University of Pittsburgh
Department of Economics

Econ 3020: Econometric Theory I
Fall 2022

Instructor: Mahrad Sharifvaghefi   **E-mail:** sharifvaghefi@pitt.edu
Course Website: https://canvas.pitt.edu   **Office:** 4927 WWPH
Lecture Time: MoWe 10:30AM to 11:45AM   **Location:** 4940 WWPH
Teaching Assistant (TA): Bruno Kömel   **TA E-mail:** brunokomel@pitt.edu

CLASS MEETING

- Beginning on **Monday, Aug. 29**, this class will meet **in person** in 4940 WWPH.

- **Recitations:** Thursdays 12:00pm-1:15pm, room 4940.

- **Office Hours:** Mondays 1:00pm-2:00pm or by appointment.

- **TA Office Hours:** TBD

- **Class Communications**: All announcements will be posted in Canvas. It is the students' responsibility to monitor Canvas regularly.

COURSE OBJECTIVE

This course provides a rigorous, nevertheless user-friendly, introduction to key concepts and basic techniques in statistics and econometrics. The topics to be covered include an overview of probability theory, random variables and distribution functions, an introduction to asymptotic theory, linear regression models, maximum likelihood estimation, generalized method of moments, and panel data models.

COURSE TEXTBOOK

I shall be using the following texts:

- **Casella, G., and Berger R. L.** (2002), *Statistical Inference, 2nd Edition.* Duxbury, California, **required**

- **Pesaran, M.H.** (2015), *Time Series and Panel Data Econometrics*. Oxford University Press, Oxford, **required**

In addition, I shall post handouts on the course website as required. The following texts are also recommended:

- **Hansen, B.** (2020), *Econometrics*, available at https://www.ssc.wisc.edu/~bhansen/econometrics/, **recommended**

- **Newey, K. W., & McFadden, D.** (1994). *Large sample estimation and hypothesis.* Handbook of Econometrics, IV, Edited by RF Engle and DL McFadden, 2112-2245, **recommended**

- **Davidson, J.** (1994), *Stochastic Limit Theory: An Introduction for Econometricians.* Oxford University Press, Oxford, **recommended**

- **Greene, W. H.** (2018), *Econometric Analysis, 8th Edition.* Pearson, Now York, **recommended**

GRADING

The final grade will be based on five problem sets (30%), a midterm exam (30%) and a final exam (40%).

Problem set	One	Two	Three	Four	Five
Posted	Sep. 12	Sep. 26	Oct. 10	Nov. 7	Nov. 16
Due	Sep. 26	Oct. 10	Oct. 17	Nov. 16	Dec. 6

Midterm Exam: A two-hour written exam, given in class on Monday, October 24.
Final Exam: Exact date to be confirmed (between Dec. 12 - Dec. 16).

ACADEMIC POLICIES

Students must be aware of the University and Dietrich School policies and procedures, which can be found at http://www.asundergrad.pitt.edu/policies-and-procedures.

Academic integrity: Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

To learn more about Academic Integrity, visit the Academic Integrity Guide for an overview of the topic. For hands-on practice, complete the Understanding and Avoiding Plagiarism tutorial.

Disability services: If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890, `drsrecep@pitt.edu`, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Statement on Classroom Recording: To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Health and Safety Statement: During this pandemic, it is extremely important that you abide by the public health regulations, the University of Pittsburgh's health standards and guidelines, and Pitt's Health Rules. These rules have been developed to protect the health and safety of all of us. Universal face covering is required in all classrooms and in every building on campus, without exceptions, regardless of vaccination status. This means you must wear a face covering that properly covers your nose and mouth when you are in the classroom. If you do not comply, you will be asked to leave class. It is your responsibility have the required face covering when entering a university building or classroom. For the most up-to-date information and guidance, please visit `coronavirus.pitt.edu` and check your Pitt email for updates before each class.

If you are required to isolate or quarantine, become sick, or are unable to come to class, contact me as soon as possible to discuss arrangements.

COURSE OUTLINE

1. Probability, Random Variables, and Distribution Functions:
   Probability theory, Transformations and expectations, Common families of distributions, Multiple random variables
   Casella and Berger (2002), Chapters 1-4

2. Asymptotic Theory:
   Concepts of convergence of random variables, Relationships among modes of convergence, Convergence in distribution, Stochastic order $O_p(.)$ and $o_p(.)$, The low of large numbers, Central limit theorems, Transformation of asymptotically normal statistics.
   Pesaran (2015), Chapter 8

3. Linear Regression Models:

   The method of ordinary least squares (OLS), Properties of OLS residuals, Covariate matrix of regression coefficients, The Gauss-Markov Theorem, Mean Square error of an estimator and the bias-variance trade-off, Distribution of the OLS estimator, Partitioned regression, Implications of misspecification for the OLS estimators, Hypothesis testing in linear regression models, Regression models with heteroskedastic disturbances.

   Pesaran (2015), Chapters 2-4

4. Maximum Likelihood Estimation:

   The likelihood function, Regularity conditions and some preliminary results, Asymptotic properties of Maximum Likelihood estimators, Likelihood-based tests.

   Pesaran (2015), Chapter 9

5. Generalized Method of Moments:

   Exact moment conditions, Excess of moment conditions, Optimal weighting matrix, Two step and iterated GMM estimators, Misspecification test, The generalized instrumental variable estimator.

   Pesaran (2015), Chapter 10

6. Panel Data Models with Strictly Exogenous Regressors (**if time permits**):

   Linear panels with strictly exogenous regressors, Pooled OLS estimator, Fixed-effects specification, Random effects specification, The between-group estimator, Testing for fixed-effects, Nonlinear unobserved effects panel data models.

   Pesaran (2015), Chapter 26