Empirical research in management and economics

Exercise

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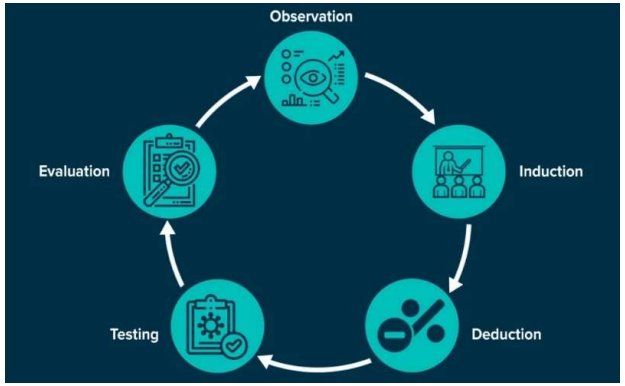
Technical University of Munich
School of Management
Chair of Behavioral Research Methods



Exercise I: Levels of measurement

In groups of 3-5

On which measurement level (nominal, ordinal, interval, ratio) is each of the following variables? Explain.

a) Number of goals of FC Bayern Munich scored in the season 22/23.
b) Field position of a soccer player (striker, defense, midfield, goalie, etc.).
c) Salary of a randomly chosen BMW employee.
d) Freeway traffic in Munich on Friday afternoon (light, medium, heavy).
e) The check-in times of a company's employees.
f) Work satisfaction ratings (from 1-8) of employees in a LIDL supermarket in downtown Munich.
g) Annual growth rate of software companies in Germany.

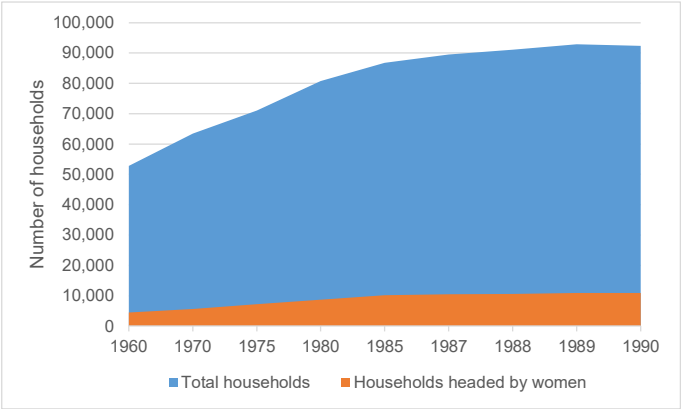
Exercise II: Data plotting

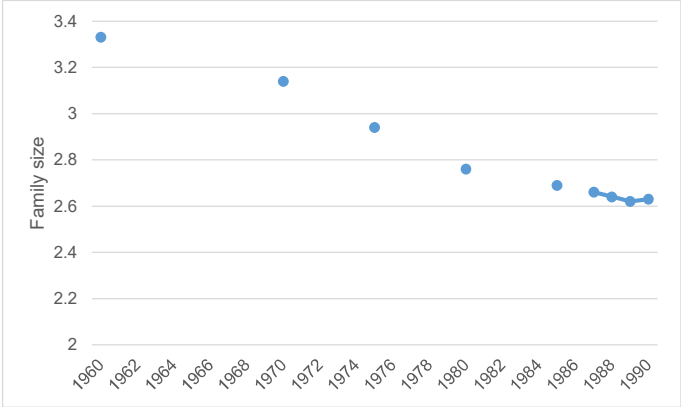
In groups of 3-5

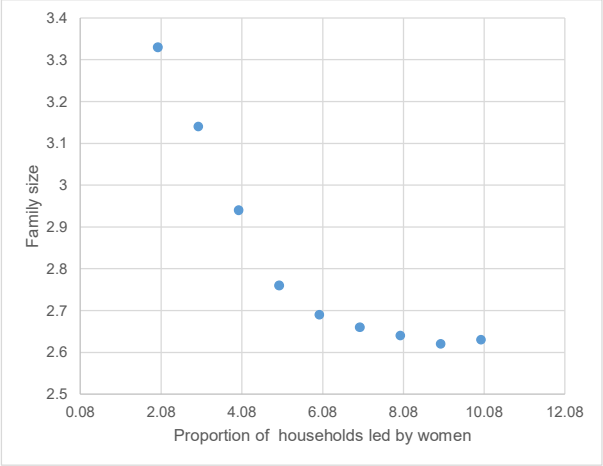
The following data represent the total number of U.S. households, the number of households headed by a woman, and family size from 1960 to 1990 (the number of households is given in thousands).

