



# Econometrics (version: 24th August 2022)

[2022-2023, first semester, second block]

**Course code:** 6012B0453Y

**Course load:** 6 EC (= 168 hours)

**Coordinator:** Hans van Ophem (room E4.34, email [j.c.m.vanophem@uva.nl](mailto:j.c.m.vanophem@uva.nl))

**Lectures:** Hans van Ophem

## **Tutorials and computer classes:**

- Pieter van Casteren
- Péter Foldvari
- Jonas Meier
- Hans van Ophem
- Rutger Poldermans
- Erik van der Sluis
- Gabriela Szini
- Ekaterina Ugulava
- Esmée Zwiers.

**Canvas page:** <https://canvas.uva.nl/courses/32571>

## **Contents of the course**

This course is dealing with regression analysis, which in applied economics is a powerful tool to analyse empirical relationships. First, the linear regression model will be discussed, its estimation with ordinary least squares (OLS) and testing hypotheses with t- and F-tests. Particular attention will be paid to the statistical assumptions underlying the basic model. These assumptions should be valid in applications in order to give reliable outcomes. Secondly, the focus will be on various specification issues: multicollinearity, functional form and qualitative variables. Thirdly, the consequences of deviations from the statistical assumptions underlying OLS (and t- and F-tests) will be examined. We will focus on heteroskedasticity, omitted variable bias, measurement error and simultaneity bias and their effects on estimation and hypothesis testing. The students will learn how to detect possible misspecification with formal statistical tests and how to adapt statistical inference methods in order to get reliable estimation and testing outcomes. The alternative estimation technique Maximum Likelihood, and in particular the probit and logit models, will be discussed as well. In the computer classes the estimation techniques and testing procedures are applied to artificial and real world economic data.

## Objectives:

- Being able to explain the theoretical background of the linear regression, logit and probit models;
- Being able to apply the linear regression, logit and probit models to real data and can interpret the estimation results;
- Being able to test relevant hypotheses using t- and F-tests;
- Being able to assess whether the basic assumptions of the linear regression model will hold, explain what the problems are if these assumptions are violated and find proper solutions for any form of misspecification (heteroskedasticity, nonlinearities, endogeneity);
- Being able to apply alternative estimation techniques (in particular IV and 2SLS) to get consistent estimation results.

## Prerequisites

To complete this course successfully, you should have knowledge about elementary mathematics, and elementary and intermediate statistics from the beginning. We build on the knowledge acquired in Mathematics 1 for Economics, Statistics 1 for Economics, Statistics 2 for Economics and Research Project in the Bachelor in Economics and Business Economics. You should be familiar with the concepts of differential calculus, exponential and logarithmic functions, second order derivatives and partial derivatives, chain rule, product rule and quotient rule, summation and product of many variables, random variable, probability distribution, probability density function (PDF), cumulative distribution function (CDF), expectation, variance and correlation. Furthermore, you should know the concepts of estimation and hypothesis testing, p-values and confidence intervals. Chapters 2 and 3 of Stock & Watson (2020) essentially list the statistical subjects you should be familiar with. If you lack this knowledge, you have to catch up instantly. More information can be found on the Canvas page of the course in the module General information (submodule Refresher Material).

## Literature/course material

- Stock, J.H. and Watson, M.W. (2020): Introduction to Econometrics. Pearson Education, 4th edition. The (updated) third edition is also usable. Note however that the page numbers, equation numbers, exercises etc can be different.
- Other course material, e.g. lecture notes, tutorial exercises, additional data sets and computer exercises, is available on Canvas (<https://canvas.uva.nl/>).

## Organisation

### In general:

In this course is a lecture (2 hours, combined for all groups), followed by a tutorial (2 hours, separate for 22 groups) and then a computer class (2 hours, separate for 22 groups) every week. The time schedule can be found at [rooster.uva.nl](http://rooster.uva.nl). The lectures are scheduled on Mondays, the tutorials on Tuesdays and Wednesdays and the computer classes on Thursdays and Friday.

During the lectures the subjects of the course will be discussed according to the schedule below. It is strongly recommended to read lecture notes and relevant parts of the book in advance. The lecturer will explain the most relevant parts of the literature only. Furthermore, some theory not discussed in the book will be introduced during the lectures. These subjects may be part of the examination.

Students are encouraged to practice with the subjects of the course in two ways:

- In the tutorials both conceptual and analytical skills are practiced by (1) answering questions from students; (2) doing exercises (these exercises are partly on the level of the examination, some old examination questions will be discussed). It is assumed that you have read the relevant

material in advance and that you understand the relevant basic statistics. The exercises that will be discussed can be found on Canvas.<sup>1</sup>

- In the computer classes students will have the opportunity to acquire practical econometric skills by making computer exercises using the program Stata. For use on your own laptop or desktop, a license is available (for more information, see Canvas). Be aware: the examination exercises might contain questions on Stata-commands.

The lecture will take place on Mondays, 9:00h-11:00h. Location:

Week 1: Theater de La Mar - Wim Sonneveld zaal - Marnixstraat 402, 1017 PL Amsterdam

Weeks 2,3,5,6,7: Lutherse kerk - Aula - Singel /Handboogstraat 2-6/ Spui, 1012 XM Amsterdam

### **Subjects lectures, tutorials, and computer classes:**

See table at the end of this document.

