

# MFE 402: Econometrics

## Course Syllabus – Fall 2022

Dan Yavorsky

### Course Meeting Times and Location

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Course Day & Time:	Section 1: Wednesdays 4:10pm – 7:00pm Section 2: Wednesdays 8:30am – 11:20am
Course Location:	B-313
Final Exam:	Wed Dec 7 from 11:30am – 2:30pm
Course Site:	<a href="#">BruinLearn Section 1</a> <a href="#">BruinLearn Section 2</a>

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### Instructor & Teaching Assistant

#### Instructor

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Faculty of Record:	Dan Yavorsky
email:	<a href="mailto:dan.yavorsky@anderson.ucla.edu">dan.yavorsky@anderson.ucla.edu</a>
Office Location:	C-201L
Office Hours:	Zoom, by appointment

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#### Teaching Assistant

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Teaching Assistant:	Priyanshee Palriwala
email:	<a href="mailto:priyanshee.palriwala.2022@anderson.ucla.edu">priyanshee.palriwala.2022@anderson.ucla.edu</a>
Office Location:	G-419
Office Hours:	Tuesday 5–6pm

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Please email the professor and cc the TA (or vice-versa); do not email us separately.

## Course Description

This course provides a broad introduction to major classes of statistical methods used by economists, including least squares, maximum likelihood, the method of moments, Bayesian, and non-parametric. Throughout, we provide an in-depth assessment of linear regression models. Emphasis is placed on conditional expectation, finite vs large sample (asymptotic) properties of estimators, inference in the presence of heteroskedasticity, and computation in R. Prerequisite topics for the course include probability, introductory statistics, basic linear algebra, and R programming.

## Course Objectives

At the end of the course, students will be able to:

1. Clearly differentiate between a model, an estimator, and an estimate.
2. Understand several classes of statistical methods for estimating common econometric models.
3. Know how and when to appropriately assume, fit, interpret, and test a linear regression model.
4. Compute “by hand” all common regression output provided by statistical software packages.
5. Advance into additional econometric topics (times series, panel data, causality, simultaneous equations, limited dependent variable, hierarchical, etc.).

## Evaluation and Grading

### Required Assignments and Weighted Percentages

This course will be graded using the following weighted percentages for each of the four assignments. Feedback and score are typically posted within one week of assignment due dates.

Problem Set 1 (due 10/18)	16%
Problem Set 2 (due 11/01)	16%
Problem Set 3 (due 11/15)	16%
Problem Set 4 (due 11/29)	16%
Final Exam (12/07)	36%

## Grades

Your overall course grade will be determined by how your performance on graded assignments and exams ranks in comparison with other students in the class according to the grade distribution model set forth by the MFE Program Office.

## Course Materials

### Strongly Recommended

The core set of course materials will be lecture slides.

However, students are strongly encouraged to supplement the lecture slides with a graduate-level econometrics text. I recommend the following pair of companion textbooks by Bruce E. Hansen:

- **BHP:** Hansen, Bruce *Probability & Statistics for Economists* ([website](#))
- **BHE:** Hansen, Bruce *Econometrics* ([website](#))

BHP covers prerequisite material on probability and statistics, as well as a key chapter on maximum likelihood.

BHE is an excellent and modern treatment of graduate level econometrics. This course will cover only 25% of the material in BHE. Appendix A to BHE provides a thorough review of the linear algebra needed for this course.

### Additional Texts

Other highly recommended texts include:

- **DM2:** Davidson, Russell & James MacKinnon *Econometric Theory and Methods*
- **GLD:** Goldberger, Arthur *A Course in Econometrics*
- **KEN:** Kennedy, Peter *A Guide to Econometrics*

Well-known encyclopedic and/or classic econometric texts include:

- **GRN:** Greene, William *Econometric Analysis*
- **JW2:** Wooldridge, Jeffrey *Econometric Analysis of Cross Section & Panel Data*
- **CAT:** Cameron, Colin & Pravin Trivedi *Microeconometrics: Methods and Applications*
- **DM1:** Davidson, Russell & James MacKinnon *Estimation and Inference in Econometrics*

Two excellent texts that start at an undergrad level but progress to a graduate level are:

- **FOX:** Fox, John *Applied Regression Analysis & Generalized Linear Models*
- **JW1:** Wooldridge, Jeffrey *Introductory Econometrics: A Modern Approach*

## **Course Policies**

### **Class Attendance**

I do not take attendance. However, lectures are the primary delivery method of content in this course, and the material covered in class is meant to provide intuition, connection, and harmonization of topics covered in textbooks. Failure to attend class regularly is almost certain to impact your performance and mastery of the discipline of econometrics.