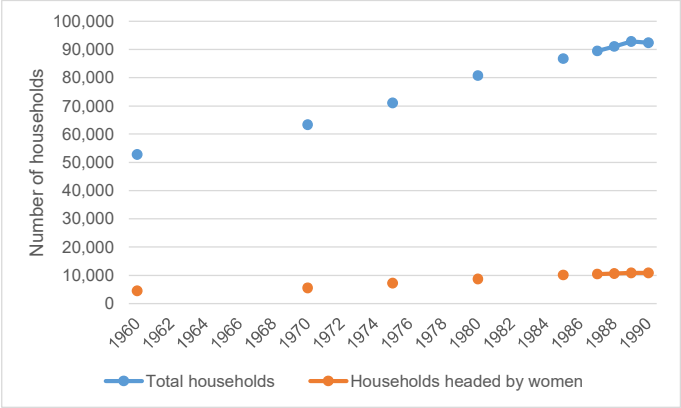
→ Discuss how the data in the table could be visualized and what pattern in the data could be highlighted by the visualization. Draw possible plots manually (or with Excel or R; "Households.csv" file in Materials folder).

Year	Total Households	Households Headed by Women	Family Size
1960	52,799	4,507	3.33
1970	63,401	5,591	3.14
1975	71,120	7,242	2.94
1980	80,776	8,705	2.76
1985	86,789	10,129	2.69
1987	89,479	10,445	2.66
1988	91,066	10,608	2.64
1989	92,830	10,890	2.62
1990	92,347	10,890	2.63


Number of households
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1960
1970
1975
1980
1985
1987
1988
1989
1990
Total households
Households headed by women


Family size
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990


Family size
3.4
3.3
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
0.08
2.08
4.08
6.08
8.08
10.08
12.08
Proportion of households led by women


Number of households
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1960
1962
1964
1966
1968
1970
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1974
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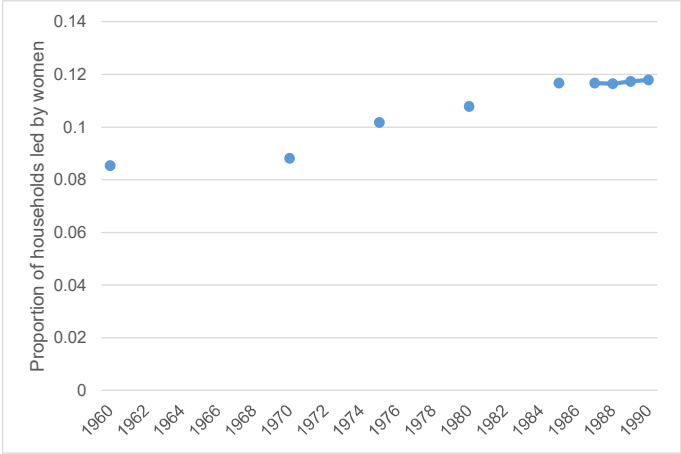
1986
1988
1990
Total households
Households headed by women


Proportion of households led by women
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990

Statistical software JASP

- Download & install the software (free)

  https://jasp-stats.org/download/

→ Free tutorials and videos and help files
  - https://jasp-stats.org/getting-started/

