          |           | .500 | .395 |      |      |
| Q6a: Government should<br>spend money:<br>Environment                     |           |      | .759 |      |      |
| Q6h: Government should<br>spend money: Culture<br>and arts                |           |      | .744 |      |      |
| Q5d: Gov. and economy:<br>Support industry to<br>develop new products     |           |      |      | .785 |      |
| Q5b: Gov. and economy:<br>Financing projects for<br>new jobs              | .314      |      |      | .675 |      |
| Q5c: Gov. and economy:<br>Less gov. reg. of<br>business                   |           |      |      |      | .758 |
| Q5a: Gov. and economy:<br>Cuts in gov. spending                           |           |      |      |      | .723 |

Extraction Method: Principal Component Analysis.  
 Rotation Method: Varimax with Kaiser Normalization.  
 a. Rotation converged in 8 iterations.

# Second Attempt

- I will remove the last 4 items, Q5d, Q5b, Q5c and Q5a, because they belong to components 4 and 5
- Please note: I am only making an example.
- If I were to do this seriously, I would first have to recode all the questions, so that they have the same scale (0-4 or 1-5) AND they must go in the same direction.
- It is very possible that these last 4 items really do fit in well, but they are coded in opposite directions – in some cases 5 denotes support for government intervention and in some cases it denotes opposition to intervention.

# After removing these items, press OK

- Now there are only 3 factors.
- We see after rotation that some items are highly correlated with several components, so they should be eliminated.
- If Q6g and Q6e are eliminated, then we see that factor 3 makes sense: the culture and environment deal with quality of life rather than economic issues.
- Now we can eliminate as well Q6f because it is also highly correlated with two factors

Rotated Component Matrix<sup>a</sup>

|   | Component |      |      |
|---|-----------|------|------|
|   | 1         | 2    | 3    |
| Q7a: Gov. responsibility: Provide job for everyone                  | .724      |      |      |
| Q5e: Gov. and economy: Support declining industries to protect jobs | .653      |      |      |
| Q7b: Gov. responsibility: Control prices                            | .644      |      |      |
| Q6g: Government should spend money: Unempl. benefits                | .546      |      | .347 |
| Q5f: Gov. and economy: Red. working week for more jobs              | .540      |      |      |
| Q6c: Government should spend money: Law enforcement                 |           | .740 |      |
| Q6b: Government should spend money: Health                          |           | .599 |      |
| Q6e: Government should spend money: Defence                         |           | .598 |      |
| Q6d: Government should spend money: Education                       |           | .527 | .423 |
| Q6f: Government should spend money: Retirement                      | .431      | .520 |      |
| Q6a: Government should spend money: Environment                     |           |      | .770 |
| Q6h: Government should spend money: Culture and arts                |           |      | .749 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

# New results: Q6b is highly related to two components, so should be eliminated

**Rotated Component Matrix<sup>a</sup>**

|   | Component |      |      |
|---|-----------|------|------|
|   | 1         | 2    | 3    |
| Q7a: Gov. responsibility: Provide job for everyone                  | .730      |      |      |
| Q7b: Gov. responsibility: Control prices                            | .691      |      |      |
| Q5e: Gov. and economy: Support declining industries to protect jobs | .681      |      |      |
| Q5f: Gov. and economy: Red. working week for more jobs              | .533      |      |      |
| Q6c: Government should spend money: Law enforcement                 |           | .805 |      |
| Q6e: Government should spend money: Defence                         |           | .720 |      |
| Q6b: Government should spend money: Health                          |           | .453 | .347 |
| Q6a: Government should spend money: Environment                     |           |      | .831 |
| Q6h: Government should spend money: Culture and arts                |           |      | .740 |

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

a. Rotation converged in 4 iterations.

# Now the rotated matrix looks very nice!

**Rotated Component Matrix<sup>a</sup>**

|   | Component |      |      |
|---|-----------|------|------|
|   | 1         | 2    | 3    |
| Q7a: Gov. responsibility:<br>Provide job for everyone                     | .733      |      |      |
| Q7b: Gov. responsibility:<br>Control prices                               | .697      |      |      |
| Q5e: Gov. and economy:<br>Support declining<br>industries to protect jobs | .686      |      |      |
| Q5f: Gov. and economy:<br>Red. working week for<br>more jobs              | .535      |      |      |
| Q6a: Government should<br>spend money:<br>Environment                     |           | .831 |      |
| Q6h: Government should<br>spend money: Culture<br>and arts                |           | .762 |      |
| Q6c: Government should<br>spend money: Law<br>enforcement                 |           |      | .790 |
| Q6e: Government should<br>spend money: Defence                            |           |      | .783 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

