Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Econometrics for Data Science M1 Time Series Analysis and Forecasting M2 Management of economic and business data (loaned from 27418 Data Management – LM-63)
Course code	27501
Scientific sector	SECS-P/05 + SECS-S/01
Degree	Master in Data Analytics for Economics and Management
Semester and academic year	1st semester a.y. 2024/2025
Year	1st study year
Credits	12 (6+6)
Modular	Yes

Total lecturing hours	72 (36+36)
Total lab hours	/
Total exercise hours	M2: 18
Attendance	recommended, but not required
Prerequisites	NA
Course page	https://www.unibz.it/en/faculties/economics-management/master-data-analytics-economics-management/
Specific educational objectives	The course covers the fundamental aspects of stochastic process theory, the stationary models and heteroskedastic models, and principles of forecasting. The theoretical aspects are complemented by modern data analysis with R. Upon successful completion of this course, the students are able to: 1) visualize and summarize time series data; 2) analyze and decompose a time series; 3) apply the appropriate model for time series data; 4) perform predictions through several tools; 5) use R to perform time series analysis; 6) professionally communicate the results of a time series analysis. The course provides students with modern data management techniques needed to process most common data sources for any business needs, especially in the public sector. The first part of the course focuses on data modeling and management techniques, and tools for data extraction, processing and visualization. Flat,

	relational and semantic data representation models will be analyzed. The second part of the course covers techniques for processing data sources through state-of-the-art programming language and techniques, using contemporary approaches for handling big economic data. In the lectures, much emphasis will be placed on developing problem-solving skills through the analysis of public sector data commonly used for evaluation and policy-making, and stimulate students to apply acquired knowledge to solve real-world economic problems.

Module 1	M1 Time Series Analysis and Forecasting
Lecturer	F. Marta L. Di Lascio, Office E5.10a Marta.DiLascio@unibz.it Tel. 0471 013285 https://www.unibz.it/en/faculties/economics-management/academic-staff/person/32845-francesca-marta-lilja-di-lascio
Scientific sector of the lecturer	SECS-S/01
Teaching language	English
Office hours	by appointment, please send an e-mail and refer to the lecturer's timetable
Lecturing assistant	None
Teaching assistant	None
List of topics covered	- Basics of stochastic processes theory and characteristics of time series data - Smoothing, filtering and decomposing a time series - Introduction to AR, MA, ARIMA and SARIMA models - Maximum likelihood estimation - Box & Jenkins procedure to analyse a time series - Forecasting methods - Volatility models: basics of ARCH and GARCH models
Teaching format	Frontal lectures and lab sessions

Module 2	M2 Management of economic and business data
Lecturer	Andrea Molinari, Office E2.05 Andrea.Molinari@unibz.it https://www.unibz.it/it/faculties/engineering/academic-staff/person/3420-andrea-molinari
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=13543%2C13723
Lecturing assistant	Tun-I Hu tuni.hu@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/48974-tun-i-hu
Teaching assistant	None
Office hours	please refer to the lecturer's timetable
List of topics covered	- Data management overview - How data are managed today: the relational model - Other management techniques: NoSQL Data Management - Creating and managing relational databases with SQL - Extracting relational data with SQL - Introduction to programming with Python - File handing, extracting, storing, curating data with Python - Working with different data formats(CSV, JSON, RDF etc.) - Managing, analysing and vizualising numeric data with Numpy, Pandas and Python matplotlib - Applications to economic and business data
Teaching format	The course will combine in-class explanations of methods, practical exercises on real data and discussion of case studies. Students will be expected to participate actively in class discussions and exercises, which will give them the opportunity to develop their problem-solving skills.

