Valid from 2025.HS

Module description: Applied Statistics with R

Module Code	w.MA.XX.ASR-M4.21HS
ECTS Credits	9
Language of Instruction/Examination	German
Module Description	The students learn to use statistical methods to investigate questions related to business and management. The first part of the module deals with descriptive statistics. Familiar concepts are briefly reviewed and new ones are introduced (especially concentration measurement, measures, and indices). The second part deals with probability theory, which provides the foundations for inductive statistics. This is the subject of the third part, which discusses interval estimators and explains hypothesis tests. In addition to parameter tests (proportion, mean, and variance), distribution tests are also presented. The statistical evaluations are performed in R.
Organizational Unit	Institut für Financial Management (IFI)
Module Coordinator	Armin Bänziger-Aiba
Deputy Module Coordinator	Oliver Bachmann
Program and Specialization	• Accounting and Controlling
Legal Framework	Academic Regulations MSc in Accounting and Controlling dated 10.12.2015, Appendix to the Academic Regulations for the degree program in Accounting and Controlling, first adopted on 26.01.2016
Module Category	**Module Type** Compulsory
Prerequisite Knowledge	Mathematics and statistics at the level of a BSc in Business Administration: • Summation signs, powers, logarithms, elementary functions, and differential calculus. The basics of integral calculus are desirable but not mandatory. • Measures of location and variability, basics of probability theory, binomial distribution, normal distribution, student distribution, and correlation. These topics will be revisited in the module.
Contribution to Program Learning Objectives (by the concerned Module)	• Professional Competence • Methodological Competence • Social Competence • Self-Competence
Contribution to Program Learning Objectives	**Professional Competence** • Knowing and Understanding Content of Theoretical and Practical Relevance • Apply, Analyze, and Synthesize Content of Theoretical and Practical Relevance • Evaluate Content of Theoretical and Practical Relevance **Methodological Competence** • Problem-Solving & Critical Thinking • Scientific Methodology • Work Methods, Techniques, and Procedures • Information Literacy • Creativity & Innovation **Social Competence** • Written Communication • Oral Communication • Teamwork & Conflict Management • Intercultural Insight & Ability to Change Perspective **Self-Competence** • Self-Management & Self-Reflection • Ethical & Social Responsibility • Learning & Change

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Module Learning Objectives

Students...
- know what statistical procedure to use for which type of data.
- calculate measures of location and variability and interpret them.
- calculate higher moments and interpret them.
- create contingency tables and characterize them using appropriate metrics.
- are able to calculate indices.
- understand the principles of probablity theory.
- apply random variables to stochastic models.
- are able to properly use important discrete and continuous theoretical distributions in context.
- estimate unknown population parameters using point and interval estimators.
- test hypotheses regarding one and more parameters of the population.
- conduct hypothesis tests regarding the distribution of a characteristic in a population.
- use R for the above procedures.
- complete exercises independently.

Module Content

- Foundations: matrix calculation and introduction to the programming environment R
- Descriptive statistics: basic concepts, one-dimensional frequency distributions (measures of location and variability, higher moments, concentration), two-dimensional frequency distributions (contingency tables, correlation analysis [Bravais-Pearson, Spearman, contingency coeff.], linear transformations), indices, implementation in R
- Elements of probability theory: probability rules, random selection and combinatorics, discrete and continuous random variables, multidimensional random variables, application example (portfolio risk and diversification), implementation in R
- Discrete and continuous probability distributions: binomial distribution, hypergeometric distribution, Poisson distribution, uniform, exponential, normal distribution, log-normal distribution, test distributions (chi-square, t, F distribution), normal approximations of discrete distributions, implementation in R.
- Inductive statistics: quality of estimators, point and interval estimation (mean, proportion, variance), hypothesis testing, two-sample tests (means, proportions, variances), distribution tests (chi-square tests), simple analysis of variance, implementation in R

Links to other modules

This module is linked to the following modules:
- w.MA.XX.RA-M10.16HS
- w.MA.XX.DSEDA.19HS
- w.MA.XX.CFFM-M7.17HS
- w.MA.XX.FAP-M2.17HS
- w.MA.XX.POF-M11.16HS
- w.MA.XX.MTAC-M13.21HS
- w.MA.XX.AOR-M9.21HS

Digital Learning Resources

- Teaching Videos
- Practice and Application Exercises (with Key)
- Multiple Choice Tests
- R illustrations with questions to check understanding

Methods of Instruction

- Interactive Instruction
- Lecture
- Exercises
- Application Tasks
- Flipped classroom

Social Settings Used:
- Individual Work

Type of Instruction

	Classroom Instruction	Guided Self-Study	Autonomous Self-Study
Lecture	34 h	52 h	
Excercise	26 h	64 h	
Project Work	-	-	
Seminar	-	-	
Total	**60 h**	**116 h**	**94 h**

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Performance Assessment

End-of-module exam	Form	Length (min.)	Weighting
Written exam	Specified documentation	90	100.00
Permitted Resources	Spec. calculator acc. to leaflet "Utilities"	With dictionary	

Others	Assessment	Format	Length (min.)	Weighting
-	-	-	-	-

Classroom Attendance Requirement

None

Compulsory Reading

- Auer, B. & Rottmann, H. (2020). Statistik und Ökonometrie für Wirtschaftswissenschaftler: Eine anwendungsorientierte Einführung. 4th edition. Wiesbaden: Springer Gabler. ISBN 978-3-658-30136-1. The book is available free of charge in the ZHAW Library as an e-book (PDF) (see link on Moodle).

Recommended Reading

Comments