

# Econ 513: Practice of Econometrics

(section 26186)

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Department of Economics, USC

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## **Course Description**

Econometrics is “*the application of statistical and mathematical methods to the analysis of economic data, with a purpose of giving empirical context to economic theories and verifying them or refuting them.*” (Maddala, Introduction to Econometrics, 1992, p.1).

ECON513 is designed to provide Master’s students with a theoretical understanding of the most widely used econometric methods and a series of data applications emphasizing the practical implementation of such methods.

Economic theory suggests relationships among variables. This course describes how the tools of statistics can be used to conduct inference on such economic relationships. Specifically, we focus on the **measurement** of economic relationships by investigating their compatibility with data and assessing the empirical magnitude of the link between two economic variables (while holding other variables constant). Measuring economic relationships also allows to infer the impact and effectiveness of a given policy and to make predictions about the effect of future interventions. We consider linear relationships first and develop the corresponding estimation and inference methods. An issue that comes up frequently in empirical economic and social science research is that variables that affect an outcome are not chosen at random. We discuss various approaches to dealing with the resulting bias. Finally, we consider nonlinear relationships, in particular the one between a discrete outcome and determining variables.

## **Learning Outcomes**

Upon completion of this course, students should:

- Be familiar with the most widely used linear and nonlinear models in econometrics.
- Understand the relative advantages and pitfalls of each method for different applications.
- Be able to identify and use appropriate estimators in their own work or research.

## Course Organization

This is a one-semester course for Master's students.

The course features lectures covering the theory underlying econometric models and guided exercises. Lectures are twice a week, on **Monday and Wednesday from 4:00pm to 5:50pm PST in VPD 105**. For each topic, short quizzes will allow students to test their knowledge of the material regularly. Assignments involving theoretical problems and data applications will help students to delve into the material in more detail and put their learning into practice.

Data applications will be performed using the software Stata, which can be accessed at no-cost through the USC Virtual Desktop Environment, or purchased at a student discount here. Occasionally, students will be directed to videos on the official Stata's YouTube Channel to learn how to perform the data tasks and econometric analyses covered by the course using the software.

TA sessions will guide students through Stata applications. They will take place in Zoom every other Friday from 12pm to 1pm PST (starting January 21st).

There will be a course website on the Blackboard system, where all the course material will be posted. This includes the syllabus, slides, suggested readings, tests, exercises, and data sets.

## Testing and Grading

### Short Quizzes: 15%

For each topic, there will be a few true/false and multiple choice questions, which will allow students to test their knowledge of the material throughout the course. These questions can only be attempted once. The average score over all the available questions will contribute 15% of the final grade. Questions left unattempted/unanswered will receive a score of 0.

### Problem Sets and Computer Exercises: 15%

There will be 4 problem sets throughout the course. The due date for each problem set will be announced. Problem sets must be turned in on time, as late problem sets will NOT be accepted and there will be no credit for them. You may discuss the solution of these problem sets with other students in the course and form study groups. However, you must do the computer assignments yourself and write up your own answers to all questions. This is your opportunity to truly understand how well you know the material: don't miss it by simply copying someone else's answers. Detailed answers and Stata code for all problem sets will be posted on Blackboard. The problem sets **will be checked, but not graded**. Each will receive full points (100/100) as long as it is submitted on time and according to the instructions. The average over the 4 problem sets will contribute 15% of the final grade.

### Midterm Exam: 30%

The midterm exam will take place on March 9, 2022. The midterm exam will contribute 30% of the final grade.

### Final Exam: 40%

The final exam will take place during the exam week (May 4-11, 2022). The date of the final is set by the College.

Although the final exam is **non-cumulative**, the topics in this course build on previous ones. Hence, to do well on the final exam, students should carefully review **all topics**.

## Prerequisites

Some background material will be briefly reviewed in the first few weeks of the course, but I strongly recommend that you become familiar (or renew the acquaintance) with matrix algebra and statistics. It is assumed that you know basic matrix operations, such as multiplication and inversion and that you have good knowledge of statistics (e.g., you know what an estimator is, what a confidence interval is, how to test hypotheses, etc.).

