

Economics 770
Introduction to Econometric Theory

Prof. Jonathan B. Hill

Lecture Time, Zoom

Tues, Thurs. 11am-12:15pm
Venue: GA 309

Office Hours, Email

Mon, Wed. 3pm-4pm/**appointment**
jbhill@email.unc.edu

Office hours are by **Zoom** (<https://unc.zoom.us/j/97847987242>): email me to set a time during **Mon, Wed. 3pm-4pm**, or we can figure out another time. I will not be on Zoom if no one emails me first. *We can also meet in person if that's more appropriate, but zoom is generally preferred.*

T.A. (email, hours)

Tianqi Li (tianqili@live.unc.edu), GA 412
Office hours Fri. (after recitation): 12:15pm-2:15pm.

Covid Announcement (Updated Aug. 5, 2020)

I am fully vaccinated, and I hope all students are too (all those for whom a vaccine would not pose a health threat = nearly all people). If you have **ANY symptoms** of any sort (runny nose, congestion, fever, etc.): **DO NOT COME TO LECTURE**. Please socially distance in the classroom as much as the classroom permits.

Mask Policy (UNC mandated)

This semester, while we are in the midst of a global pandemic, all enrolled students are required to wear a mask covering your mouth and nose at all times in our classroom. This requirement is to protect our educational community — your classmates and me — as we learn together. If you choose not to wear a mask, or wear it improperly, I will ask you to leave immediately, and I will submit a report to the [Office of Student Conduct](#). At that point you will be disenrolled from this course for the protection of our educational community. Students who have an authorized accommodation from Accessibility Resources and Service have an exception. For additional information, see [Carolina Together](#).

Objectives

This course provides the statistical and probability theoretic foundations of econometrics, and will have practical value to Economics, Finance and Statistics Ph.D. students, in particular Economics students within any of the trilogy subfields: micro, macro or econometrics. The long run goal is to build a foundation for manipulating stochastic objects, including point estimation and inference, incorporating probability, mathematical statistics and large sample theory for point estimators, and minimum discrepancy estimators including least squares, maximum likelihood, empirical likelihood and generalized method of moments (many of the latter topics are treated in subsequent Ph.D. Econometrics courses here). The short-run goals include the following topics: probability theory, mathematical expectation, conditional expectation, modes of convergence, limit theorems, inequalities, and the asymptotics of maximum likelihood.

Evaluation

There will be one midterm exam (30%) that will take place in the afternoon or evening (2 hours) on a date TBD, a final exam (40%) in class (3 hours) on a date/time set by UNC, and an assortment of assignments based on theory and some computer applications that involve programming simulations (30%). While students may consult with each other, *each student must turn in his or her own work.*

Statistics Software

Students are expected to incorporate any major statistics software as they see fit, including possibly Matlab, Python, Fortran, Stata, R, Ox, and so on. Matlab, Stata and Fortran are highly popular in Economics and Finance, while R is popular in statistics. Students can obtain Matlab inexpensively from UNC; R is shareware and therefore free online; Fortran is fairly expensive, but fast, with a massive support community. Students will be required to program simulations, so a point-and-click software will not satisfy our needs (e.g. Eviews, SPSS), and SAS does not have the sophistication to handle the type of code you need to write. See UNC's ITS software links¹ for students for free/cheap software (e.g. Matlab, Python, STATA).

Reading and Textbooks

Required Reading

Hansen, B. E. (2020). *Probability and Statistics* (freely available, and stored in the course Sakai resources).
Casella, G. and R. L. Berger (2002), *Statistical Inference*, 2nd edition (pdf in Sakai resources)

I will focus lectures on **Hansen's** textbook material but will use **Casella and Berger's** from time to time due to its greater volume of examples. In terms of your studies, Hansen's text is inadequate since it lacks examples for some subtopics. Casella and Berger's fills in these gaps, as do the course lectures and other textbooks. Another good introductory book on statistics for economics students is Amemiya's *Introduction to Statistics and Econometrics* listed below.

Suggested Readings

Any graduate level textbook or monograph on the theory of probability, expectation, point estimation, and large sample theory will be helpful. Some that I have found helpful include the following, separated into texts written for econometricians and for statisticians.

Econometrics:

Amemiya, T. (1985). *Advanced Econometrics*, Harvard Univ. Press
Amemiya, T. (1994). *Introduction to Statistics and Econometrics*, Harvard Univ. Press
White, H. (1996). *Estimation, Inference, and Specification Analysis*, Cambridge Univ. Press
White, H. (2001). *Asymptotic Theory for Econometricians*, Academic Press

Statistics:

Ash, R.B. and C.A.Doleans-Dade (2000). *Probability and Measure Theory*, Academic Press
Dudley, R.M. (2002). *Real Analysis and Probability*, Cambridge Univ. Press
Fristedt, B. and G. Gray (1997). *A Modern Approach to Probability Theory*, Birkhäuser
Kallenberg, O. (1997). *Foundations of Modern Probability*, Springer (*e-book at UNC Libraries*)
Shao, J. (2003). *Mathematical Statistics*, Springer (*e-book at UNC Libraries*)

Topics (these may change during the semester)

	Hansen Ch.	C/B Ch.
1. Probability Theory	1	1.1-1.3
2. Real Random Variables and Expectations	2	1.4-1.6, 2.1-2.3, 3.6
3. Distributions	3, 5	3.1-3.4
4. Multivariate Distributions and Conditional Expectations	4, 5	4
5. Sampling, Point Estimation, Estimator Properties	6	5.1-5.3, 7.3.1, 7.3.2
6. Asymptotics: Law of Large Numbers, Central Limit Th.	7, 8	5.5
7. Confidence Intervals and Hypothesis Testing	12, 13	8.1, 8.2.1, 8.3.1,2,4, 9.1, 9.2.1, 9.3
8. Maximum Likelihood	10, 11	6.1-6.4

¹Go to <https://software.sites.unc.edu/>.

