Syllabus
Course description

Course title	**Statistics for the Public Sector** **- M1 Introduction to statistical methods** **- M2 Economic Statistics**
Course code	27066 – other students code --- (M1)/--- (M2) Erasmus
Scientific sector	SECS-S/01 (M1) - SECS-S/03 (M2)
Degree	Master in Public Policies and Administration
Semester and academic year	1st semester 2020/2021 (M1) – 2nd semester 2020/2021 (M2)
Year	1
Credits	12 (6+6)
Modular	Yes

Total lecturing hours	72 (36 + 36)
Total lab hours	
Total exercise hours	42 – M1: 20 (*Preparatory Course*) + 16; M2: 6
Attendance	Suggested, 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 aimed at checking 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	Course home page

Specific educational objectives	**M1 Introduction to statistical methods** The course refers to the educational activities and belongs to the scientific area of Statistic. 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 estimators of parameters; compute estimates of parameters from sample data; 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 in relation to response and explanatory variables;
- address basic statistical issues concerning concrete problems;
- perform basic statistical data analysis by means of the R software.

M2 Economic Statistics
This course refers to the educational activities and belongs to the scientific area of Statistic.
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	**Francesca Marta Lilja Di Lascio** Office E510a e-mail: Marta.DiLascio@unibz.it Tel: 0471/013285 Personal home page
Scientific sector of the lecturer	SECS-S/01
Teaching language	English
Office hours	Please refer to the lecturer's web page.
Lecturing assistants	**Massimo Cannas** e-mail: Massimo.Cannas@unibz.it Personal home page **Maja Miletic** e-mail: Maja.Miletic@unibz.it Personal home page
Teaching assistant	Not foreseen.
Office hours	Please refer to the lecturer's web page.
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	**Teresio Poggio** e-mail: teresio.poggio@unibz.it Personal home page
Scientific sector of the lecturer	SPS/07
Teaching language	English
Office hours	Please refer to the official Timetable
Lecturing assistant	**Damiano Marino Somenzi** e-mail: Damiano.Somenzi@unibz.it Personal home page
Teaching assistant	Not foreseen
Office hours	Not foreseen
List of topics covered	**How to develop an empirical research project** Fundamentals in design of scientific projects. Developing scientific research questions and hypotheses. Different research strategies and designs. Different 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. Doing this, in practice, using R.

	Design your data: introduction to survey methods
	Introduction to surveys for economic research. Data quality and the Total Survey Error Framework. Survey modes. Question and questionnaire design. Coverage, sampling and non-response. Field management, post-field work and quality assessment. Websurveys, with practical programming using LimeSurvey.
	Overview of other designed and not designed data
	Experimental and observational data. Secondary analysis of existing survey data. Official statistics. Administrative records and open data. Organic data (aka 'big data).
	Applied statistical models
	The logic behind statistical modelling: relations among variables and the need for statistical control. A review of multiple regression models for continuous dependent variables. A review of the basic of categorical data analysis. Introduction to the generalized linear model. Statistical models for binary dependent variables: linear probability, logistic and probit models. Practical statistical modelling using R.
	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; Basics of survey methodology and sampling. 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. Ability to program a survey and its questionnaire with the LimeSurvey platform. 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** Written exam on a case study: students will have to solve theoretical, practical and computational issues concerning a given concrete problem. The assessment method indicated is valid for both attending and non-attending students. **M2 Economic Statistics** DEFAULT ASSESSMENT (ALL STUDENTS): a. 15% Assignment 1 (Questions design, individual assignment), delivered at own pace but at least one week

before the exam;*

b. 15% Assignment 2 (Programming a short questionnaire on LimeSurvey – individual assignment), delivered at own pace but at least one week before the exam;*

c. 35% Assignment 3 / Final project (data management, analysis and reporting exercise – individual assignment), delivered at own pace but at least one week before the exam;*

d. 35% Final test: 40 minutes. A set of multiple choice questions + a few short open-ended questions/exercise (open book).

* Students must contact the instructor no later than one month before the exam, for the assignments' arrangements.

ASSESSMENT OPTION FOR ATTENDING STUDENTS:

a. 15% Assignment 1 (Questions design, in two steps – group assignment)

b. 15% Assignment 2 (Programming a short questionnaire on LimeSurvey – individual assignment)

c. 30% Assignment 3 / Final project (data management, analysis and reporting exercise – individual assignment)

d. 30% Final test: 40 minutes. A set of multiple choice questions + a few short open-ended questions/exercise (open book).

e. 10% based on participation (including timely delivering of the three graded assignments).

Assessment language	English
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 sufficiency (marks $>= 18$) in both the (c) and (d) steps above, in order to pass the M2 exam. Failing in any of these two steps would mean not passing the module exam, irrespective of the grades attained in the remaining assessment steps. Correctness and clarity of the assignments delivered (assignments 1, 2, 3) and of the answers provided in the final exam, ability to write a few questions for a survey in an informed approach (assignment 1), ability to program a short questionnaire in LimeSurvey (assignment 2), ability to write correct R code (assignment 3) and to interpret R outputs (assignment 3 and final exam) are relevant for the Module 2 assessment.

	Overall course (M1+M2) assessment Passing both the Module 1 and the Module 2 exam is a prerequisite for passing the (whole) course exam. The final marks for the whole course (M1 and M2) will be computed as the average of the two modules marks. Pass with distinction in the Preparatory class: up to 1 point added.

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. 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. - 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** A. Agresti, *An Introduction to Categorical Data Analysis*, 2nd edition. Wiley, Haboken (NJ), 2007. ISBN: 9780471226185. Chapters 1-5 (sections 2.5, 2.6, 3.3 excluded). (106 pp.). A. Agresti, *Statistical Methods for the Social Sciences*, 5th edition. Pearson, Harlow (UK), 2018. ISBN: 9781292220314. Chapter 10, "Introduction to Multivariate Relationships". (19 pp.). The previous version of this textbook (same chapter, same content) can also be used: Agresti, A. and Finlay, B., *Statistical Methods for the Social Sciences*, 4th edition. Pearson, Harlow (UK), 2009. ISBN: 9780205646418. M. Couper, "Is the sky falling? New technology, changing media, and the future of surveys". *Survey Research Methods*, 2013, 7(3), 145-156. (11 pp.) R.M. Groves, F. J. Fowler Jr., M. P. Couper, J. M. Lepkowski, E. Singer, R. Tourangeau, *Survey Methodology*, 2nd Ed. Wiley, Haboken (NJ), 2009. ISBN: 9780470465462. Chapters 1-7; 10 (part 1.3 excluded). (242 pp.). J. Hox, "From Theoretical Concepts to Survey Questions". In L. Lyberg, et al. (eds.) *Survey Measurement and Process Quality*, New York, NY: Wiley, 1997, pp. 47-69. (22 pp.) W. J. Radermacher, *Official Statistics 4.0: Verified Facts for People in the 21st Century*. Springer, Cham (CH), 2020. ISBN: 9783030314927. Chapter 2. (33 pp.). H. Wickham, G. Grolemund, *R for Data Science* (current live version). Selected parts.
Supplementary readings	**M1 Introduction to statistical methods** - 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 A list of – non mandatory - suggested readings and further resources will be provided during the course.