### **Class Participation**

Please do participate: don't deprive your peers of your insight and perspective.

I do not award explicit points toward your final grade due to class participation. However, some letter grades may be adjusted based on class contributions. For example, regular positive contributions to class may lead to "rounding up" of your score for students very near a threshold between letter grades.

### **Collaboration**

All assignments, but not the final exam, may be worked on in collaboration with other students currently enrolled in any section of this course. Collaboration is optional, and when undertaken, groups should be small. However, each student is individually responsible for creating and submitting their own answers and code (e.g., it is a violation of UCLA's Student Code of Conduct and this course's policies to have one group member type the assignment, and other group members simply copy the file and change their names. Such violations will be reported to the MFE program office.)

### **Late Submissions**

Late deliverables will only be accepted for full credit in grave circumstances with documentation, such as serious illness or death in the family, with some form of notification required prior to the deliverable due date (e.g., a text or email).

However, at the discretion of the professor and TA, an assignment may be accepted late for partial credit. It should be exceedingly rare that any students requests this, and there is no guarantee that such a request will be granted.

### **Re-grade Requests**

Any request for re-grading must be made in writing within two weeks of a deliverable being assessed and before final course grades are submitted to the Registrar. The professor and/or TA will entirely regrade any such deliverable, meaning that the resulting grade change may be positive or negative, depending on the specifics of the situation.

## Course Outline

### Week 0: R Programming

Read one of:

- Lander, Jared (2017) *R for Everyone (2nd Ed)*
- Matloff, Norman (2011) *The Art of R Programming*
- Wickham, Hadley & Garrett Grolmund (2017) *R for Data Science* [\[link\]](#)
- Wickham, Hadley (2019) *Advanced R (2nd Ed)* [\[link\]](#)
- Chambers, John (2008) *Software for Data Analysis: Programming with R*
- Leemis, Lawrence (2022) *Learning Base R (2nd Ed)*

...or any free “overview” book online at the [Big Book of R](#).

### Week 1: Intro & Review

- Introduction to Course and Instructional Team
- What is econometrics (BHE Ch 1 Sec 1-5)
- Review of Probability and Statistics (BHP Ch1 - Ch6)
- Review of Linear Algebra (BHE Appendix A)

### Week 2: CEF and OLS Estimation

- The Conditional Expectation Function (BHE 2.1-2.9)
- Linear CEF as a Predictor or Approximation (BHE 2.11, 2.14-2.21)
- Solving for the Least Squares Estimator (BHE 3.1-3.7, 3.10)
- Calculating the OLS Estimator (BHE 4.1-4.5, 4.7)

### Week 3: Error Variance and OLS Estimator Variance

- Residuals (BHE 3.8, 4.10)
- Projections (BHE, 3.11-3.12, 3.15)
- R-Squared (BHE 3.14, 4.18)
- Error Variance (BHE 2.10, 2.12-2.13, 3.13, 4.11)
- OLS Estimator Variance (BHE 4.6, 4.8, 4.13-4.15)
- Computation (BHE 3.25, 4.17)

#### **Week 4: Inference for Linear Regression**

- Asymptotic Theory (BHP 7.1-7.11 and 8.1-8.13, BHE 6.1-6.8)
- Asymptotics Properties of Least Squares Estimator (BHE 7.1-7.8)
- Inference under Asymptotic Approximation (BHE 7.11-7.13)
- Confidence Intervals and Hypothesis Tests (BHE 9.1-9.8)
- Inference under Normality of Errors (BHE 5.1-5.12)

