# . - Quantitative Methods

## Proff. Daniele Moro-Paolo Sckokai

# Applied Mathematics and Statistics for the Agri-Food System

## Prof. Daniele Moro

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims to provide the students with mathematical and statistical tools for both the theoretical and the empirical analysis of the agrifood sector.

By the end of the course, students should be able to:

* master the main statistical and mathematical tools presented;
* use a rigorous mathematical approach in tackling economic problems;
* apply mathematical and statistical reasoning to problem solving in economics;
* handle basic tools for the following module.

***COURSE CONTENT***

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|  | CFU |
| *Linear Algebra*  Definitions of vector and matrix; linear independence; matrix operations; rank and determinant; linear systems in matrix form | 1.0 |
| *Mathematical tools*  Notion of derivative; partial derivatives and total derivative; unconstrained and constrained optimization; comparative statics | 1.5 |
| *Random variables and probability distribution*  Notion of probability; random variables; main distributions (normal distribution); estimators and sampling distributions | 1.0 |
| *Inference*  Confidence intervals and hypotheses testing; *t*, *2* and *F* distributions; one-sample and two-sample hypotheses; Chi-squared tests | 1.0 |
| *Simple linear regression analysis.*  Least squares estimates; tests for the regression coefficients and for the overall model | 0.5 |
| Tutorials. | 1.0 |

***READING LIST***

Selected readings from the following textbooks:

K. Black, *Business Statistics for Contemporary Decision Making,* 5e, John Wiley & Sons, USA, 2007.

M. Hoy-J. Livernois-C. Mckenna-R. Rees-T. Stengos, *Mathematics for Economics*, 3rd Edition, MIT Press, USA, 2011.

Slides and classnotes.

***TEACHING METHOD***

The course is organized with 5 credit units of class lectures (35 hours) and 1 credit unit of class/lab exercises (12 hours), in which further applications on lectures’ notions will be presented. Solving problems is required for passing final examination.

***ASSESSMENT METHOD AND CRITERIA***

The assessment will be based on one final written exam and assignments/homeworks. The global assessment is intended to evaluate the student’s skills in managing mathematical and statistical tools.

The final written exam will last about 120 minutes. Questions mainly relate to the application of the analytical methodologies presented in class, but they may also refer to theoretical issues. The exam is intended to provide a measure of the students’ ability to meet the learning objectives and to offer to the instructor a grasp of the students’ reasoning skills in applying the methodological instruments presented in class.

The assignments/homeworks will require to solve problems/exercises.

***NOTES AND PREREQUISITES***

Further information can be found on the instructor's webpage or on the Faculty notice board.

***OFFICE HOURS FOR STUDENTS***

Professor Daniele Moro is availlable to meet students after classes at SMEA or by appointment (phone: 0523/599292 – email: *daniele.moro@unicatt.it*).

## **Applied Econometrics for the Agri-food system**

## Prof.Paolo Sckokai

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims to introduce students to some basic econometric tools applied to food and agricultural data. Special attention will be given to those models that can be applied to data available in a business environment.

At the end of the course, the student will be able to use selected econometric tools for analysing different type of data (cross-sections, time series, panel data) in order to analyse some relevant phenomena that characterise the dynamics of the agricultural and food system. The student will be also able to use a specific econometric software for computer applications.

#### COURSE CONTENT

|  |  |
| --- | --- |
|  | CFU |
| **Introduction**. The logic of econometrics. Type of data (cross-section, time series, panel data). Estimators and properties of estimators. | 0.5 |
| **The multiple regression model on cross sectional data**. Review of the two-variable regression model. The multiple regression model. The use of regressions. | 1.5 |
| **Heteroscedasticity.** Definition, tests and correction for heteroscedasticity. | 0.5 |
| **The multiple regression model on time series data**. Properties of time series. Use of time series data in regressions. | 0.5 |
| **Serial correlation.** Definition, tests and correction for serial correlation. | 0.5 |
| **Pooled cross section and panel data models**. Estimation of pooled cross section models: first difference estimator. Estimation of panel data models: Fixed-effect and Random effect models. | 0.5 |
| **Instrumental Variable estimation.** Correlation between explanatory variables and error term. IV estimation, endogeneity and 2SLS estimation. | 0.5 |
| **Models of qualitative choice.** Definitions: binary and multiple choice models. Linear Probability Model, Probit Model, Logit Model, Multinomial logit model, Ordered Probit Model, Censored Regression Model. | 0.5 |
| **Tutorial computer sessions** | 1.0 |

#### READING LIST

Selected readings from the following textbooks:

J.M.Wooldridge, *Introductory Econometrics: A Modern Approach,* 7th ed., South-Western Cengage Learning, 2019.

R.S Pindyck-D.L. Rubinfeld, *Econometric Models and Economic Forecasts,* 4th ed., McGraw-Hill, 1998.

Further readings on specific topics will be provided by the instructor.

#### TEACHING METHOD

The course consists of five credits of lectures and one credit of tutorial computer sessions. Lectures are given using computer presentations that are made available to students. During lectures, several practical examples of model estimations are provided. Computer sessions imply the use of a specific econometric software.

***ASSESSMENT METHOD AND CRITERIA***

The exam is structured in two parts: one final written exam and two computer-based exams.

The final written exam lasts 120 minutes and it is structured with open questions and exercises concerning applications of econometric models to agricultural and food economic data. The score attached to each question may change depending on the test. The assessment is intended to provide a sufficiently precise measure of the student’s learning and to offer to the instructor a grasp of the student’s reasoning skills and abilities to use econometric tools.

The two computer-based exams will refer to the content of the tutorial computer sessions and will ask the students to carry out econometric analysis of agricultural and food economic data using a specific econometric software.

***NOTES AND PREREQUISITES***

Knowledge of elementary statistics and of some basic mathematical tools (linear algebra and calculus) are required.

***OFFICE HOURS FOR STUDENTS***

Prof. Paolo Sckokai is available to meet with students after class in the SMEA offices or by appointment (tel. *0523-599290*; email *paolo.sckokai@unicatt.it*).