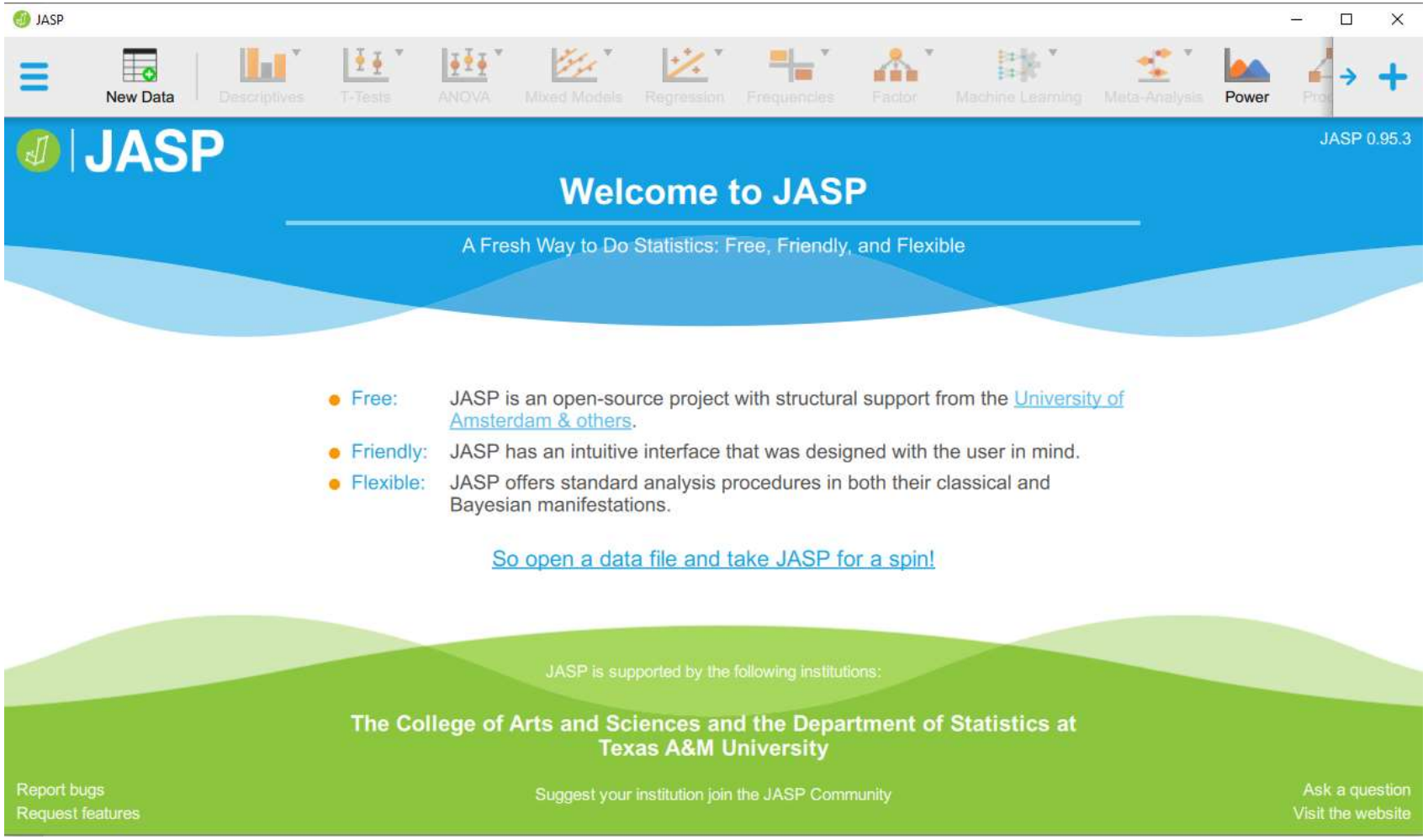
Exercise III: Data plotting and descriptive statistics with JASP