#### **Week 5: Additional Regression Topics**

- Linear Hypothesis Tests (BHE 5.13, 7.16, 9.10-9.11, 9.15)
- Multicollinearity (BHE 3.24, 4.20)
- Omitted Variable Bias (BHE 2.24)
- Measurement Error (12.3)
- Endogenous Regressors (BHE 12.1-12.4)
- Generalized Least Squares (BHE 4.9)
- Tests for Heteroskedasticity (KEN 8.3)
- Forecast Intervals (not covered in 2022)
- Leverage and Influential Observations (not covered in 2022)

#### **Week 6: Maximum Likelihood**

- Introduction to the Method of Maximum Likelihood (BHP 10.1-10.3)
- Optimization basics (BHP 12.1-12.9)
- Examples of one-parameter models (BHP 10.6)
- The MLE of the Normal Linear Regression Model (BHE 5.5)

#### **Week 7: Maximum Likelihood**

- Properties of Maximum Likelihood Estimators (BHP 10.5, 10.7-10.15)
- Logit Regression for Binary Dependent Variable Model (BHE 25.1-25.5, 25.7-25.10)

#### **Week 8: Bayesian Statistics**

- Introduction to Bayesian Statistics
- Conjugate Priors
- One-Parameter Models

#### **Week 9: Bayesian Statistics**

- Posterior Approximation through Markov-Chain Monte-Carlo Simulation
- Gibbs Sampling of the Normal Linear Regression Model

**Week 10: Non-Parametrics**

- Introduction to Non-Parametric Regression
- Kernel Density Estimation and Splines

**Week 11: Final Exam**

## **Anderson Policies**

### **Netiquette**

The written language has many advantages: more opportunity for reasoned thought, more ability to go in-depth, and more time to think through an issue before posting a comment. However, written communication also has certain disadvantages, such a lack of the face-to-face signaling that occurs through body language, intonation, pausing, facial expressions, and gestures. As a result, please be aware of the possibility of miscommunication and compose your comments in a positive, supportive, and constructive manner.

## **UCLA Policies**

### **Code of Conduct**

All participants in the course are bound by the [UCLA Student Conduct Code](#)

### **Academic Integrity**

UCLA is an institution of learning, research, and scholarship predicated on the existence of an environment of honesty and integrity. As members of the academic community, instructors, students, and administrative officials are all responsible for maintaining this environment. It is essential that all members of the academic community practice academic honesty and integrity and accept individual responsibility for their work. Academic misconduct is unacceptable and will not be tolerated in this course. Cheating, forgery, dishonest conduct, plagiarism, and collusion in academic misconduct erode the University's educational, research, and social roles.

Students who knowingly or intentionally conduct or help another student engage in acts that violate UCLA's expectations of academic integrity will be subject to disciplinary action and referred to the Dean of Students' Office.

Please familiarize yourself with UCLA's [Academic Integrity Policy](#). Speak to your instructor if you have any questions about what is and is not allowed in this course.

### **Integrity in Research**

Integrity in research includes not just the avoidance of wrongdoing, but also the rigor, carefulness, and accountability that are hallmarks of good scholarship. All persons engaged in research at the University are responsible for adhering to the highest standards of intellectual honesty and integrity in research.

Please familiarize yourself with the University of California [Policy on Integrity in Research](#)



## **Accessible Education & Inclusive Education**

### **Disability Services**

UCLA is committed to providing a barrier-free environment for persons with documented disabilities. If you are already registered with the Center for Accessible Education (CAE), please request your Letter of Accommodation in the Student Portal. If you are seeking registration with the CAE, please submit your request for accommodation via the CAE website. Students with disabilities requiring academic accommodations should submit their request for accommodations as soon as possible, as it may take up to two weeks to review the request. For more information, please visit the [CAE website](#), visit the CAE at A255 Murphy Hall, contact CAE by phone at (310) 825-1501, or by telecommunication device for the deaf at (310) 206-6083.

### **Equity, Diversity, and Inclusion**

Please familiarize yourself with UCLA Anderson's [commitment to maintaining an equitable, diverse, and inclusive community](#)