Class Policies and Syllabus:
Computational and Numerical Methods in Econometrics

Course	:	Computational and Numerical Methods in Econometrics
Date and Time	:	Monday 15:30 to 18:40 ; Friday (TBA).
Location	:	
Semester	:	2022-I
Professor	:	**Luis Chancí**
Website	:	www.luischanci.com
Office Hours	:	by appoitment
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I. Course Description

This course introduces graduate students to computational approaches for solving econometric models. The first part will review numerical methods and their implementation in software like Julia, R, Python, and Stata. The idea is to explore the software in econometrics from a developer's perspective rather than being the standard consumer of packages. The second part of the course will introduce grad students to additional topics in econometrics. This part briefly reviews techniques in Stochastic Frontier analysis, Spatial Econometrics, Nonparametric Econometrics, Methods of Moments in Structural Econometrics, and Bayesian Econometrics. Thus, students will be able to use numerical methods in econometrics while understanding their applications in fields like industrial organization, macroeconomics, or finance.

II. Pre-requisites

The minimum prerequisites are undergraduate-level statistics and calculus. If you have not had statistics and are not comfortable with high school algebra, then you should not take this course. Completion of 'Teoría Econométrica I' and 'Teoría Econométrica II' are highly recommended, which also means being familiar with any software in econometrics.

III. Readings

You are expected to have read the assigned book chapters and papers before coming to class. Check the references list in the course outline.

IV. Course Outline (subject to change)

1. **Part I: Numerical Methods in Economics**
   (a) Introduction to Numerical Methods and Computation in Economics.
   Basic readings: Judd, Chap 1; Also research about Mata/ado-files (Stata), Julia, Atom, and GitHub.
   (b) Linear and Nonlinear Equations: Gauss-Jacobi, Gauss-Seidel, Newton-Raphson, Bisection method
   Basic readings: Judd, Chap 3.
   (c) Optimization: Newton's method, Penalty Function Method
   Basic readings: Judd, Chap 4.
   (d) Function Approximations: Taylor series, Interpolation methods (e.g., spline)
   Basic readings: Judd, Chap 6.
   (e) Numerical Dynamic Programming (time permiting): value function iteration, projection methods
   Basic readings: Judd, Chap 12.
2. **Part II: Additional Topics in Econometrics**
   (a) Introduction to methods that may rely on distributional assumptions:
      i. Stochastich Frontier Analysis.
      Textbook: Kumbhakar and Lovell (2003)
      ii. Spatial Econometrics.
      Textbooks: LeSage and Pace (2009), Elhorst (2014)
   (b) GMM in Structural Econometrics:
      i. Productivity and Production Functions Estimation in Industrial Organization.
      Basic readings: Low and Meghir (2017), Olley and Pakes (1996)
      ii. Simulated Method of Moments in Macroeconomics.
      Basic readings: TBA
   (c) Introductory Nonparametric Econometrics.
   Textbooks: Li and Racine (2007), Racine (2019)
   (d) Introduction to Bayesian Econometrics.
   Textbook: McElreath (2020), Greenberg (2012)

Notes: Buying textbooks for this course is optional (not mandatory) and any edition is welcome.

V. Grading

Your course grade will be based on:

1. Problem Sets and presentations: 30%.
2. Midterm: 20%.
3. Term paper: 50%.

- **About problem sets:** Doing computation is the only way to learn computation. I strongly encourage you to discuss the problem sets with your classmates. A write-up of your solution, one write-up per student, is due on the date indicated on the problem set. You are expected to provide a short and clear description of the methods employed, use tables and/or graphs to organize and present your results, and contain your computer programs in an appendix. Only sending the computer programs is not acceptable.

- **About the term paper:** You will write an original paper for this course. You have the freedom to follow your interest in choosing the topic. For instance, you may want to consider a project part of your master thesis. It could also be replicating a published paper, but you will need to add significant extensions or novelties. Sending the idea and partial reports with progress will be required during the semester.
- **About the presentations:** You will be actively involved in this course by discussing and presenting published articles that illustrate the application of the econometrics methods we will review. The professor will assign the papers.

References

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Baum, C. F. et al. (2009). *An introduction to Stata programming*, Volume 2. Stata Press College Station.

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Henderson, D. J. and C. F. Parmeter (2015). *Applied nonparametric econometrics*. Cambridge University Press.

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Kumbhakar, S. C. and C. K. Lovell (2003). *Stochastic frontier analysis*. Cambridge university press.

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Miranda, M. J. and P. L. Fackler (2004). *Applied computational economics and finance*. MIT press.

Olley, S. and A. Pakes (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica 64*(6), 1263–1297.

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