Syllabus

Course Description

Course Title	Econometrics for Data Science
Course Code	27501
Course Title Additional	
Scientific-Disciplinary Sector	SECS-P/05
Language	English
Degree Course	Master in Data Analytics for Economics and Management
Other Degree Courses (Loaned)	
Lecturers	Prof. Francesco Ravazzolo, Francesco.Ravazzolo@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/36066 Prof. Francesca Marta Lilja Di Lascio, Marta.DiLascio@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/32845
Teaching Assistant	
Semester	All semesters
Course Year/s	1
CP	12
Teaching Hours	M1: - 24 hours of in-person lectures - 12 hours of video lectures (counted as 24 hours to account for re-watching) M2: - 24 hours of in-person lectures - 12 hours of video lectures (counted as 24 hours to account for re-watching)
Lab Hours	M2: 18 hours
Individual Study Hours	-
Planned Office Hours	M1: 18 hours

	M2: 18 hours
Contents Summary	M1 The first module introduces the fundamentals of stochastic process theory, stationary and heteroskedastic models, and the principles of forecasting. It covers the core workflow of time-series analysis - from exploratory visualization and summarization to decomposition, model building, and forecasting. The theoretical aspects are complemented by modern data analysis with R. M2 This module equips students with practical skills to manage, process, and analyze data relevant to both business operations and economic decision-making. It covers relational and non-relational data models, data extraction using SQL, and advanced Business Intelligence tools such as PowerBI and Tableau for data transformation and visualization. Through hands-on activities and real-world datasets, students learn how to build and interpret data infrastructures that support performance monitoring, strategic planning, and policy evaluation in both corporate and public sector environments. The course emphasizes applied problem-solving and data-driven insight generation in economics and management.
Course Topics	M1 - 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 M2 TBD
Keywords	M1 Stochastic processes, SARIMA models, Volatility models, Forecasting methods, Data analysis

	M2 TBD
Recommended Prerequisites	M1 Basic knowledge of mathematics and statistical inference, and basic familiarity with R software. M2 TBD
Propaedeutic Courses	
Teaching Format	Lectures, pre-recorded videos, and laboratory sessions. The course 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 inperson 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.
Mandatory Attendance	Recommended, but not required.
Specific Educational Objectives and Learning Outcomes	Knowledge and understanding: The student will acquire knowledge of the analytical techniques and tools required to understand and quantitatively analyse economic and business phenomena in order to support decision-making processes. Knowledge of statistical inference, linear models and their generalisations, linear algebra, and optimisation techniques will be consolidated. In-depth knowledge of the main techniques of supervised and unsupervised statistical learning will be acquired, which are functional for the development of analysis and visualisation capabilities of economic and business data. Applying knowledge and understanding: Ability to apply and implement analysis techniques focusing on different types of datasets such as streaming data, tabular data, documents and images and analysis on joint datasets. Ability to apply supervised and unsupervised learning topics, and

	knowledge modelling, extraction, integration, analysis and exploitation; these skills are declined in various application domains of interest to companies and public and private entities. Making judgements: Master graduates will have the ability to apply the acquired knowledge to interpret data in order to make managerial and operational decisions in a business context. Master's graduates will have the ability to apply the acquired knowledge to support processes related to production, management and risk promotion activities and investment choices through the organisation, analysis and interpretation of complex databases. Communication skills: Master's graduates will be able to communicate effectively in oral and written form the specialised contents of the individual disciplines, using different registers, depending on the recipients and the communicative and didactic purposes, and to evaluate the formative effects of their communication. Learning skills: "MSc graduates should be familiar with the tools of scientific research. They will also be able to make autonomous use of information technologies to carry out bibliographic research and investigations both for their own training and for further education. In addition, through the curricular teaching and the activities related to the preparation of the final thesis, they will be able to acquire the ability - to identify thematic connections and to establish relationships between methods of analysis and application contexts; - to frame a new problem in a systematic manner and to implement appropriate analysis solutions; - to formulate general statistical-econometric models from the phenomena studied.
Specific Educational Objectives and Learning Outcomes (additional info.)	M1 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. M2 TBD
Assessment	The overall exam mark will be determined by the assessment of the two modules (M1+M2) 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 TBD
Evaluation Criteria	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 TBD
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 TBD
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 TBD
Further Information	
Sustainable Development Goals (SDGs)	Partnerships fot the goals, Quality education

Course Module

Course Constituent Title	M1 - Time Series Analysis and Forecasting
Course Code	27501A
Scientific-Disciplinary Sector	SECS-P/05
Language	English
Lecturers	Prof. Francesca Marta Lilja Di Lascio, Marta.DiLascio@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/32845 Prof. Francesco Ravazzolo, Francesco.Ravazzolo@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/36066
Teaching Assistant	
Semester	First semester
CP	6
Responsible Lecturer	
Teaching Hours	- 24 hours of in-person lectures - 12 hours of video lectures (counted as 24 hours to account for re-watching)

Lab Hours	-
Individual Study Hours	-
Planned Office Hours	18
Contents Summary	The first module (M1) introduces the fundamentals of stochastic process theory, stationary and heteroskedastic models, and the principles of forecasting. It covers the core workflow of time-series analysis - from exploratory visualization and summarization to decomposition, model building, and forecasting. The theoretical aspects are complemented by modern data analysis with R.
Course Topics	- 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	Lectures, pre-recorded videos, and laboratory 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 inperson 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.
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	- Selection of papers provided by the lecturers. - Lecture notes and exercises will be provided.
Supplementary Readings	- 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.

Course Module

Course Constituent Title	M2 - Management of economic and business data
Course Code	27501B
Scientific-Disciplinary Sector	SECS-P/05
Language	English
Lecturers	
Teaching Assistant	
Semester	Second semester
CP	6
Responsible Lecturer	
Teaching Hours	- 24 hours of in-person lectures - 12 hours of video lectures (counted as 24 hours to account for re-watching)
Lab Hours	18
Individual Study Hours	-
Planned Office Hours	18
Contents Summary	This module equips students with practical skills to manage, process, and analyze data relevant to both business operations and economic decision-making. It covers relational and non-relational data models, data extraction using SQL, and advanced Business Intelligence tools such as PowerBI and Tableau for data

	transformation and visualization. Through hands-on activities and real-world datasets, students learn how to build and interpret data infrastructures that support performance monitoring, strategic planning, and policy evaluation in both corporate and public sector environments. The course emphasizes applied problem-solving and data-driven insight generation in economics and management.
Course Topics	TBD
Teaching Format	TBD
Required Readings	TBD
Supplementary Readings	TBD