ECON-UB 251

Econometrics I (Spring 2024)

Instructors

My name is Sebastiano Manzan and I will be the instructor for this course. You can contact me by email at sm10237@nyu.edu.

Class Schedule

Tuesday and Thursday from 2pm to 3.15pm in **KMC 4-60**. All classes will be recorded and posted in the Content area of *Brightspace*.

Office Hours

The in-person office hours is on *Thursday from 12.30pm to 1.30pm* (**KMC 7-187**) and on Zoom at other times (email me to agree a mutually convenient time)

Course Description

Econometrics represents the branch of economics devoted to the quantitative analysis of economic data and relationships. This course is devoted to introduce students to the most important econometric tools by developing a theoretical understanding of the concepts and familiarity with their application. The course starts by introducing the Linear Regression Model (LRM), how to estimate it, and conduct statistical inference. We will then continue by extending the LRM to account for nonlinear effects and to conduct causal inference. We will also discuss classification models and time series models that are routinely used in macroeconomics and finance.

Learning Outcomes

At the end of the course, students will:

- Develop understanding of the Linear Regression Model (LRM)
- Be able to estimate and test hypothesis about the parameters of the LRM
- Understand the pitfalls of regression analysis and how to conduct causal inference
- Demonstrate knowledge of linear and nonlinear classification techniques
- Be able to apply time series models to forecast economic and financial variables
- Be confident in conducting an empirical ianalysis using `R` or `Python`

Pre-requisite

ECON-UB 1 (Micro) and STAT-UB 103 (Statistics & Regression)

Textbook

The textbook for the course is

> Stock and Watson, *Introduction to Econometrics*, 4th Edition, Pearson.

Third or global editions of the book are acceptable as well.

Additional resources to complement SW are:

- [AP] Angrist and Pischke, *Mastering 'Metrics: The Path from Cause to Effect*, Princeton University Press
  - This book is a relatively easy read and a useful complement on the topic of causal inference
- [W] Wooldridge, *Introductory Econometrics*, Cengage
  - This is an alternative and equally popular introductory econometrics textbook; you might want to consult this book for a different discussion of a topic
- [HTF] Hastie, Tibshirani, and Friedman, *The Elements of Statistical Learning*, Springer
  - Unless you really enjoy the pleasure of the physical book, an electronic copy of the book can be downloaded at this link

Grading

The overall grade is determined as follows:

- *Datacamp*: 10% (10 courses, 1% each)
- *Empirical Exercises*: 20% (4 at 5% each)
- *Midterm Exams*: Midterm I 25%, Midterm II 30%
- *Final Project*: 15%

Submitting your work by the deadlines is very important in this course. Datacamp courses and empirical assignments submitted late are given a grade of 0%, unless the late submission was agreed with the instructor. The midterm exams cannot be rescheduled with the exception of serious and justified reasons communicated to the instructor in advance of the exam. In this case the makeup exam will be scheduled before the regularly scheduled date and the format will be an oral assessment.

Programming Languauge

The `R` or `Python` programming language will be used in this course to complete the assignments and no previous knowledge is expected. The slides integrate the relevant commands and the practical implementation of the econometric methods discussed in class. You are required to use `R` or `Python` to complete the empirical exercises. `Stata`, `Minitab` or any other econometric or statistical software are discouraged.

The data science platform Datacamp will be used to learn `R` and `Python` programming. Datacamp provides online short courses that consist of videos and practice exercises on a wide variety of topics. I created a Datacamp group and a link to join the group will be distributed at the beginning of the semester. You will be asked to create an account and, in case you already have one, please use those credentials so that you get credit for the courses that you already completed.

In the Datacamp group you will find two sets of courses with similar names and "*... in R*" or "*... in Python*". Complete the set of courses related to your choice of programming language. The courses are part of your overall grade and the grading scheme will be discussed in class. Each course can take approximately 3-4 hours and can be completed in different sessions. The goal is to complete these 10 courses in the first 5 weeks of the semester to develop the knowledge to complete the empirical assignments. The list of `R` courses is as follows:

1. Introduction to R (week 1)
2. Introduction to Data Visualization with ggplot2 (week 2)
3. Introduction to Importing Data in R (week 2)
4. Reporting with R Markdown (week 3)
5. Intermediate Importing Data in R (week 3)
6. Intermediate R (week 3)
7. Intermediate Data Visualization with ggplot2 (week 4)
8. Data Manipulation with dplyr (week 4)
9. Introduction to Regression in R (week 5)