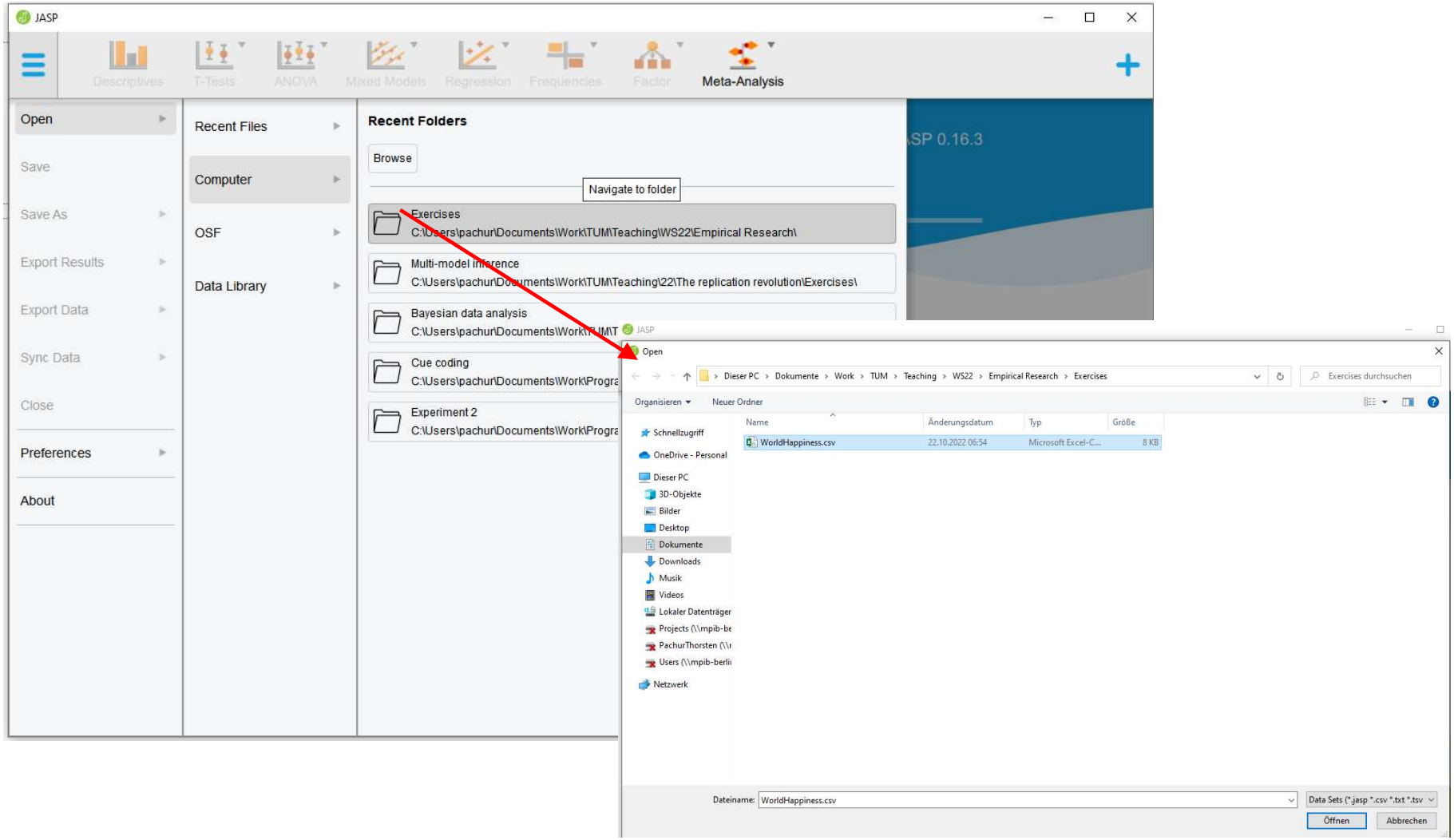
- Open dataset “WorldHappiness.csv“

→ Data for 141 countries on 5 variables

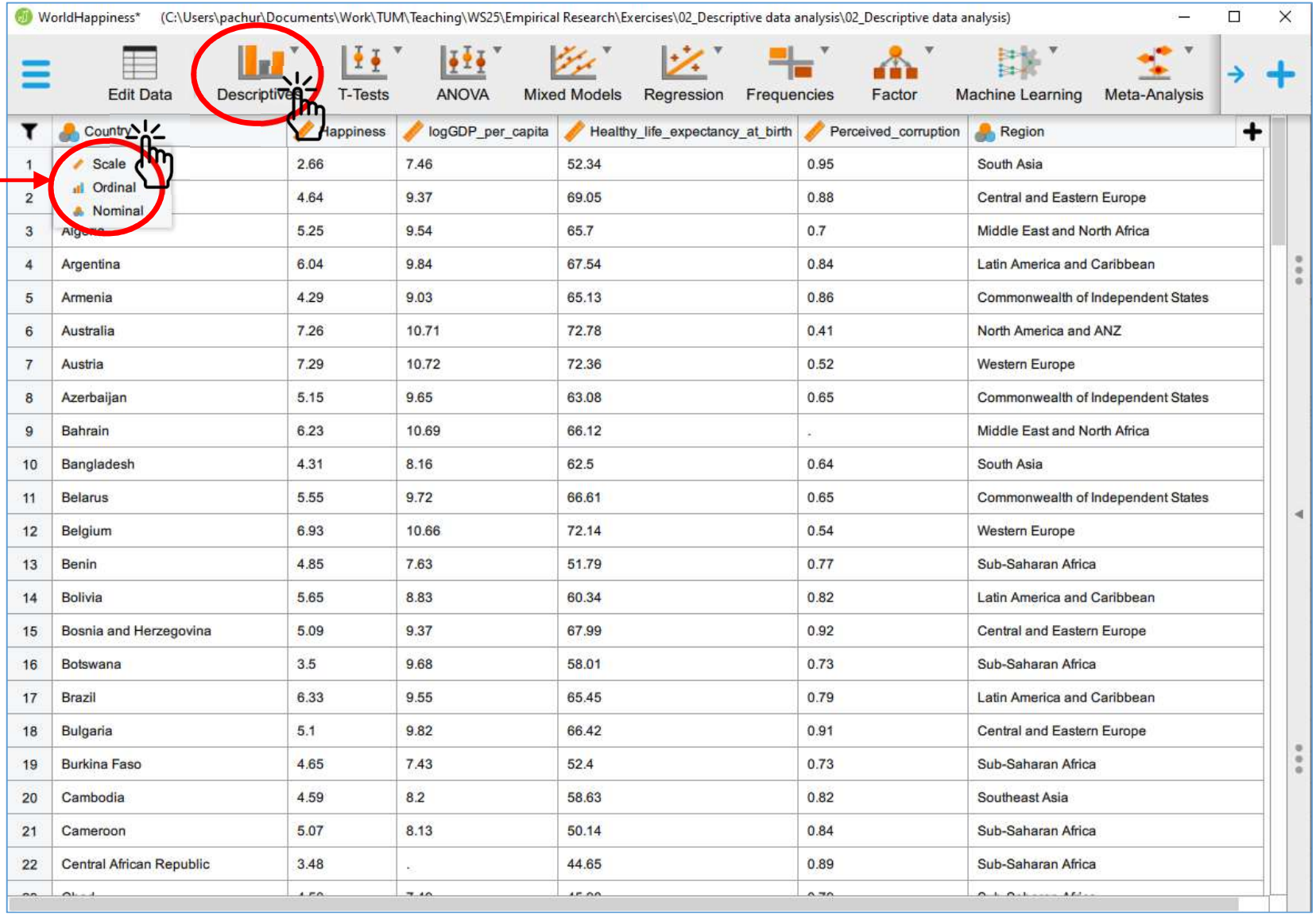
happiness score; GDP per capita (log-transformed); healthy life expectancy at birth; perceived corruption; world region

