Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	**Statistics for the Public Sector** **- M1 Introduction to statistical methods** **- M2 Economic Statistics**
Course code	27066
Scientific sector	SECS-S/01 (M1) - SECS-S/03 (M2)
Degree	Master in Public Policies and Administration
Semester and academic year	1st semester 2022/2023 (M1) – 2nd semester 2022/2023 (M2)
Year	1
Credits	12 (6+6)
Modular	Yes

Total lecturing hours	72 (36 + 36)
Total lab hours	
Total exercise hours	54 – M1: 20 (*Preparatory Course*) + 16; M2: 18
Attendance	Recommended, but not required
Prerequisites	Students without a background in statistics are encouraged to attend the *Preparatory Course* in Statistics for the Public Sector scheduled at the beginning of the first semester, before Module M1 starts. At the end of the *Preparatory Course*, students are encouraged to take an exam to assess the basic requirements to access Statistics for the Public Sector. Students receiving a "not passed" grade in the preparatory course will be put in contact with the main lecturer to bridge existing knowledge gaps. Students receiving a "pass with distinction" grade in the preparatory course will be awarded an additional point for the final mark in Statistics for the Public Sector.
Course page	https://www.unibz.it/en/faculties/economics-management/master-public-policies-administration/

Specific educational objectives	**M1 Introduction to statistical methods** The course refers to the educational activities and belongs to the scientific area of Statistics. Upon successful completion of the course students will be able to: - explore different types of data and examine their distribution through graphs and numerical measures; represent, measure and interpret relationships between variables representing observed phenomena; - understand sampling distributions and the implications for statistical inference; know the criteria for constructing good parameter estimators; compute parameter estimates from a data sample; understand the philosophy and scientific principles underlying hypothesis testing; carry out hypothesis tests for a variety of statistical problems;

- understand and use descriptive and inferential statistics for single and multiple samples and to study the relation between response and explanatory variables;
- conduct meaningful answers to real-world data analysis problem;
- perform data analysis using the R computing environment.

M2 Economic Statistics
This course refers to the educational activities and belongs to the scientific area of Statistics.
This course introduces students to the development, implementation, analysis, and reporting of empirical research projects. The focus of the course is on quantitative methods. Emphasis is placed on hands-on exercises in all stages of an empirical research project.
Upon completion of this course students should be able to:
- develop a data analysis plan based on specified research questions and hypotheses;
- collect primary data (via Web-based techniques);
- prepare the data for analysis;
- perform planned and exploratory quantitative analyses using the R statistical software;
- present and interpret the results of their analyses.

Module 1	M1 Introduction to statistical methods
Lecturer	**Davide Ferrari** Office E205 e-mail: Davide.Ferrari2@unibz.it Tel: 0471/013307 https://www.unibz.it/en/faculties/economics-management/academic-staff/person/39001-davide-ferrari
Scientific sector of the lecturer	SECS-S/01
Teaching language	English
Office hours	18 hours MySNS – My timetable Webpage: https://www.unibz.it/en/timetable/?sourceId=unibz&department=26&degree=13426%2C13543
Lecturing assistants	**Marta Nai Ruscone** Marta.NaiRuscone@unibz.it
Teaching assistant	Not applicable.
List of topics covered	**Data exploration** Observations, types of data and scales of measurement numerical and qualitative variables; data visualization and exploration using graphical and numerical summaries. **Probability** Description of empirical phenomena under study through continuous and discrete random variables and their

distribution. Basic characteristics of random variables and linear combination of variables. Central Limit theorem.

Statistical inference
Drawing conclusions about a population from a sample data via probability calculations. Random sampling, sampling distributions and estimation. Estimators and confidence intervals in one-sample and two-sample problems. Statistical decision-making and hypothesis testing for one-sample and two-sample problems. Test of independence.

Statistical Models
Correlation, regression and causation. The simple linear regression model. The multiple regression model and its extensions (including categorical variables, interactions and non-linearity). Inference methods for regression.

R software
Exploratory and inferential data analysis and data modeling in R with focus on real examples relevant for the Public Sector.

Teaching format	Online frontal lectures, online lectures with computers, frontal exercises in presence

Module 2	M2 Economic Statistics
Lecturer	Jan Ditzen Office: 5.23 Email: jan.ditzen@unibz.it https://www.unibz.it/it/faculties/economics-management/academic-staff/person/44644-jan-ditzen
Scientific sector of the lecturer	SECS/S01
Teaching language	English
Office hours	18 hours MySNS – My timetable Webpage: https://www.unibz.it/en/timetable/?sourceId=unibz&department=26&degree=13426%2C13543
Lecturing assistant	**Damiano M. Somenzi** Damiano.Somenzi@unibz.it
Teaching assistant	Not applicable.
List of topics covered	**Introduction into Econometrics** The course will introduce students to econometric methods, in particular regression analysis. Students will learn how to interpret regression results and evaluate their reliability using hypothesis testing. We will start with a simple univariate linear regression model, followed by multivariate linear regression model. Furthermore, the following topics are covered: Inference, Binary and Dummy Variables, difference between Cross-sectional, time series and panel data models.

