ECO 304: Analytics for Economics
Spring 2024
DePaul University - Department of Economics

Time: Tuesday/Thursday 11:50-1:20pm   Brian J. Phelan, Ph.D.
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Office Hours: Tuesday 3:00-4:30 (or by appointment)   DePaul Center, Room 6209

Textbook:

Michael A. Bailey, *Real Econometrics: The Right Tools to Answer Important Questions,* 1st or 2nd Edition, Oxford University Press. Along with the book, I will post detailed notes and occasionally assign articles to read. The notes and readings will be available on D2L.

This course will also use the statistical package, Stata. Stata is available on all computers in all computer labs under "statistics/economics" and can be accessed online using the virtual lab. However, students should strongly consider purchasing a 6 month license of Stata BE, which costs $48. The issue is that some of the data files we will analyze are quite large and analyzing data via the virtual lab will be slow when the files are large. You can purchase a six month license of Stata here: https://www.stata.com/order/new/edu/profplus/student-pricing/.

Course Description:

What separates economics from most other social sciences is that our discipline begins with a few basic assumptions and utilizes these as building blocks for models of behavior. Models are only useful if they can be tested and economists have developed a large toolkit of statistical models that are used to test these theories and estimate economic parameters. The workhorse statistical model in the social sciences (and all data science) is the ordinary least squares (OLS) regression. The bulk of the course will be based around teaching you how to use OLS regressions to answer important questions related to economics, economic policy, and business. Indeed, regression analysis is increasingly used by businesses to evaluate business decisions and forecast demand. Thus, we will develop a broad understanding of regression and the different ways it is being used. The course will not, however, just be an abstract exercise. For each topic, we'll also incorporate readings that demonstrate the usefulness of the technique and integrate real data to allow you to perform your own empirical analysis.

To perform these empirical analyses, we will use Stata, a statistical software package frequently used by economists. It is expected that most (if not all of you) are not familiar with Stata. We'll hold several classes to teach you how to use the software and I will provide sample code to get you started on each of the exercises.

Learning Outcomes:
- Understand and apply the linear regression model to applications in economics and business
- Clean real-world data and further develop data presentation skills
- Perform, interpret, present, and write about one's own empirical analyses
- Develop statistical programming skills using Stata

Prerequisites:
> ECO 105, ECO 106, BUS 102, and MAT 137 (or equivalent).

> I have put together a detailed review of the basic statistics that you need for this course. It is available on D2L. This handout goes over most of the important concepts that we will use this quarter including expected values, covariance, correlation coefficients, and hypothesis testing. We will also review these concepts over the course of the quarter.

Assessment of Students:
> Problem Sets (5):   30%
> Midterm: 30%
> Final Project: 30%
> Class Participation: 10%

Assignments:
> **Problem Sets**: Five problem sets will be assigned during the quarter. These problem sets are designed to gauge your understanding of the concepts discussed in class and your ability to apply the material. The problem sets will have four types of questions. The first are "pencil-to-paper" where you are asked to calculate an estimate, derive an equation, or discuss the implications of a set of assumptions. The second are "interpretation" questions where you are asked to interpret a set of results. The third are "read and reply" questions related to a course reading. And lastly, the fourth are "estimate and analyze" questions where you will be given a data set and asked to generate and interpret statistical output using Stata. Stata will not be introduced until later in the quarter. So, those questions will not come into play until the second half of the quarter.

> You are encouraged to work in groups of 2 or 3 on the problem sets. Problem set answers should be posted to D2L by 11:59pm on their due date. I will accept late problem sets, but they will be marked down 10 percent for each day they are late (up to 4 days date). Problem sets not be accepted more than 4 days after the due date so I can post the answers to D2L at that point.

> **Midterm:** The "midterm" for this course will be held in class at the end of week 7. It will count for 30% of your final grade. I expect that it will cover Topics 1-5 in the course outline described below. The midterm will not require students to work with data, but you will likely be required to interpret regression results (among other things). More details and information will be provided in the week prior to the exam.