- Determine the level of measurement of each of the different variables
- Generate plots
  - Histograms and scatter plots for the variables with at least ordinal level
  - Pie chart (and frequency table) for nominal variable (“Region“)
- Compute descriptive statistics
  - Central tendency: means, median, etc
  - Variability and shape of distribution: SD, kurtosis, skewness etc


JASP
New Data
Descriptives
T-Tests
ANOVA
Mixed Models
Regression
Frequencies
Factor
Machine Learning
Meta-Analysis
Power
JASP
JASP 0.95.3
Welcome to JASP
A Fresh Way to Do Statistics: Free, Friendly, and Flexible
Free: JASP is an open-source project with structural support from the University of Amsterdam & others.
Friendly: JASP has an intuitive interface that was designed with the user in mind.
Flexible: JASP offers standard analysis procedures in both their classical and Bayesian manifestations.
So open a data file and take JASP for a spin!
JASP is supported by the following institutions:
The College of Arts and Sciences and the Department of Statistics at Texas A&M University
Report bugs
Request features
Suggest your institution join the JASP Community
Ask a question
Visit the website


JASP
Descriptives
T-Tests
ANOVA
Mixed Models
Regression
Frequencies
Factor
Meta-Analysis
Open
Save
Save As
Export Results
Export Data
Sync Data
Close
Preferences
About
Recent Files
Computer
OSF
Data Library
Recent Folders
Browse
Navigate to folder
Exercises
C:\Users\pachur\Documents\Work\TUM\Teaching\WS22\Empirical Research\
Multi-model inference
C:\Users\pachur\Documents\Work\TUM\Teaching\22\The replication revolution\Exercises\
Bayesian data analysis
Cue coding
Experiment 2
SP 0.16.3
Open
Dieser PC › Dokumente › Work › TUM › Teaching › WS22 › Empirical Research › Exercises
Exercises durchsuchen
Organisieren
Neuer Ordner
Name
Änderungsdatum
Typ
Größe
WorldHappiness.csv
22.10.2022 06:54
Microsoft Excel-C...
8 KB
Schnellzugriff
OneDrive - Personal
Dieser PC
3D-Objekte
Bilder
Desktop
Dokumente
Downloads
Musik
Videos
Lokaler Datenträger
Netzwerk
Dateiname:
WorldHappiness.csv
Data Sets (*.jasp *.csv *.txt *.tsv
Öffnen
Abbrechen