	How to develop an empirical research project Fundamentals in design of scientific projects. Developing scientific research questions and hypotheses. Research strategies and designs. Types of data and their sources. Setting up a research project with a good literature review. Managing the research workflow: assure reproducibility and methodological transparency; gaining efficiency in the project. Data management and curation, in theory and practice. Presentation standards for scientific findings. Application of the above topics within the R computing environment. **Official statistics and economics** An overview from both the data producer and the data user perspectives.
Teaching format	Frontal lectures, exercises, lectures with computers

Learning outcomes	**M1 Introduction to statistical methods** Knowledge and understanding: Knowledge of the basics of the inferential statistical theory, from estimation to hypothesis testing. Knowledge of the procedures for simple and multiple linear statistical modelling. Ability to understand basic R code and implement statistical methods in the R computing environment. Applying knowledge and understanding: Ability to perform basic statistical analyses of socio-economic data through descriptive and the inferential statistical tools. Ability to apply statistical techniques using a statistical software. Making judgments: on the appropriateness of statistical tools to analyse data and on the results of a statistical analysis of concrete cases. Communication skills: to present in a consistent and precise way the results obtained from a statistical analysis of observed data. Learning skills: Ability to *i)* understand the logic of statistical reasoning, *ii)* address statistical issues concerning concrete problems, and *iii)* interpret the results of statistical data analysis. **M2 Economic Statistics** Knowledge and understanding: Basics research strategies, designs and methods; Other types of data: opportunities and methodological challenges. The basics of the

generalized linear model. Applied multiple regression for continuous and binary dependent variables.

Applying knowledge and understanding: Ability to find existing statistical data relevant to given research topics; Basic abilities to design own data collection projects and to draft a simple questionnaire. Basic abilities in building a statistical model. Basic abilities in the use of R software for data management, analysis and reporting, assuring reproducibility of results.

Making judgments: Ability to choose appropriate research strategies and designs to address a given research question. Ability to assess data quality in terms of both measurement and generalizability issues.

Communication skills: Ability to present in a consistent and precise way the results obtained from the statistical analysis. Ability to write a technical report on specific economic issues by analysing data

Learning skills: Ability to link theory to empirical research and to translate research hypothesis into empirical studies. Ability to understand and analyse the economic data from a quantitative perspective.

Assessment	**M1 Introduction to statistical methods** Take-home data analysis project (30% of the final mark): The project has a mid-semester dedline. Students will work on a practical analysis task using real data within the R computing environment. Final written exam (70% of the final mark): students will have to solve theoretical, practical and computational issues concerning a given concrete problem. For students not turning in the take-home project by the mid-semester deatline, 100% of the final mark in the subject is given by the final exam. The assessment mode is the same for attanding and non-attending studetns. **M2 Economic Statistics** Take-home data analysis project (30% of the final mark): Students will work on a practical empirical project using real data and the statistical software R. The task will involve data management, writing R script files and the interpretation of results. Final written exam (70% of the final mark): students will have to solve theoretical, practical, and computational issues concerning a given concrete problem showing

	knowledge and understanding of the covered theories and methods. For students not turning in the take-home project by the mid-semester deadline, 100% of the final mark in the subject is given by the final exam. The assessment mode is the same for attending and non-attending students.
Assessment language	English (B1 level is required to enrol)
Evaluation criteria and criteria for awarding marks	**M1 Introduction to statistical methods** To pass the M1 module exam students must obtain a positive evaluation on the written exam. The following aspects are relevant for the written exam: correctness and clarity of answers, ability to interpret R outputs in the context of real data and ability to write correct R code. **M2 Economic Statistics** All students must reach a passing grade on the written exam. The following aspects are relevant for the exam: correctness of answers, ability to interpret R outputs and a critical assessment of regression results considering econometric and economic theory. **Overall course (M1+M2) assessment** Passing both the Module 1 and the Module 2 exam is required for passing the (whole) course. The final mark for the whole course (M1 and M2) is computed as the average of the two modules marks. Obtaining a "Pass with distinction" mark in the Preparatory class adds 1 point to the overall course mark.

Required readings	**M1 Introduction to statistical methods** - D. S. Moore, G. P. McCabe, B. A. Craig, *Introduction to the Practice of Statistics*, WH Freeman, New York, pp. 814, 2017, 9th Ed.. ISBN 978-13-190-1338-7. Chapters 1-2, 4-11. - P. Dalgaard, *Introductory Statistics with R*, Springer Verlag, New York, pp. 364, 2008, 2nd Ed.. ISBN: 978-03-877-9053-4. - Lecture notes and R code of the labs will be provided. **M2 Economic Statistics** - J. M. Wooldridge, *Introductory Econometrics: A Modern Approach,* Cengage*,* 6th Ed. ISBN 9781305270107, Chapters 1-10, 13, - Lecture notes and R code will be provided

Supplementary readings	**M1 Introduction to statistical methods** - *P. Newbold, W. L. Carlson, B. M. Thorne, Statistics for Business and Economics, Pearson, New York, 2013, 8th Ed.. ISBN 978-01-327-4565-9. Chapters 1-14.* - *A. Agresti, C. A. Franklin, B. Klingenberg, Statistics: The Art and Science of Learning from Data, Pearson, 2017, 4th Ed.. ISBN: 978-01-338-6082-5.* - *T. Hothorn, B. S. Everitt, A handbook of statistical analyses using R, Chapman and Hall/CRC, 2014, 3rd Ed.. ISBN: 978-14-822-0458-2.* **M2 Economic Statistics** Marno Verbeek, *A Guide to Modern Econometrics,* Wiley 4th Edition. Jim H. Stock and Mark W. Watson, *Introduction to Econometrics*, Pearson International 3d Edition. A list of – non mandatory - suggested readings and further resources will be provided during the course.