10. Intermediate to Regression in R (week 5)

For those students that opt for `Python` the courses are:

1. Introduction to Python (week 1)
2. Introduction to Data Visualization with Matplotlib (week 2)
3. Introduction to Importing Data in Python (week 2)
4. Reporting with R Markdown (week 3)
5. Intermediate Importing Data in Python (week 3)
6. Intermediate Python (week 3)
7. Intermediate Data Visualization with Seaborn in Python (week 4)
8. Data Manipulation with pandas (week 4)
9. Introduction to Regression with statsmodels in Python (week 5)
10. Intermediate to Regression with statsmodels in Python (week 5)

Using `R` requires the installation in your machine of the following:

- `R` that can be downloaded at this link
- `Rstudio` is a very popular IDE that I recommend using; it is downlodable at this link

My suggestion is to have Rstudio/R installed in your laptop which makes easier to complete the assignments. However, there are alternatives:

- One is to use a cloud service like Rstudio Cloud; this solution runs Rstudio on a browser and does not require any installation. This is an interesting option if you are interested in running `R` on a tablet or a machine in the computer labs. You can create a *free account* that provides a limited monthly computing allowance (enough to complete the assignments).
- Another option is to use Rstudio via APPS@STERN.

`Python` users are encouraged also to install `Rstudio` which is also an IDE for Python programming. The advantage is that notebooks can integrate both R and Python code which allow to perform some data science task in the tool that is more suitable for that. Alternatively, install `Jupiter` or your favorite IDE.

Final Group Project

The goal of the final group (max 3 students) project is to apply the econometric tools discussed in class to an economic or business problem chosen by the student. The topic of the project could be inspired by an issue discussed in a course or based on real events. After having identified a topic of interest, the second step is to gather data that can be used in the empirical investigation. The deliverable for the project is a *report* that should be max 10 pages long (font 12, spacing 1.5) with the following structure:

- *Introduction*: explanation of the topic of your project, its relevance, the main findings in the literature, and a brief discussion of your results.
- *Survey of the literature*: here you discuss a few articles/papers that have investigated the topic. It is probably a good idea to start with the earlier papers and explain in reasonable detail the technique, data, and results. The discussion of latest papers on the topic should be related to the earlier ones: what are the latest papers adding or doing different compared to the earliest ones? different data and/or econometric technique? are their results different?
- *Model*: provide an explanation of the empirical model that is used in the project. It can be a model suggested by economic theory or an empirical model inspired by the problem at hand.
- *Data*: report the data source, the variables included in the dataset, and the sample size
- *Empirical Application*: in this section you discuss the results of the model estimation and the econometric issues that you addressed in arriving to the final specification. In the final specification you might have dropped some irrelevant variables, played with the functional form, allowed for heteroskedasticity, serial correlation, stochastic trends, endogeneity, etc.
- *Conclusion*: summarize the results of your project and whether they confirm or refute earlier results.

The due date of the final project is at latest by the date of the final exam (exact date will be announced later)

Tentative Schedule

Date	Day	Seq.	Topic	Chapter	HW due
2024-01-23	Tue	1	Introduction to the course		
2024-01-25	Thu	2	Review of probability	2	
2024-01-30	Tue	3	Review of statistics	3	
2024-02-01	Thu	4	Review of statistics	3	Datacamp
2024-02-06	Tue	5	Linear regression with one regressor	4	
2024-02-08	Thu	6	Linear regression with one regressor	4	Datacamp
2024-02-13	Tue	7	Linear regression with one regressor	4	
2024-02-15	Thu	8	Hypothesis testing and confidence interval	5	HW1,Datacamp
2024-02-20	Tue	9	Linear regression with multplie regressors	6	
2024-02-22	Thu	10	Linear regression with multplie regressors	6	Datacamp
2024-02-27	Tue	11	Hypothesis testing and confidence interval	7	
2024-02-29	Thu	12	Nonlinear Regression Model	8	Datacamp
2024-03-05	Tue	13	Nonlinear Regression Model	8	
2024-03-07	Thu	14	Nonlinear Regression Model	8	HW2
2024-03-12	Tue	15	Review Ch 2 to 8		
2024-03-14	Thu	16	**Midterm Exam I (chapter 2 to 8)**	ch 2-8	
			SPRING BREAK		
2024-03-26	Tue	17	Panel Data	10	
2024-03-28	Thu	18	Panel Data	10	
2024-04-02	Tue	19	Panel Data	10	
2024-04-04	Thu	20	Binary dependent variables	11	
2024-04-09	Tue	21	Binary dependent variables	11	HW3
2024-04-11	Thu	22	Instrumental variables regression	12	
2024-04-16	Tue	23	Instrumental variables regression	12	
2024-04-18	Thu	24	Instrumental variables regression	12	
2024-04-23	Tue	25	Forecasting	15	
2024-04-25	Thu	26	Dynamic causal effects	16	HW4
2024-04-30	Tue	27	Dynamic causal effects	16	
2024-05-02	Thu	28	**Midterm Exam II (chapter 10 to 12, 15 and 16)**	ch 10-16	