Scale level of measurement



	Country	Happiness	logGDP_per_capita	Healthy_life_expectancy_at_birth	Perceived_corruption	Region
1	[illegible]	2.66	7.46	52.34	0.95	South Asia
2	[illegible]	4.64	9.37	69.05	0.88	Central and Eastern Europe
3	[illegible]	5.25	9.54	65.7	0.7	Middle East and North Africa
4	Argentina	6.04	9.84	67.54	0.84	Latin America and Caribbean
5	Armenia	4.29	9.03	65.13	0.86	Commonwealth of Independent States
6	Australia	7.26	10.71	72.78	0.41	North America and ANZ
7	Austria	7.29	10.72	72.36	0.52	Western Europe
8	Azerbaijan	5.15	9.65	63.08	0.65	Commonwealth of Independent States
9	Bahrain	6.23	10.69	66.12	.	Middle East and North Africa
10	Bangladesh	4.31	8.16	62.5	0.64	South Asia
11	Belarus	5.55	9.72	66.61	0.65	Commonwealth of Independent States
12	Belgium	6.93	10.66	72.14	0.54	Western Europe
13	Benin	4.85	7.63	51.79	0.77	Sub-Saharan Africa
14	Bolivia	5.65	8.83	60.34	0.82	Latin America and Caribbean
15	Bosnia and Herzegovina	5.09	9.37	67.99	0.92	Central and Eastern Europe
16	Botswana	3.5	9.68	58.01	0.73	Sub-Saharan Africa
17	Brazil	6.33	9.55	65.45	0.79	Latin America and Caribbean
18	Bulgaria	5.1	9.82	66.42	0.91	Central and Eastern Europe
19	Burkina Faso	4.65	7.43	52.4	0.73	Sub-Saharan Africa
20	Cambodia	4.59	8.2	58.63	0.82	Southeast Asia
21	Cameroon	5.07	8.13	50.14	0.84	Sub-Saharan Africa
22	Central African Republic	3.48	.	44.65	0.89	Sub-Saharan Africa

WorldHappiness* (C:\Users\pachur\Documents\Work\TUM\Teaching\WS25\Empirical Research\Exercises\02_Descriptive data analysis\02_Descriptive data analysis)

Edit Data | Descriptives | T-Tests | ANOVA | Mixed Models | Regression | Frequencies | Factor | Machine Learning | Meta-Analysis | Power | Process | Reliability

Descriptive Statistics

Country
Happiness
logGDP_per_capita
Healthy_life_expectancy_at_birth
Perceived_corruption

Variables: Region

Split

Transpose descriptives table

Statistics

Basic Plots

Distribution plots | Correlation plots | Interval plots
Display density | Q-Q plots
Display rug marks | Pie charts
Bin width type: Sturges | Dot plots
Number of bins: 30

Categorical Plots
Pareto plots
Pareto rule: 95 %
Likert plots
Assume all variables share the same levels
Adjustable font size for vertical axis: Normal

Customizable Plots

Tables
Frequency tables | Stem and leaf tables
Maximum distinct values: 10
scale: 1

Descriptive Statistics

	Region
Valid	141
Missing	0

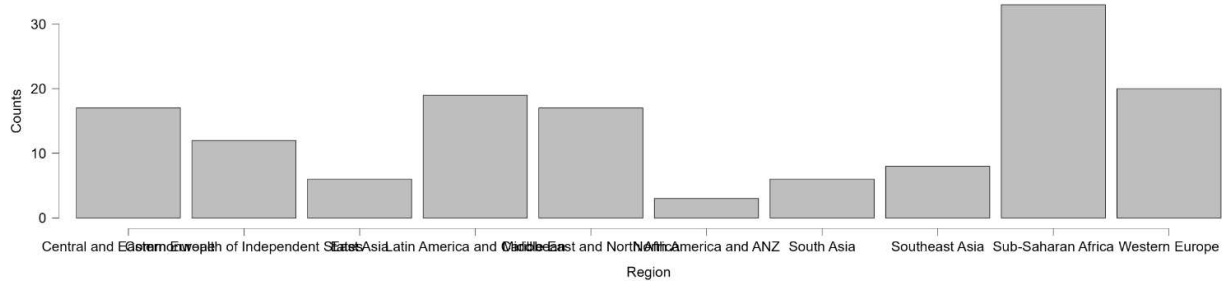
Frequency Tables

Frequencies for Region

Region	Frequency	Percent	Valid Percent	Cumulative Percent
Central and Eastern Europe	17	12.1	12.1	12.1
Commonwealth of Independent States	12	8.5	8.5	20.6
East Asia	6	4.3	4.3	24.8
Latin America and Caribbean	19	13.5	13.5	38.3
Middle East and North Africa	17	12.1	12.1	50.4
North America and ANZ	3	2.1	2.1	52.5
South Asia	8	5.7	5.7	56.7
Southeast Asia	8	5.7	5.7	62.4
Sub-Saharan Africa	33	23.4	23.4	85.8
Western Europe	20	14.2	14.2	100.0
Missing	0	0.0		
Total	141	100.0		