Learning outcomes	The course will provide students with the ability to analyze and interpret data using econometric models. 1) **Knowledge and understanding.** The course will equip students with the ability to organize and combine economic and business data starting from structured databases. It will also enable students to acquire knowledge about state-of-the-art of models to represent time series data. 2) **Applying knowledge and understanding:** Students will be able to implement data management techniques and econometric models in order to extract proper information from data, useful to analyse real phenomena in several fields of economics and management, and to understand their most important aspects. 3) **Making judgements:** students who successfully complete this course will be able to select the most appropriate data management approaches and apply

	proficiently statistical model to obtain inferences and predictions using statistical software, and organize results in order to draw conclusions and decide in uncertain situations, like in specific economic and business situations. 4) **Communication skills:** students who successfully complete this course will be able to communicate, to experts and non-experts the results of their analyses using specific software. 5) **Learning skills:** the course is aimed to provide the methodological and applied knowledge of data management and statistical modelling, necessary to address subsequent studies, in particular the advanced courses in econometrics, statistics, computer science, the quantitative aspects of economics courses, the applied projects in laboratories and internships, the empirical analyses in the final thesis.

Assessment	**M1**: **Attending students:** Project work (20% of the final grade), written exam composed of exercises and theoretical questions (60% of the final grade) and presentation project report done in groups (20% of the final grade). **Non-attending students:** Written exam composed of exercises, theoretical questions, tasks related to data analysis (100% of the final grade). **M2**: The final exam includes multiple problems assessing the acquisition of data management concepts and students' ability to apply such knowledge in different situations. Questions related to interpretation of computer outputs assess students' ability to interpret analysis results. The assignment measures students' ability to correctly apply methods to data sets within a computing environment and address relevant scientific questions from an applied viewpoint. **Attending students:** - Final exam (50% of the final grade): The final exam consists of problems related to the extraction, analysis and interpretations of various data sets - Project assignment (50% of the final grade): A data analysis project will be assigned during the semester. Students will give a in-class presentation on their analyses towards the end of the semester.

	Non-attending students: 100% of the final grade in the subject is given by the final exam, that will be proportioned to the missing project assignment
Assessment language	English
Evaluation criteria and criteria for awarding marks	**M1**: **Attending students:** 60% written exam consisting of theoretical questions and exercises, 20% project report consisting of analysis tasks on data sets assigned during the semester to be carried out through the use of statistical software and 20% presentation of the project. **Non-attending students:** 100% written exam consisting of theoretical questions, exercises, and data analysis tasks. Evaluation criteria for both written exams and projects: clarity in exposition, knowledge and understanding of statistical methods, ability to apply appropriate statistical procedures, correctness of results. **M2**: **Attending students:** - Final exam: 50% - Assignments: 50% **Non-attending students:** - Final exam: 100% Students must pass the final exam to receive a passing 4/4 grade in the overall course. The project assignment is compulsory and must be carried out regardless of whether students are attending classes. To pass the final exam students must give a correct answer to the majority of points awarded in the exam questions. Criteria for evaluation of the project assignment are ability to correctly interpret data analysis requests, chose correct methods for the analyses, correctly execute analyses and interpret results, summarize and clearly communicate, proficiency in interpreting python outputs and ability to write and execute relevant python code.

Required readings	**M1**: - Peter J. Brockwell and Richard A. Davis, Introduction to Time Series and Forecasting, 2016, 3rd ed., Springer, ISBN: 978-3-319-29852-8. Chapters: 1-3, 5-7, 10. - Christopher Chatfield and Haipeng Xing, The Analysis of Time Series – An introduction with R, 2019, 7th ed.,

	Chapman & Hall, ISBN: 978-1-498-79563-0. Chapters: 1-5, 12. - Lecture notes and exercises will be provided. **M2**: All the compulsory materials will be provided by instructors through course notes and exercises, using OLE website.
Supplementary readings	**M1**: - George E.P. Box, Gwilym M. Jenkins, Gregory C. Reinsel and Greta M. Ljung, Time series analysis, Forecasting and Control, 2016, 5th Ed., Wiley, ISBN: 978-1-118-67502-1. - Robert H. Shumway and David S. Stoffer, Time Series Analysis and Its Applications: With R Examples, 2017, 4th ed., Springer, ISBN: 978-3-319-52451-1. Chapters: 1-3, 5. - James D. Hamilton, Time series analysis, Princeton University Press, 1994, ISBN: 978-0-691-04289-3. **M2**: - Larose, Chantal D., and Daniel T. Larose. Data science using Python and R. John Wiley & Sons, 2019. - Shan J., Goldwasser M., Malik U., Johnston B. SQL for Data Analytics: Harness the power of SQL to extract insights from data, 2022.