**Empirical Analysis I – Fall 2018**

**Instructor**: Azeem M. Shaikh
**Office Hours**: Mon., 4:00p – 5:00p (or by appt.), SHFE 345
**email:** amshaikh@uchicago.edu

**Teaching Assistant 1**: Myungkou Shin
**Office Hours**: Tues., 9:00a – 10:00a (or by appt.), Grad. Student Lounge
**email**: myungkoushin@uchicago.edu

**Teaching Assistant 2**: Sota Ichiba
**Office Hours**: Thurs., 4:00p – 5:00p (or by appt.), Grad. Student Lounge
**email**: ichibasota@uchicago.edu

**Class**: Mon. & Wed., 11:00a – 12:20p, SHFE 021
**Section**: Tues., 4:30p – 5:20p, SHFE 021

**Webpage**: http://canvas.uchicago.edu

**Course Description**: This course provides a rigorous introduction to some basic methods in econometrics, including the ordinary least squares (OLS) estimator, (linear) instrumental variable (IV) methods, and maximum likelihood (ML) methods. We begin in the first part of the course by developing the requisite large-sample (asymptotic) theory. Along the way, we will illustrate the use of the asymptotic theory for estimation and inference. In the second part of the course, we will introduce the linear regression model and study the OLS estimator and IV methods for this model. A distinguishing feature of this part of course is an emphasis on different interpretations of the linear regression model, i.e., descriptive versus structural (causal) uses of linear regression. In the final part of the course, we will study ML estimators. We will apply the theory to some limited dependent variable models.

**Prerequisites**: Students are expected to be familiar with basic probability theory (the concept of a random variable, expectations, etc.) and statistics. An exposure to linear algebra will also be helpful as well as the mathematical maturity that comes from, say, a course in real analysis.

**Required Textbook**: There is no required textbook. You are encouraged to attend all of the lectures. Some important material may also be covered during the Monday discussions. The following textbooks may also provide useful supplemental reading:

1. *Statistical Inference* (2002) by George Casella and Roger Berger
2. *Econometrics* (2015) by Bruce Hansen (available online!)
3. *Econometric Analysis of Cross Section and Panel Data* (2002) by Jeffrey Wooldridge
4. *A Course in Econometrics* (1991) by Arthur S. Goldberger
5. *Asymptotic Statistics* (2000) by Aad van der Vaart
6. *Testing Statistical Hypotheses* (2005) by Erich L. Lehmann and Joseph P. Romano

**Grading**: There will be regular problem sets, two in-class midterm exams, and a final exam. The final grade will be calculated as follows:

Problem Sets = 15%

Midterm 1 = 25%

Midterm 2 = 25%

Final Exam = 35%

You are encouraged to work in groups of at most four to solve the problem sets. You may turn in one problem set for each group. Late problem sets will not be accepted.

**Major Topics**: Possibly with some additions and deletions, the course will cover the following material:

1. Large-Sample Theory ($\approx$ 5 lectures)
   (a) Convergence of Random Variables
   (b) Laws of Large Numbers and Central Limit Theorems
   (c) Continuous Mapping Theorems and Slutsky's Lemma
   (d) The Delta Method
2. Conditional Expectations ($\approx$ 1 lecture)

**Midterm Exam #1**

3. Interpretations of the Linear Regression Model ($\approx$ 1 lecture)
4. Ordinary Least Squares (OLS) ($\approx$ 4 lectures)
   (a) The OLS Estimator
   (b) A Projection Interpretation of OLS
   (c) Properties of the OLS Estimator
   (d) Hypothesis Testing and Confidence Regions
   (e) Estimation of the (Asymptotic) Variance
5. Instrumental Variables (IV) ($\approx$ 3 lectures)
   (a) The IV Estimator
   (b) Two-Stage Least Squares (TSLS) Estimator
   (c) Properties of the TSLS Estimator
   (d) Estimation of the (Asymptotic) Variance
   (e) Heterogenous Treatment Effects

   **Midterm Exam #2**
6. Maximum Likelihood (ML) Estimators ($\approx$ 3 lectures)
   (a) Unconditional vs. Conditional ML
   (b) Properties of ML Estimators
   (c) Hypothesis Testing and Confidence Regions

   **Final Exam**