

## Subject card

|                                             |                                                                                                                                                                                                                              |                                                          |                                         |                                     |                                                                                              |            |     |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Analytical Software and Data Visualization - B, PG_00178506                                                                                                                                                                  |                                                          |                                         |                                     |                                                                                              |            |     |
| Field of study                              | Informatics and Econometrics                                                                                                                                                                                                 |                                                          |                                         |                                     |                                                                                              |            |     |
| Date of commencement of studies             | October 2025                                                                                                                                                                                                                 |                                                          | Academic year of realisation of subject |                                     | 2026/2027                                                                                    |            |     |
| Education level                             | Bachelor's studies                                                                                                                                                                                                           |                                                          | Subject group                           |                                     | Optional subject group<br>Subject group related to scientific research in the field of study |            |     |
| Mode of study                               | part-time studies                                                                                                                                                                                                            |                                                          | Mode of delivery                        |                                     | at the university                                                                            |            |     |
| Year of study                               | 2                                                                                                                                                                                                                            |                                                          | Language of instruction                 |                                     | Polish                                                                                       |            |     |
| Semester of study                           | 3                                                                                                                                                                                                                            |                                                          | ECTS credits                            |                                     | 7.0                                                                                          |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                     |                                                          | Assessment form                         |                                     | exam                                                                                         |            |     |
| Conducting unit                             | Department of Econometrics -> Faculty of Management -> Rector                                                                                                                                                                |                                                          |                                         |                                     |                                                                                              |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                           |                                                          | mgr Tomasz Jastrzębski                  |                                     |                                                                                              |            |     |
|                                             | Teachers                                                                                                                                                                                                                     |                                                          |                                         |                                     |                                                                                              |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                  | Lecture                                                  | Tutorial                                | Laboratory                          | Project                                                                                      | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                        | 8.0                                                      | 16.0                                    | 16.0                                | 0.0                                                                                          | 0.0        | 40  |
|                                             | E-learning hours included: 0.0                                                                                                                                                                                               |                                                          |                                         |                                     |                                                                                              |            |     |
| Learning activity and number of study hours | Learning activity                                                                                                                                                                                                            | Participation in didactic classes included in study plan |                                         | Participation in consultation hours |                                                                                              | Self-study | SUM |
|                                             | Number of study hours                                                                                                                                                                                                        | 40                                                       |                                         | 2.0                                 |                                                                                              | 133.0      | 175 |
| Subject objectives                          | 1. To become familiar with IT tools for statistical and econometric analysis and data presentation.<br>2. To acquire the ability to independently prepare software for data analysis, visualisation and computer simulation. |                                                          |                                         |                                     |                                                                                              |            |     |