# Each factor explains a lot of the variance (at least 16%)

**Total Variance Explained**

| Component | Initial Eigenvalues |               |              | Extraction Sums of Squared Loadings |               |              | Rotation Sums of Squared Loadings |               |              |
|-----------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|-----------------------------------|---------------|--------------|
|           | Total               | % of Variance | Cumulative % | Total                               | % of Variance | Cumulative % | Total                             | % of Variance | Cumulative % |
| 1         | 2.136               | 26.705        | 26.705       | 2.136                               | 26.705        | 26.705       | 1.823                             | 22.791        | 22.791       |
| 2         | 1.324               | 16.546        | 43.251       | 1.324                               | 16.546        | 43.251       | 1.364                             | 17.055        | 39.846       |
| 3         | 1.041               | 13.014        | 56.265       | 1.041                               | 13.014        | 56.265       | 1.314                             | 16.419        | 56.265       |
| 4         | .905                | 11.316        | 67.581       |                                     |               |              |                                   |               |              |
| 5         | .763                | 9.537         | 77.118       |                                     |               |              |                                   |               |              |
| 6         | .675                | 8.439         | 85.558       |                                     |               |              |                                   |               |              |
| 7         | .595                | 7.437         | 92.995       |                                     |               |              |                                   |               |              |
| 8         | .560                | 7.005         | 100.000      |                                     |               |              |                                   |               |              |

Extraction Method: Principal Component Analysis.

# Now we can look at the test statistics

## KMO and Bartlett's Test

|  |                    |           |
|--|--------------------|-----------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. |                    | .661      |
| Bartlett's Test of Sphericity                    | Approx. Chi-Square | 31305.627 |
|  | df                 | 28        |
|  | Sig.               | .000      |

- The Kaiser-Olkin measure is over .6, so it is acceptable
- And the Bartlett's Test is also significant
- So the model seems to be OK.

# Now we must interpret these factors and give them names

- Factor 1 seems to do with the government intervening in the economy.
- Factor 2 seems to deal with government responsibility for the quality of life
- Factor 3 has to do with security.

Rotated Component Matrix<sup>a</sup>

|   | Component |      |      |
|---|-----------|------|------|
|   | 1         | 2    | 3    |
| Q7a: Gov. responsibility:<br>Provide job for everyone                     | .733      |      |      |
| Q7b: Gov. responsibility:<br>Control prices                               | .697      |      |      |
| Q5e: Gov. and economy:<br>Support declining<br>industries to protect jobs | .686      |      |      |
| Q5f: Gov. and economy:<br>Red. working week for<br>more jobs              | .535      |      |      |
| Q6a: Government should<br>spend money:<br>Environment                     |           | .831 |      |
| Q6h: Government should<br>spend money: Culture<br>and arts                |           | .762 |      |
| Q6c: Government should<br>spend money: Law<br>enforcement                 |           |      | .790 |
| Q6e: Government should<br>spend money: Defence                            |           |      | .783 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.



# Now there are two possibilities

- A: One can create three different scales by using the COMPUTE VARIABLE function as in creating the Cronbach Alpha scale
- Or one can let SPSS create a factor value for each factor.
- I favor the first method.
- To let SPSS create a factor value, go back to the function for factor analysis and click on SCORES...
- Then click on the save as variables box and press continue and run factor analysis one more time.

# Creating factor scores

The image shows two overlapping dialog boxes from the SPSS software. The background is a data view with columns for variable names and values.

**Factor Analysis Dialog:**

- Variables:** Q5e: Gov. and eco, Q5f: Gov. and eco, Q5a: Government, Q5c: Government, Q5e: Government, Q5h: Government, Q7a: Gov. respons, Q7h: Gov. respons
- Buttons:** Descriptives..., Extraction..., Rotation..., Scores...

**Factor Analysis: Factor Scores Dialog:**

- Save as variables
- Method:**
  - Regression
  - Bartlett
  - Anderson-Rubin
- Display factor score coefficient matrix



# Finally you can conduct multivariate regressions on each factor

- Try to create a model for each 3 factor.
- Choose again some independent variables that you think might be able to explain attitudes toward these factors, such as AGE, SEX, EDUCATION, INCOME, etc.
- Examine whether the same independent variables are significant for each factor.
- If some variables are more important for explaining one factor than another, think about why this could be the case.

# THEORY!

- Please remember that I have presented everything inductively now to show you how statistics work.
- You should actually begin with theory.
- From the beginning you should have hypotheses based on previous studies as to which variables should be able to predict your outcomes.
- Also you should make use of theory to choose what questions you will put in your original factor analysis. You should have a hypothesis about how many factors there will be.
- Even if your hypothesis is proven wrong, you should think theoretically about how to name the factors that you end up with.