1 Basic Information

Professor: Carl Sanders, carlsanders@wustl.edu
Office Hours: Wednesdays 3-5, email for other appointments.

“Assistant to Instructor”: Yuan Huang, huang.yuan@wustl.edu
Office Hours: TBD

T-Th 1:00-2:30, Seigle 103
Books (no need to buy the second two at this point):

- Bruce Hansen, Econometrics online notes. http://www.ssc.wisc.edu/~bhansen/econometrics/
- Jeffery Wooldridge, Econometric Analysis of Cross Section and Panel Data
- Arthur Goldberger, A Course in Econometrics

Exams: 2 Exams and 1 Final, Dates TBD
Homeworks: Bi-weekly homeworks, posted on Blackboard and assigned as we go. Work in small groups but submit your own work.


2 Course Outline

This class is meant to help you pick up the basic tools of modern econometrics at the graduate level. We will focus almost exclusively on the most widely used tool in empirical data analysis: estimation, inference, and interpretation of parameters of conditional distributions. This focus on “parameters” distinguishes this course from other similar statistical topics, e.g. machine learning.

With this goal in mind, we will be covering a variety of topics to help you do this correctly.

Distributions and Sampling

1. Data generating processes and sampling (Hansen Chapter 1, Wooldrige 1, Goldberger 1)
   - Parametric forms and identification
   - The conditional expectation function

2. Sampling distributions and asymptotic distributions (H 6, W 3, G 9)

3. The regression and projection models (H 2,3, + 4; W 2; G 3 + 5)

How can we estimate conditional moments?

1. Least Squares: identification, estimation, and inference (H 7, W 4, G 14 (for fixed $X$, which is not done anymore) + 25 (for random $X$, the standard))

2. Topics in regression analysis
   - Restricted estimation (H 8)
   - Regression extensions (NLLS, GLS, etc.) (H 12, W 12 (sort of), G 29)
   - Series and spline estimation (H 15)
   - Panel data (H 20, W 10)

How can we interpret our estimated parameters?

1. Endogeneity (H 10, W 5, G 32 + 33)
   - Omitted variables
   - Classical measurement error
   - Simultaneous Equations bias
   - Structural and reduced form equations
   - Indirect Least Squares
   - Instrumental Variables

2. Causal inference (W 18, Instructor's Notes)
   - Counterfactuals
   - Treatment Effects
3 Python Programming

Programming will be an important part of this class. Using pre-packaged statistical programs is useful for actual empirical work, but using those packages without having ever created those routines oneself is dangerous since you may not understand what the package is actually doing.

We will be using the language “Python” version 3.6 along with the most recent releases of the packages NumPy, SciPy, Matplotlib, and Numba.

Installation instructions:

- There are two parts to installation:

  1. Installing the language itself: the “Miniconda” distribution will contain Python and ways to install the packages above:
     (a) Download and follow the installation instructions at https://conda.io/miniconda.html (make sure you get the 3.6 version, 64 bit)
     (b) Create a virtual environment named “econometrics”
     (c) Switch to that virtual environment (“activate econometrics” or (if on Linux) “source activate econometrics”) and run
        i. “conda install numpy”
        ii. “conda install scipy”
        iii. “conda install matplotlib”
        iv. “conda install numba”

  2. Installing an Interactive Development Environment (IDE), which will make writing, running, testing, and debugging much easier. The IDE “Thonny” is simple enough to get started:
     (a) Follow the download and installation instructions at http://thonny.org/
     (b) After opening Thonny, go to Tools->Options->Interpreter tab and click “Locate another executable”; navigate to the Miniconda directory and go into “envs/econometrics” and select the Python executable there.
        i. On Windows (for me) this was “C:\Users\[username]\miniconda3\envs\econometrics\python.exe”
        ii. On Linux this was “/home/\[username]/miniconda3/envs/econometrics/bin/python”
        iii. OSX: it’s probably “/Users/\[username/miniconda3/envs/econometrics/bin/python”... haven’t been able to test this yet, I’ll send an update if not.
     (c) Copy and paste the following code into the main Thonny window
        import numpy as np
        print(np.random.random(1))
        and click the “Run” button. In the “Shell” window below you should see a number between 0 and 1, and if so installation is likely fine.