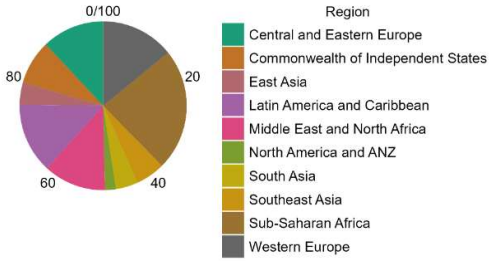
Distribution Plots

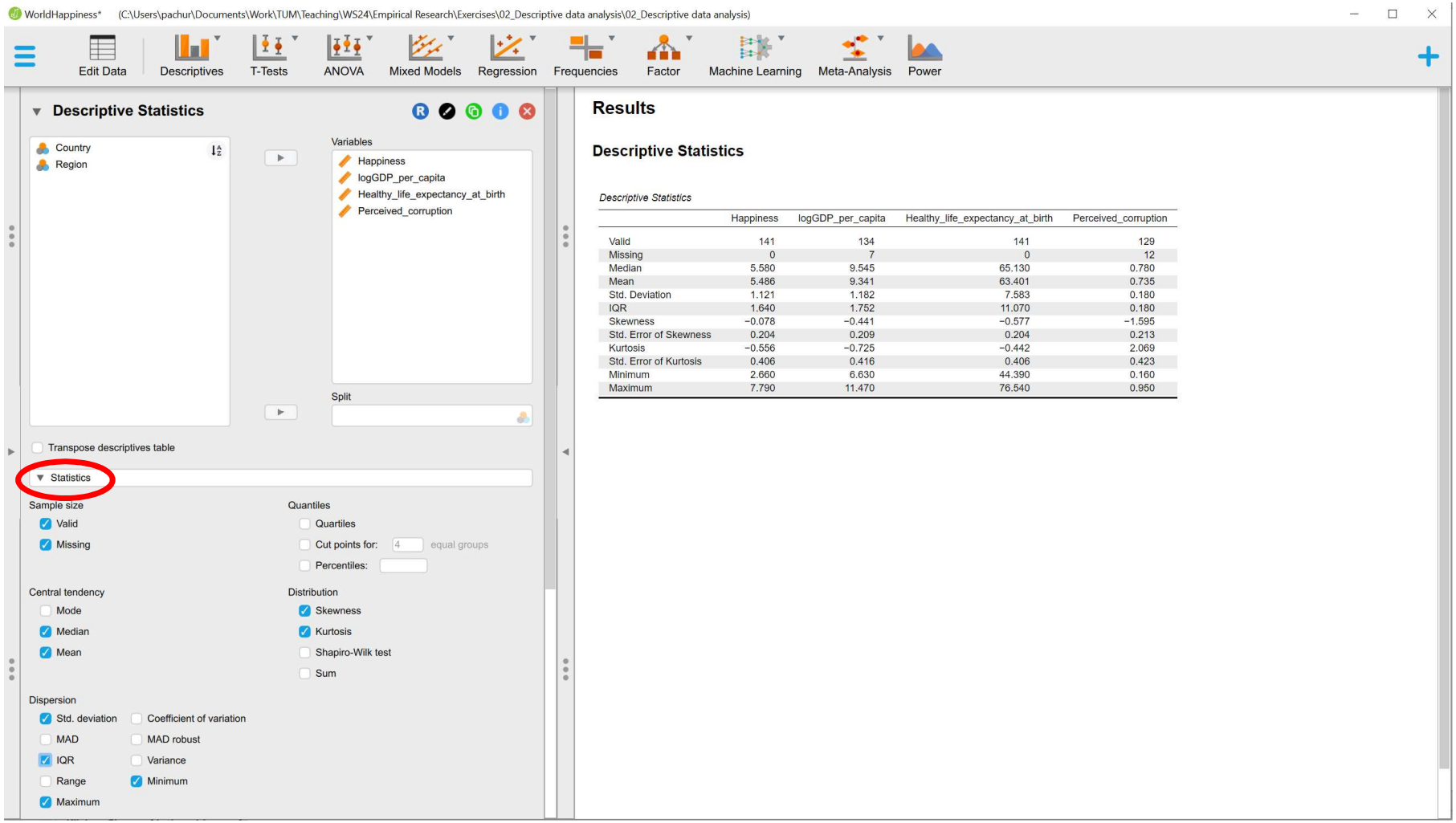
Region



Pie charts

Region

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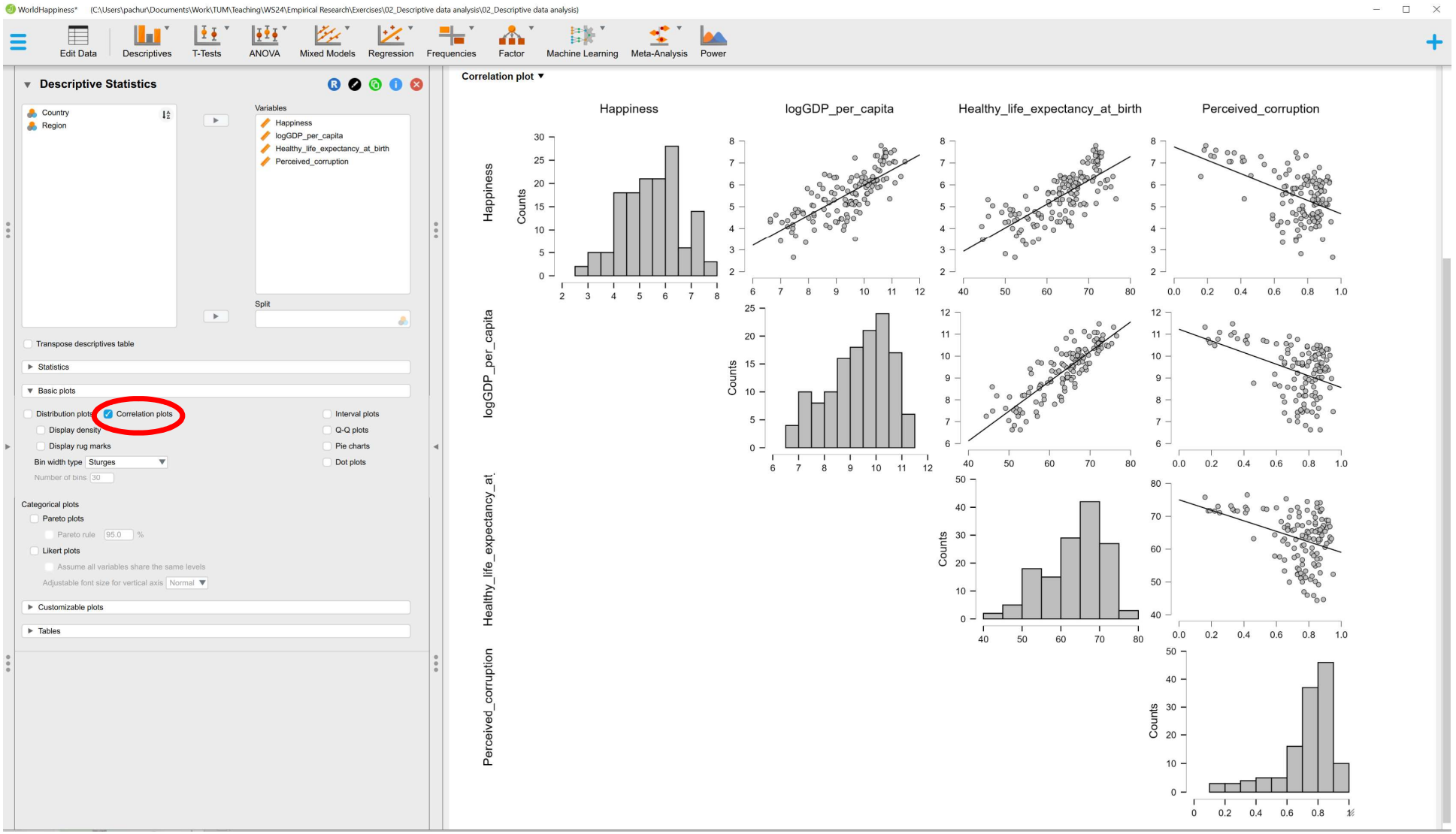
Healthy_life_expectancy_at_birth
Perceived_corruption
Split
Transpose descriptives table
Statistics
Sample size
Valid
Missing
Quantiles
Quartiles
Cut points for: 4 equal groups
Percentiles:
Central tendency
Mode
Median
Mean
Distribution
Skewness
Kurtosis
Shapiro-Wilk test
Sum
Dispersion
Std. deviation
Coefficient of variation
MAD
MAD robust
IQR
Variance
Range
Minimum
Maximum
Results
Descriptive Statistics
Descriptive Statistics
Happiness
logGDP_per_capita
Healthy_life_expectancy_at_birth
Perceived_corruption
Valid 141 134 141 129
Missing 0 7 0 12
Median 5.580 9.545 65.130 0.780
Mean 5.486 9.341 63.401 0.735
Std. Deviation 1.121 1.182 7.583 0.180
IQR 1.640 1.752 11.070 0.180
Skewness −0.078 −0.441 −0.577 −1.595
Std. Error of Skewness 0.204 0.209 0.204 0.213
Kurtosis −0.556 −0.725 −0.442 2.069
Std. Error of Kurtosis 0.406 0.416 0.406 0.423
Minimum 2.660 6.630 44.390 0.160
Maximum 7.790 11.470 76.540 0.950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Counts