Disabilities

Contact me if you require academic accommodation for the course and exams. Refer to the Moses Center for Students with Disabilities to provide a recommendation regarding the appropriate accommodation. An Exam Accomodations Form should be submitted at least one week before the date of the exam.

Academic Integrity

Our undergraduate Academics Pillar states that we take pride in our well-rounded education and approach our academics with honesty and integrity. Indeed, integrity is critical to all that we do here at NYU Stern. As members of our community, all students agree to abide by the NYU Stern Student Code of Conduct, which includes a commitment to:

- Exercise integrity in all aspects of one's academic work including, but not limited to, the preparation and completion of exams, papers and all other course requirements by not engaging in any method or means that provides an unfair advantage.
- Clearly acknowledge the work and efforts of others when submitting written work as one's own. Ideas, data, direct quotations (which should be designated with quotation marks), paraphrasing, creative expression, or any other incorporation of the work of others should be fully referenced.

- Refrain from behaving in ways that knowingly support, assist, or in any way attempt to enable another person to engage in any violation of the Code of Conduct. Our support also includes reporting any observed violations of this Code of Conduct or other School and University policies that are deemed to adversely affect the NYU Stern community.

The Stern Code of Conduct and Judiciary Process applies to all students enrolled in Stern courses and can be found here. To help ensure the integrity of our learning community, prose assignments you submit to Brightspace will be submitted to Turnitin. Turnitin will compare your submission to a database of prior submissions to Turnitin, current and archived Web pages, periodicals, journals, and publications. Additionally, your document will become part of the Turnitin database.

General conduct and behavior

Students are also expected to maintain and abide by the highest standards of professional conduct and behavior. Please familiarize yourself with Stern's Policy in Regard to In-Class Behavior & Expectations and the NYU Student Conduct Policy.

Student accessibility

If you will require academic accommodation of any kind during this course, you must notify me at the beginning of the course and provide a letter from the Moses Center for Student Accessibility (212-998-4980, mosescsa@nyu.edu) verifying your registration and outlining the accommodations they recommend. If you will need to take an exam at the Moses Center for Student Accessibility, you must submit a completed Exam Accommodations Form to them at least one week prior to the scheduled exam time to be guaranteed accommodation. For more information, visit the CSA website

Student wellness

Our aim is for students to be as successful academically as they can, and to help them overcome any impediments to that. Bookmark the NYU Stern Well-being Resource Hub (https://www.stern.nyu.edu/wellbeing) for existing services at NYU and Stern covering a wide variety of topics including financial well-being, relationship well-being, mental well-being, and more. Any student who may be struggling and believes this may affect their performance in this course is urged to contact the Moses Center for Student Accessibility (see also the Student Accessibility section of this syllabus) at 212 998 4980 to discuss academic accommodations. If mental health assistance is needed, call the NYU's 24/7 Wellness Exchange hotline 212 443-9999. Furthermore, please approach me if you feel comfortable doing so. This will enable me to provide relevant resources or referrals. There are also drop in hours and appointments. Find out more at this link

Name pronunciation and pronouns

NYU Stern students now have the ability to include their pronouns and name pronunciation in Albert. I encourage you to share your name pronunciation and preferred pronouns this way. Please utilize this link for additional information: Pronouns & Name Pronunciation

Religious observances and other unique situations

NYU Stern is committed to ensuring an equitable educational experience for all students regardless of identity or religious/cultural background. The observance of religious and cultural holidays/traditions and the recognition of unique circumstances - such as serving as a caregiver - are important aspects of this commitment. Please review all class dates at the start of the semester and review all course requirements to identify any foreseeable conflicts with exams, course assignments, projects, or other items required for participation and attendance. Please contact me within the first two weeks of the class semester to discuss any potential conflicts.