### **Attendance**

Econometrics is considered to be a challenging course by many students. To prepare optimally for the examination it has been proven over and over again that active participation by actually attending and preparing lectures, tutorials and computer class is crucial. Looking only at recordings, at solutions to (computer) exercises or at old examinations does not really improve your chances of passing the exams. Active involvement (preparing lectures beforehand, doing exercises yourself beforehand) is a much better preparation. Be aware:

- The faculty policy stipulates that lectures have to be recorded and published before the resit takes place. Be aware:
  - The lecturer is not, apart from the publication of the recording, in control here. A third party creates the recording of the lectures. Last year, two out of six recordings failed.
  - The recordings of the lectures will be published directly after they become available. However, if lecture attendance drops below 25% ( $\approx$  200 students) the recordings will only be published after the final examination of December 19th, 2022.
- The attendance of tutorials and computer classes will be monitored for each student. Tutorials and computer classes will not be recorded.
  - Brief solutions of the exercises not discussed in one of the tutorials will be published on Canvas on Thursday.
  - Solutions to the computer exercises (and a relevant Stata do-file) will be published at the end of the week.

### **Examination**

- The final mark consists of a closed book midterm examination (20%, two hours, multiple-choice questions) and a closed book final written examination (80%, three hours, open questions). To pass the course the combined (unrounded) mark should be at least a 5.5 and the mark for the final written examination must be at least a 5.0;
- In the case of a resit (100%, two hours, open questions), the results obtained for the partial examinations will be disregarded. The mark for the resit examination should be at least a 5.5 to pass the course.
- The midterm, the final and the resit exams are closed book, but you will be handed some important formulas and relevant statistical tables (this document is available on Canvas).

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<sup>1</sup>Additional exercises are available in the book. But be aware some of these exercises are very basic and others quite complicated. Solutions are not available. Lots of old exams (with solutions) are available on Canvas.

- Exam material: Any material covered in the lectures, tutorials and tutorial exercises, computer classes and computer exercises, and relevant parts of the book can be part of the examination. You also need to familiar with the Stata commands discussed in class. These can be part of the examinations.
  - Midterm exam material: weeks 1-3
  - Final and Resit exams material: all weeks but the questions concentrate on weeks 4-5.
- While doing the final or resit you have to always motivate your solutions/answers. A simple yes or no will not earn you points. Also, if you have to perform a statistical test or evaluate significance do this in the steps you learned in your statistics classes ((i) write down the null and alternative hypotheses; (ii) calculate the test statistics and give its distribution; (iii) state the critical value (at 5% usually, except if indicated otherwise); (iv) draw a conclusion one rejecting or accepting (for the moment) the null hypothesis).

*Dates examinations: (see rooster.uva.nl)*

- Midterm exam: Tuesday,, November 22nd 2022; 13:00h-25:00h, World Fashion Center, Halls East and West.
- Final exam: Monday, December 19th 2022, 13:30h-15:30h., Passenger Terminal Amsterdam.
- Resit exam: Monday, July 3rd 2023, 16:00h-18:00h, location tba. [PRELIMINARY DATE AND TIME - consult rooster.uva.nl]

## **Course schedule**

See next page.

## **Exemptions**

The Examination Board decided that exemptions of compulsory courses of the educational program of FEB-programs are no longer possible.

## Course schedule

| Week           | Topics   | Stock and Watson/Computer exercises                |
|----------------|--|--|
| 1              | Lecture:<br>Introduction and simple regression model | Chapters 4+5<br>(incl. Appendices 4.2+4.3+5.1+5.2) |
|                | Tutorial   | Exercises: See Canvas - Week 1                     |
|                | Computer class                                       | Introduction Stata + simple regression model       |
| 2              | Lecture:<br>Multiple regression model                | Chapter 6+7<br>(incl. Appendices 6.1+6.2)          |
|                | Tutorial   | Exercises: See Canvas - Week 2                     |
|                | Computer class                                       | Excel + Multiple regression model                  |
| 3              | Lecture:<br>Multiple regression and functional form  | Chapters 7+8<br>(incl. Appendix 8.2)               |
|                | Tutorial   | Exercises: See Canvas - Week 3                     |
|                | Computer class                                       | Functional form                                    |
| 4 (study week) | Midterm Exam: Tuesday, November 22nd                 | 13:00h-15:00h (World Fashion Center)               |
| 5              | Lecture:<br>Validity and endogeneity                 | Chapters 9   |
|                | Tutorial   | Exercises: See Canvas - Week 5                     |
|                | Computer class                                       | Validity and endogeneity                           |
| 6              | Lecture:<br>Instrumental variables (IV & 2SLS)       | Chapter 12<br>(incl. Appendices 12.2+12.3)         |
|                | Tutorial   | Exercises: See Canvas - Week 6                     |
|                | Computer class                                       | Endogeneity  |
| 7              | Lecture:<br>Binary choice models                     | Chapter 11<br>(incl. Appendices 11.2+11.3)         |
|                | Tutorial   | Exercises: See Canvas - Week 7                     |
|                | Computer class                                       | Binary choice models + unreliability               |
| Examination    | Final Exam: Monday, December 19th                    | 13:30h-15:30h (Passenger Terminal Amsterdam)       |
| Resit          | Monday, July 3rd 2023 (16:00h-18:00h)                | Preliminary date, consult rooster.uva.nl           |