## Textbook and References

- **CT\_Stata (textbook):**

Cameron, A. C. and Trivedi, P. K., “Microeconometrics Using Stata,” 2010 (revised edition).

- **CT\_Theory:**

Cameron, A. C. and Trivedi, P. K., “Microeconometrics: Methods and Applications,” 2005.

- **W1:**

Wooldridge, J. M., “Introductory Econometrics (a modern approach),” 2009 (4th edition).

- **W2:**

Wooldridge, J. M., “Econometric Analysis of Cross Section and Panel Data,” 2002.

- **AP:**

Angrist, J. D. and Pischke, J-S., “Mostly Harmless Econometrics,” 2009.

- **G:**

Green, W. H., “Econometric Analysis,” 2003 (5th edition).

**Note:** All these books provide examples and exercises which you can use to practice and review course material.

The official textbook is Cameron and Trivedi “Microeconometrics Using Stata.” This book describes how to do microeconomic research using Stata and it will be of great help for the empirical analyses involved in this course and for your future research. Some background and other material that supplements this book will be discussed in the lectures and often taken from less advanced books. The slides will be made available in Blackboard. If you have another book that you think covers the material in this course, please consult me. In general, undergraduate textbooks do not cover the material at the level of this course.

**The most important study material for this course are lecture slides, short quizzes, and problem sets.**

If you want/need further details for each topic, you can refer to the references below.

## Topics and Corresponding References

Topic 1: Empirical economic relationships

W1: Chapter 1.

Topics 2&3: The Classical Linear Regression model and the Ordinary Least Squares solution

CT\_Stata: Chapter 3; W1: Chapters 2-3; G: Chapters 2-3;.

Topic 4: Inference in the CLR model

W1: Chapter 4; G: Chapter 4.

Topic 5: Statistical inference in large samples: asymptotics

CT\_Stata: Chapter 4; W1: Chapter 5; W2: Chapters 3-4.

Topic 6: Heteroskedasticity, delta method and bootstrap

CT\_Stata: Chapters 5 and 13.

Topic 7: Instrumental variables (IV)

CT\_Stata: Chapter 6; W1: Chapter 15; W2: Chapter 5.

Topic 8: Panel data – pooled OLS, random and fixed effects

CT\_Stata: Chapter 8. W2: Chapter 10.

Topic 9: Econometric methods for policy evaluation

W2: Chapter 18; CT: Chapter 25.

Topic 10: Maximum Likelihood (ML) estimation: theory and implementation

CT\_Stata: Chapter 10.3 and 11.4; W2: Chapter 13.

Topic 11: Binary response models

CT\_Stata: Chapter 14 and 15; W2: Chapter 15.

### **Policy on Missed Exams**

Students must take the exams as scheduled. The only valid reason for missing an exam is serious illness (as verified in writing by a medical doctor).

There will be no make-up exams unless a student has a valid medical excuse and can provide documentation for such an excuse, or if a student cannot take the exam because of extenuating circumstances, and prior arrangements are made with the instructor if possible. The student will receive zero credit for unexcused missed exams.

Student will receive an F for the course if final exam is missed for unexcused absence regardless of student's performance during the semester. If a student has a valid reason for missing the final exam, and can document it, he/she will be awarded an incomplete.

### **Academic Accommodations**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early as possible in the semester. DSP is located in STU 301, and is open 8.30am-5.00pm, Monday through Friday. The phone number for DSP is (213)-740-0776.

## **Academic Integrity Policy**

We are committed to upholding the University's Academic Integrity code as detailed in the SCampus Guide. It is the policy of the Economics Department to report all violations of the code. Any serious violation or pattern of violations of the Academic Integrity Code will result in the student's expulsion from the major or minor, or from the undergraduate program.

"Re-grades" will only be undertaken if there is evidence of a grading error. However, the whole exam will be re-graded, so the exam grade could go down.