> **Final Project:** The final assignment for this class will be an empirical project, which will bring together everything you have learned in the class. It is due on 6/13/24 at 8pm. The gist of the assignment is that I will provide you with a few possible questions and data associated with each question. Each student will choose to address one of the possible topics, use the associated data to best answer the question (by running a series of regressions), and then write-up their analysis, findings, and conclusions. As such, the final project must include a statement

of your research question, a description of your data, an explanation of your empirical approach, and a description of your results. Grades on the final project will be based on the quality/clarity of the writing, the justification for the empirical model you estimate, the quality/clarity of the empirical tables and figures of your analysis that you present, and the accuracy with which you interpret your statistical models. More information about the project will be provided later in the quarter.

Important Dates:

Problem Set #1 Due:	04/12/24 (End of week 2)
Problem Set #2 Due:	04/26/24 (End of week 4)
No Class	04/30/24
Problem Set #3 Due:	05/10/24 (End of week 6)
Midterm:	05/16/24 (In class. End of week 7)
Problem Set #4 Due:	05/27/24 (Beginning of week 9)
Problem Set #5 Due:	06/05/24 (Middle of week 10)
Final Paper Due:	06/13/24 (End of exam period)
Approximate Stata Classes:	4/18, 5/7, 5/21, 6/5, 6/7

Syllabus: ECO 304

I. **Introduction: Moving from Correlation to Causation (Week 1)**
> Readings: Bailey, Chapter 1-2
> Applications: Estimating the price elasticity of demand
>> Do police lower crime?

II. **The Bivariate Regression Model: Estimation, Interpretation, and Inference (Week 2-3)**
> Readings: Bailey, Chapter 3-4
>> Detailed notes posted to D2L
> Applications: Does greater healthcare spending improve health outcomes?
>> How does college completion affect earnings?
> Additional Concepts: True model vs. Estimated model
>> Omitted Variable Bias

III. **Multivariate Regression Model: Estimation, Interpretation, and Inference (Week 4-5)**
> Readings: Bailey, Chapter 5
>> Detailed notes posted to D2L
> Applications: How much does another bathroom increase the sale price of your house?
>> Do smaller class sizes lead to better schooling outcomes?
> Additional Concepts: Type I vs. Type II error
>> Unbiasedness

IV. **Dummy Variables (Week 5)**
> Readings: Bailey, Chapter 6
> Applications: How large is the gender wage gap?
> Additional Concepts: Intercept vs. Slope effects

V. **Specifying Models (Week 6 and Week 7)**
      Readings: Bailey, Chapter 7
      Applications: What are the returns to education?
            How much regional variation is there in economic growth?
      Additional Concepts: Linear vs. Quadratic Effects

Midterm at end of Week 7

VI. **Limited Dependent Variable Regressions (Week 8)**
      Readings: Bailey, Chapter 12
      Applications: Is there racial discrimination in access to public services?

VII. **Using Regression as a Predictive Tool and Forecasting (Week 9-10)**
      Readings: Bailey, Chapter 13
      Applications: Forecasting Real Estate Prices
            Inventory management of perishable foods at Supermarkets

Additional Expectations:

Academic Integrity: Work done for this course must adhere to the University Academic Integrity Policy, which you can review in the *Student Handbook* or by visiting Academic Integrity at DePaul University (http://academicintegrity.depaul.edu). That said, as I previously mentioned, I do allow students to work in groups of 2 or 3 for the problem sets, where they should submit a single answer sheet with all team member names.

Timeliness: All assignments are due as posted in this syllabus. While I do accept late problem set submissions (see discussion above under Problem Sets), the time frame is limited and the penalties associated with late submissions are fairly significant. Thus, you shouldn't make it a habit of handing in late problem set. I do not allow automatic extensions on the midterm or final project. If you foresee a problem with a due date associated with one of these assignments, see me in advance and I may (or may not) grant you an extension. Last minute extension requests are unlikely to be accommodated.

Disability: Students with disabilities that require additional time on exams or other efforts on my part, must work through the Center for Students with Disabilities (CSD) to arrange these accommodations. I will happily comply with all accommodations, but they must first be approved by CSD. Please also give me a heads up if you expect to be working with CSD on specific accommodations. Contact: CSD; Loop Campus: Lewis Center 1420, Ph:312.362.8002.

Respect: The classroom is a place for learning. This is best achieved by asking questions, thinking out loud, and even making mistakes. Please treat all of your classmates with respect - we will all struggle at some point or another. If anyone has concerns about the behavior of other people in the class, please come see me right away.