

Syllabus

Course Description

Course Title	Econometrics for Data Science
Course Code	27501
Course Title Additional	
Scientific-Disciplinary Sector	ECON-05/A
Language	English
Degree Course	Master in Data Analytics for Economics and Management
Other Degree Courses (Loaned)	
Lecturers	<p>Prof. Francesco Ravazzolo, Francesco.Ravazzolo@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/36066</p> <p>Prof. Francesca Marta Lilja Di Lascio, Marta.DiLascio@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/32845</p>
Teaching Assistant	
Semester	All semesters
Course Year/s	1
CP	12
Teaching Hours	<p>M1:</p> <ul style="list-style-type: none"> - 24 hours of in-person lectures - 12 hours of video lectures (counted as 24 hours to account for re-watching) <p>M2:</p> <ul style="list-style-type: none"> - 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	<p>M1</p> <p>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.</p> <p>M2</p> <p>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.</p>
Course Topics	<p>M1</p> <ul style="list-style-type: none"> - 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 <p>M2</p> <p>TBD</p>
Keywords	<p>M1</p> <p>Stochastic processes, SARIMA models, Volatility models, Forecasting methods, Data analysis</p>

	M2 TBD
Recommended Prerequisites	<p>M1 Basic knowledge of mathematics and statistical inference, and basic familiarity with R software.</p> <p>M2 TBD</p>
Propaedeutic Courses	
Teaching Format	<p>Lectures, pre-recorded videos, and laboratory sessions.</p> <p>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.</p>
Mandatory Attendance	Recommended, but not required.
Specific Educational Objectives and Learning Outcomes	<p>Intended Learning Outcomes (ILO)</p> <p>M1</p> <p>ILO 1 Knowledge and understanding:</p> <p>ILO 1.1 The student acquires knowledge of the analytical techniques and tools required to understand and quantitatively analyse economic and business phenomena in order to support decision-making processes.</p> <p>ILO 1.2 The student consolidates knowledge of statistical inference, linear models and their generalisations, linear algebra, and optimisation techniques.</p> <p>ILO 1.3 The student acquires an in-depth knowledge of the main techniques of supervised and unsupervised statistical learning, which are instrumental in the development of analysis and visualisation of economic and business data.</p>

	<p>ILO 2 Applying knowledge and understanding:</p> <p>ILO 2.1 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.</p> <p>ILO 2.2 Ability to apply supervised and unsupervised learning, and knowledge modelling, extraction, integration, analysis and exploitation; these skills are declined in various application domains of interest to companies and public and private organisations.</p> <p>ILO 3 Making judgements:</p> <p>ILO 3.1 The student acquires the ability to apply acquired knowledge to interpret data in order to make directional and operational decisions in a business context.</p> <p>ILO 3.2 The student acquires the ability to apply 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.</p> <p>ILO4 Communication skills:</p> <p>ILO 4.1 The student acquires the ability to communicate effectively in oral and written form the specialised content of the individual disciplines, using different registers, depending on the recipients and the communicative and didactic purposes, and to evaluate the formative effects of his/her communication.</p> <p>ILO 5 Learning skills:</p> <p>ILO 5.1 The student acquires knowledge of scientific research tools. He/she will also be able to make autonomous use of information technology to carry out bibliographic research and investigations both for his/her own training and for further education. Furthermore, through the curricular teaching and the activities related to the preparation of the final thesis, she will be able to acquire the ability</p> <ul style="list-style-type: none"> - 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
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	<p>implement appropriate analysis solutions; - to formulate general statistical-econometric models from the phenomena studied.</p> <p>M2</p> <p>ILO 1 Knowledge and understanding:</p> <p>ILO 1.1 Students acquire programming skills specifically geared towards data analysis and statistical methodologies aimed at implementing models and analysing large datasets.</p> <p>ILO 1.2 Students acquire knowledge of textual data and network analysis and aspects related to the security and privacy of such data.</p> <p>ILO 2 Applying knowledge and understanding:</p> <p>ILO 2.1 Ability to apply and implement, through the development of algorithms, techniques for analysing large datasets and spatial and temporal data, under conditions of uncertainty, in order to ensure the usefulness, quality and effectiveness of the analysis.</p> <p>ILO 2.2 Ability to use IT technologies, techniques and methodologies for the acquisition, management, integration, analysis and visualisation of large datasets, in order to ensure scalability in terms of the volume and speed of dataset acquisition. These skills relate in particular to large database and dataset management systems and related visualisation techniques, models and languages for expressing data semantics, learning techniques, decision-making models, information system organisation, web search techniques and data flow management techniques.</p> <p>ILO 3 Making judgements:</p> <p>ILO 3.1 The student acquires the ability to apply acquired knowledge to interpret data in order to make directional and operational decisions in a business context.</p> <p>ILO 3.2 The student acquires the ability to apply 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.</p> <p>ILO4 Communication skills:</p>
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	<p>ILO 4.1 The student acquires the ability to communicate effectively in oral and written form the specialised content of the individual disciplines, using different registers, depending on the recipients and the communicative and didactic purposes, and to evaluate the formative effects of his/her communication.</p> <p>ILO 5 Learning skills: ILO 5.1 The student acquires knowledge of scientific research tools. He/she will also be able to make autonomous use of information technology to carry out bibliographic research and investigations both for his/her own training and for further education. Furthermore, through the curricular teaching and the activities related to the preparation of the final thesis, she will be able to acquire the ability</p> <ul style="list-style-type: none"> - 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.)	<p>M1</p> <p>The course will provide students with the ability to analyze and interpret data using econometric models.</p> <p>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.</p> <p>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.</p> <p>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</p>