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| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Subject outcome                                                                                                                                                                                                                                             | Method of verification                  |
|                                 | [liEL3_U02] Students can select or construct econometrics, informatics or statistics tools and apply them to describe and solve economic and social problems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The student is able to select or construct econometric, IT or statistical tools enabling the acquisition, processing and analysis of data reflecting the functioning of phenomena and processes occurring in the socio-economic environment.                | [SU2] presentation/project/paper/report |
|                                 | [liEL3_U03] Students can obtain data from appropriately selected sources, use these data to solve economic and social problems, and process and interpret them using econometrics, informatics or statistics tools.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | The student is able to exploit various data sources and use adequate methods of data acquisition and processing using appropriate IT, statistical or econometric tools in order to perform socio-economic analyses.                                         | [SU2] presentation/project/paper/report |
|                                 | [liEL3_W05] To an advanced degree, the student knows and understands the methods, techniques and informatics or statistics tools used to acquire, collect, process and present data in decision-making processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | The student recognizes and selects appropriate IT or statistical tools enabling the acquisition, collection, processing and visualization of data reflecting the functioning of phenomena and processes occurring in the socio-economic environment.        | [SW2] presentation/project/paper/report |
|                                 | [liEL3_W06] To an advanced degree, the student knows and understands the processes and methods of creating, developing, and providing appropriate conditions for using informatics or statistics tools, particularly those that improve human and organizational functioning.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The student recognizes and selects appropriate IT tools (taking into account their limitations) enabling the acquisition, processing and analysis of data reflecting the functioning of the organization and the processes taking place in its environment. | [SW2] presentation/project/paper/report |
| Subject contents                | <p><b>Python:</b> Anaconda: download and installation; Jupyter Notebook environment, Spyder, PyCharm, Google Colab; Philosophy of the Python language ; Instructions and loops ; Building user functions; Actions on matrices and vectors; Using the software in computer simulations; Data frames; Data frames; Visualisations in python; Interactive visualisations in python; Data preparation and data frame analysis in practice.</p> <p><b>SPSS:</b> General information about the programme; Programme windows: data editor window, report window, commands; Working on a sample dataset; Defining variables and values; Retrieving data from external files; Statistical analysis; Transforming variables; Weighting data; Filtering a dataset; Subgroup analysis; Data validation; Creating and editing charts and reports in PS IMAGO DESIGNER; Automating work (SPSS Syntax scripting language).</p> <p><b>Excel:</b> Excel's built-in statistical functions, uses and limitations; Methods for calculating characteristics not included in Excel; Performing statistical analyses in Excel for statistical data analysis; Using the Data Analysis tool in statistical analysis; Downloading/exporting data (csv), organizing data (variable formats), creating charts.</p> <p><b>Statistica:</b> General information about the programme; Programme windows: data editor, report window, commands; Working on a sample dataset; Defining variables and values; Retrieving data from external files; Statistical analysis; Transforming variables; Weighting data; Filtering a dataset; Analysis in subsets; Data validation; Creating and editing charts; Automation of work (single analysis macros, global macros).</p> <p><b>R:</b> Philosophy of the R language; Importing data; Selecting subsets; Variable types; Variable names, variant labels for factors; Descriptive statistics; Transforming data and structures. Conditional analysis; Storing results; Transforming data using the dplyr package ; Loops and conditional statements; Building user functions; Computer simulations; Creating visualisations in graphics and related packages; Creating visualisations in ggplot2 and related packages; Creating a report and working in R Markdown.</p> |                                                                                                                                                                                                                                                             |                                         |
| Prerequisites and co-requisites | Knowledge of descriptive statistics and mathematical statistics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                             |                                         |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Passing threshold                                                                                                                                                                                                                                           | Percentage of the final grade           |
|                                 | Project 2 (SPSS, Excel, Statistica)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 51.0%                                                                                                                                                                                                                                                       | 50.0%                                   |
|                                 | Project 1 (Python, R)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 51.0%                                                                                                                                                                                                                                                       | 50.0%                                   |

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|----------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended reading                                            | Basic literature         | <ol style="list-style-type: none"> <li>1. R Core Team, <i>An Introduction to R</i>, 2021, <a href="https://cran.r-project.org/doc/manuals/r-release/R-intro.html">https://cran.r-project.org/doc/manuals/r-release/R-intro.html</a></li> <li>2. H. Wickham, G. Grolemund, <i>R for Data Science: Import, Tidy, Transform, Visualize, and Model Data</i>, O'Reilly Media, Sebastopol, CA 2017, <a href="https://r4ds.had.co.nz/">https://r4ds.had.co.nz/</a></li> <li>3. K. Grzeszkiewicz-Radulska, J. Wiktorowicz, M.M. Grzelak, <i>Analiza statystyczna z IBM SPSS Statistics</i>, Wydawnictwo UŁ, Łódź 2020, <a href="https://wydawnictwo.uni.lodz.pl/wp-content/uploads/2021/01/Wiktorowicz-i-in._Analiza-statystyczna-.pdf">https://wydawnictwo.uni.lodz.pl/wp-content/uploads/2021/01/Wiktorowicz-i-in._Analiza-statystyczna-.pdf</a></li> <li>4. W. McKinney, <i>Python w analizie danych. Przetwarzanie danych za pomocą pakietów Pandas i NumPy oraz środowiska IPython</i>. Wydanie II, Helion, Gliwice, 2018</li> <li>5. M. Rabiej, <i>Analizy statystyczne z programami Statistica i Excel</i>, Helion, Gliwice, 2018</li> </ol> |
|                                                                | Supplementary literature | <ol style="list-style-type: none"> <li>1. E. Matthes, <i>Python. Instrukcje dla programisty</i>. Wydanie II, Helion, Gliwice, 2019, str. 31-215</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                | eResources addresses     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example issues/<br>example questions/<br>tasks being completed |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Work placement                                                 | Not applicable           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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