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  
| 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.

<table>
<thead>
<tr>
<th>Module 1</th>
<th>M1 Time Series Analysis and Forecasting</th>
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<tbody>
<tr>
<td>Lecturer</td>
<td>F. Marta L. Di Lascio, Office E5.10a</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:Marta.DiLascio@unibz.it">Marta.DiLascio@unibz.it</a></td>
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<tr>
<td></td>
<td>Tel. 0471 013285</td>
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<tr>
<td>Scientific sector of the lecturer</td>
<td>SECS-S/01</td>
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<tr>
<td>Teaching language</td>
<td>English</td>
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<tr>
<td>Office hours</td>
<td>by appointment, please send an e-mail and refer to the lecturer’s timetable</td>
</tr>
<tr>
<td>Lecturing assistant</td>
<td>None</td>
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<tr>
<td>Teaching assistant</td>
<td>None</td>
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| 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 |

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<tr>
<th>Module 2</th>
<th>M2 Management of economic and business data</th>
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<tbody>
<tr>
<td>Lecturer</td>
<td>Andrea Molinari, Office E2.05</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:Andrea.Molinari@unibz.it">Andrea.Molinari@unibz.it</a></td>
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<td><a href="https://www.unibz.it/it/faculties/engineering/academic-staff/person/3420-andrea-molinari">https://www.unibz.it/it/faculties/engineering/academic-staff/person/3420-andrea-molinari</a></td>
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<tr>
<td>Scientific sector of the lecturer</td>
<td>Sees-S/01</td>
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<td>Teaching language</td>
<td>English</td>
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<tr>
<td>Office hours</td>
<td>18 hours MySNS – My timetable</td>
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<td>Webpage:</td>
<td><img src="https://www.unibz.it/en/timetable/?sourceId=unibz&amp;department=26&amp;degree=13543%2C13723" alt="Image" /></td>
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| **Lecturing assistant** | Tun-I Hu  
  tuni.hu@unibz.it  
| **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 visualising 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 analyze 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

### Supplementary readings

**M2:**
- 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.

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