	<p>specific economic and business situations.</p> <p>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.</p> <p>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.</p> <p>M2 TBD</p>
Assessment	<p>The overall exam mark will be determined by the assessment of the two modules (M1+M2)</p> <p>M1 Attending students: Written exam composed of exercises and theoretical questions (50% of the final grade) - (ILOs 1, 2.2, 3-5), group project and presentation (50% of the final grade) - (ILOs 1-5).</p> <p>Non-attending students: Written exam composed of exercises, theoretical questions, tasks related to data analysis (100% of the final grade). (ILOs 1-5)</p> <p>M2 TBD</p>
Evaluation Criteria	<p>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.</p> <p>Non-attending students: 100% written exam consisting of theoretical questions, exercises, and data analysis tasks.</p>

	<p>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.</p> <p>M2 TBD</p>
Required Readings	<p>M1</p> <ul style="list-style-type: none"> - 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. <p>M2 TBD</p>
Supplementary Readings	<p>M1</p> <ul style="list-style-type: none"> - 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. <p>M2 TBD</p>
Further Information	

Sustainable Development Goals (SDGs)	Partnerships for the goals, Quality education
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Course Module

Course Constituent Title	M1 - Time Series Analysis and Forecasting
Course Code	27501A
Scientific-Disciplinary Sector	ECON-05/A
Language	English
Lecturers	<p>Prof. Francesca Marta Lilja Di Lascio, Marta.DiLascio@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/32845</p> <p>Prof. Francesco Ravazzolo, Francesco.Ravazzolo@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/36066</p>
Teaching Assistant	
Semester	First semester
CP	6
Responsible Lecturer	
Teaching Hours	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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

	<ul style="list-style-type: none"> - 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	<p>Lectures, pre-recorded videos, and laboratory sessions.</p> <p>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.</p>
Required Readings	<ul style="list-style-type: none"> - 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.
Supplementary Readings	<ul style="list-style-type: none"> - 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	ECON-05/A
Language	English
Lecturers	
Teaching Assistant	
Semester	Second semester
CP	6
Responsible Lecturer	
Teaching Hours	<ul style="list-style-type: none"> - 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	<p>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.</p>
Course Topics	TBD
Teaching Format	TBD
Required Readings	TBD
Supplementary Readings	TBD