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
Course code	27501
Scientific sector	SECS-P/05 - ECON-05/A
Degree	Master in Data Analytics for Economics and Management
Semester and academic year	1st and 2nd semester a.y. 2025/2026
Year	1 st study year
Credits	12 (6+6)
Modular	Yes

Total lecturing hours	96 (48+48)
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 first module (M1) 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 second module (M2) 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 module 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 module 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
Lecturers	**F. Marta L. Di Lascio, Office E5.10a** Marta.DiLascio@unibz.it Tel. 0471 013285 Francesca Marta Lilja Di Lascio / Free University of Bozen-Bolzano **Francesco Ravazzolo**, Office E2.07 Francesco.Ravazzolo@unibz.it Tel. 0471 013133 Francesco Ravazzolo / Free University of Bozen-Bolzano
Scientific sector of the lecturers	SECS-S/01 - STAT-01/A former SECS-P/05 - ECON-05/A
Teaching language	English
Office hours	Please refer to the lecturers' timetables
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: time series forecasting, density forecasting, forecasting from ARIMA models - Volatility models: ARCH and GARCH models and forecasting - Case studies
Teaching format	Frontal lectures and lab sessions. The module adopts a blended, student-centred approach that emphasises problem-based learning and active engagement. A portion of the lecture content is made available online in advance, allowing students to explore key concepts independently and at their own pace before attending class. This preparatory work enables in-person sessions to focus on the application of knowledge through real-world problems, collaborative activities, and guided discussions — fostering critical thinking and deeper learning. The course is fully

	aligned with the principles of the Italian Universities Digital Hub (EDUNEXT) initiative (https://edunext.eu), which promotes the integration of digital resources and active learning strategies within university teaching.

Module 2	M2 Management of economic and business data
Lecturer	TBD
Scientific sector of the lecturer	TBD
Teaching language	English
Office hours	Please refer to the lecturer's timetable
Lecturing assistant	TBD
Teaching assistant	None
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 Business Intelligence and Analytics - Multi-dimensional data modeling for data analysis - Star, snowflake and constellation schema, fact tables, - Dimension tables - Extracting, storing, curating and transforming data with BI tools - Working with different data formats (CSV, JSON, RDF etc.) - Managing, analyzing and visualizing numeric data with - Business Intelligence Tools (PowerBI, Google Studio, Kibana, Tableau) - Advanced transformation and multidimensional - Modeling with PowerBI - Applications to economic and business data
Teaching format	The module adopts a blended, student-centred approach that emphasises problem-based learning and active engagement. A portion of the lecture content is made available online in advance, allowing students to explore key concepts independently and at their own pace before attending class. This preparatory work enables in-person sessions to focus on the application of knowledge through real-world problems, collaborative activities, and guided discussions — fostering critical thinking and deeper learning. The course is fully aligned with the principles of the Italian Universities Digital Hub (EDUNEXT) initiative (https://edunext.eu), which promotes the integration of digital resources and active learning strategies within university teaching.

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 for subsequent econometric modeling, and necessary to address subsequent analyses.

Assessment	**M1**: **Attending students:** Written exam composed of exercises and theoretical questions (50% of the final grade), group project and presentation (50% 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. **Final exam**: 50% of the final grade consists of problems related to the extraction, analysis and interpretations of various data sets in SQL. The other 50% of the final grade is a data analysis project using the BI tool used during the course.
Assessment language	English
Evaluation criteria and criteria for awarding marks	**M1**: **Attending students:** 50% written exam (consisting of theoretical questions and exercises), 50% group project report (consisting of analysis tasks on data sets assigned during the semester to be carried out through the use of statistical software) and 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, choose correct methods for the analyses, correctly execute analyses and interpret results, summarize and clearly communicate them. Moreover, evaluation will integrate an adequate proficiency in using Business intelligence tools to provide appropriate data representation, cleaning, transformation, curation and respective solutions to organizations.

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. - Selection of papers provided by the lecturers. - 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. - Further readings will be announced during the course. **M2**: - Shan J., Goldwasser M., Malik U., Johnston B. SQL for Data Analytics: Harness the power of SQL to extract insights from data, 2022. - Soheil Bakhshi, Expert Data Modeling with Power BI - Second Edition: Enrich and optimize your data models to get the best out of Power BI for reporting and business needs 2nd ed. Edition - Ramesh Sharda, Dursun Delen, Efraim Turban Business Intelligence, Analytics, Data Science, and AI