Syllabus

Descriptive Statistics – Normal Track

AQM1021E

Prof. Dr. Harry Niederau

Summer term 2017

Lecture	AQM1021E Descriptive Statistics – Normal Track
Performance record	Written exam, 60 minutes
Lecturer	Prof. Dr. Harry Niederau Office: W3.1.03 Office hours: to be announced in class E-mail: harry.niederau@hs-pforzheim.de
Time of the lecture	Tuesdays, 15:30 – 17:00 Start on 14 March
Location	AUDIMAX

Course Description

Since the emergence of the Internet in the nineties, data storage facilities have witnessed a true revolution being geared by clouding technologies that are in widespread use nowadays. In parallel, statistical analysis software has gone through a comparable development. The topics under discussion in introductory statistics courses to economics, legal-, and social sciences have not changed a lot during the last twenty years. However, the *relevance* of the knowledge that students acquire in these lectures for their later professional record of accomplishment has increased substantially. Today, nearly every strategic decision being taken in companies needs to be backed-up by preceding data analyses. In this lecture, the students will be familiarized with the concept of a *statistical assessment* and its associated *data matrix*. This is the framework based on which uni- and bivariate techniques of descriptive data analysis will be introduced and developed. The topics towards the end of the lecture, i.e. bivariate linear regression and a short introduction to probabilities, set the stage for the ensuing course on inferential statistics in the winter term 2016 / 2017.

Objectives

Students successfully passing this course,

1. understand the relevance of basic statistical concepts in an economic environment;
2. can calculate and interpret given a data set by means of univariate key statistics or graphical illustration;
3. have the ability to apply and interpret correctly bivariate techniques concerning correlation and linear regression;
4. understand the basic concepts to probabilities – in particular their underlying axiomatic motivation;
5. have become aware of potential stumble stones subject to any descriptive analysis;
6. can analyse descriptively smaller data sets by hand / pocket calculator.

Schedule of the lecture

14 March	Motivation, statistical intuition, and basic working definitions
21 March	Introduction to the different data types that can occur in a statistical assessment
28 March	Introduction of the empirical distribution function
04 April	Univariate statistics subject to *metric* data
11 April	Case study: sharpening the notions introduced through analysing a *real* data set
25 April	Histograms and the analysis of *grouped* data, Univariate statistics for *nominal* data
02 May	Introduction to *bivariate* analysis: the correlation coefficient by Bravais-Pearson
09 May	Kendall's tau for granular and grouped data, Bivariate analysis of nominal data
16 May	Bivariate Analysis of nominal data – continued, Introduction to bivariate *regression* analysis
23 May	Calibration of a bivariate regression model, Introduction to residual analysis
30 May	Model selection in bivariate linear regression analysis, Introduction to *probabilities*
13 June	Probability spaces, the Kolmogorov axioms, and random variables
20 June	Conditional and unconditional distribution functions
27 June	Repetition, Q&A

Learning Strategy

Particular emphasis is placed on *how* the various topics discussed in this lecture interrelate. Likewise, the interconnection to other lectures is not faded out. Hence, a careful transition from the material discussed in the later parts of the lecture *Analysis and Linear Algebra* to the main framework underlying this course will be provided right at the beginning of the course. Geometric intuition will be developed and exploited to understand the important notion of linear dependence. This will prove rewarding not only when discussing measures of correlation but also when conveying the main idea of linear regression models. *Learning by understanding* is the driving didactic approach to this lecture.

Course Material

Course material will offered through the E-learning platform with weekly uploads of next week's material. The primary reference book to this lecture is

- Cleff, Th. (2015): Deskriptive Statistik und Explorative Datenanalyse, Eine computergestützte Einführung mit Excel, SPSS und STATA, 3. Auflage, Springer Gabler.

Suggestions for further reading

- Lane, D.M., Scott, D., Hebel, M., et al: Introduction to Statistics, E-learning tutorial, online.
- Handel, A., Kuhlenkasper T. (2016): Einführung in die Statistik mit R, online.
- Schira, J. (2009): Statistische Methoden der VWL und BWL, 3. Aufage, Pearson.

Additional course material

- Six exercise sheets that will be discussed biweekly in six tutorials throughout the semester.

Performance record

The exam will stretch over an hour. Four double written or printed pages are allowed as supplementary material, which can be brought to the exam. On total 60 points can be reached and the exam is passed when 30 points could be granted. The following grading will apply: An exam is graded 'Excellent' if the performance shows a superior understanding and handling of the material covered in the lecture. A grade of 'Good' is obtained if the demonstrated performance is distinctly above the average performance. The result "Satisfactory" testifies that the demonstrated command of the exam tasks is within the average performance of all exam results. The level of shown understanding will be graded 'Sufficient' if there are remarkable but still tolerable deficits. In other cases, the performance shown is not sufficient to pass this class.

Contribution of this lecture to the overall goals of the study program

Goal	Contribution of this lecture
1. Technical knowledge in quantitative methods	Uni- and bivariate analysis of different data types is carefully introduced and developed on an introductory level. Various links to entrepreneurial practice assure that the covered material connects to the real world. Special emphasis will be put on decent abstraction. This is to make sure that the students can transfer their obtained knowledge during the lecture to the tackling of statistical problems met in their later professional life.
2. Using statistical tools	Is not a focus in this lecture. However, first encounters with statistical software packages will be part of practical sequences during the lecture and in the tutorials.
3. Translational thinking	Is cultivated with emphasis in the course. Rather abstract notions or formula, such as the correlation coefficient by Bravais-Pearson, will be made accessible and tangible through geometric interpretation.

3.	Critical Thinking	Critical judgment is cultivated concerning the benefits and limitations of statistical methods aiming to analyse empirical data.
4.	Ethical Awareness	Motivating empirical analyses for benefit of decision support in companies according to the following rules: (1) Results obtained must be tractable and arguably. (2) The executive summary of a statistical analysis should not only stress the desired results but should at the same time not hide away findings that are less supportive regarding the goal of an analysis. (3) It is beyond any professional integrity of statistical work to employ with intention inappropriate methods to in order to meet desired results. (4) The process of data collation must be well documented, reconcilable and arguable. Data manipulation or biased data selection in order to obtain desired results is not allowed.
5.1	Written Skills	The ability to phrase statistical problems with the help of suitable mathematical notation, but also in a spoken or written word once in a while, are key capabilities that the students will be trained for both in this lecture and the tutorials.
5.2	Oral Skills	Are important when presenting solutions in a tutorial or in ad hoc opportunities granted within the lecture, e.g. proposing a solution to a given problem or only phrasing a question in a clear and understandable way.
6.	Teamwork	It is highly recommended by the lecturer that students digest and practice the presented material regularly in small working groups (min 2, max 4-5 students) with rotating roles.
7.	Arriving at conclusions from a data analysis	In practice, any statistical analysis is not worth more than the recommendations for decision taking that it inspires. Especially in the practical exercises / examples, the students will (start to) acquire this ability.