

**ECON 298**  
**ECONOMETRICS**  
**DICKINSON COLLEGE**  
**FALL 2022**

**Professor:** Tony Underwood

**Office:** Althouse 216

**Office Hours:** Monday & Wednesday, 3-4pm; Thursday, 2-3pm; or by appointment.

**Email:** [underwoa@dickinson.edu](mailto:underwoa@dickinson.edu)

\*I check my email very frequently. If you are unable to meet with me during my scheduled office hours, please email me to schedule an alternative time to meet. My door is (almost) always open!

**QR Associate:** Harry Do '24, Quantitative Economics & Mathematics

**QRA Office Hours:** Wednesday, 6:30-8:30pm, location TBA

**QR Center Hours:** Thursday, 7-9pm; Sunday, 9-10:30pm; [click here](#) to make an appointment.

**Class Meets:**

MWF, 12:30 – 1:20 pm, Stern 11

**Prerequisites:**

- ECON 111 (Intro to Microeconomics) and ECON 112 (Intro to Macroeconomics)
- MATH 170 and (MATH 121 or MATH 225 or INBM 220)

**COURSE DESCRIPTION & OBJECTIVES**

This course is an introduction to econometrics in which the tools of economic theory, mathematics, and statistical inference are applied to the analysis of economic data. Students will develop foundational knowledge of applied statistics and econometrics through exploration of empirical techniques relevant to quantitative economics including probability, estimation, hypothesis testing, correlation, modeling, and simple and multiple linear regression analysis. In addition, this course will cover basic extensions of a multiple linear regression model such as dummy variables and interaction terms. Students will use Stata, or other statistical analysis software widely used in economics, to understand and apply empirical work.

- Learn the econometric methodology, including how to construct econometric models, estimate relevant economic parameters, predict economic outcomes, and test economic hypotheses using quantitative data.
- Do regression analysis. They will be able to choose a topic conducive to regression analysis, specify a regression equation, collect data, run descriptive statistics, run regressions, interpret and evaluate the results, and demonstrate the necessary components of a well-written empirical research paper and the economics discipline formatting and style conventions.
- Evaluate regression results, determining whether the regression coefficients have the expected sign and magnitude, whether the regression coefficients are statistically significant, whether the equation includes irrelevant variables or omits theoretically relevant variables, and whether the goodness of fit of the equation appears adequate.
- Demonstrate an understanding of Stata syntax, data management skills, and best coding and documentation practices for reproducibility.

## COURSE STRUCTURE

### Textbooks & Website:

#### *Required*

Bailey, Michael A. (2020). *Real Econometrics*. 2<sup>nd</sup> edition. Oxford University Press. ebook available for rent (starting at \$59.99) or purchase (\$108) via RedShelf [here](#). Hard copies are available at the bookstore.

*Recommended* (selected required chapters will be posted to Moodle)

Stock, James H. and Watson, Mark W. (2019). *Introduction to Econometrics*. 4<sup>th</sup> edition. Pearson. ebook available for rent (\$59.99 for 4 months or \$9.99/month) [here](#).

#### **Moodle** (via Gateway)

Most materials for this course – syllabus, lecture slides, any supplemental reading assignments, homework assignments, datasets, workshop exercises, and solutions – will be available via *Moodle*. You should check *Moodle* regularly as I will post any additional supplemental material there.

### Required Software:

Stata is a complete, integrated statistical software package that provides everything you need for data analysis, data management, and graphics. You will use Stata in workshops, to complete homework assignments, and your group project. Stata 17 is available on campus, in Althouse 204, Stern 11, and Denny 112; therefore, you are not required to purchase Stata. However, if you would like to be able to work with Stata off-campus or in the library, or to facilitate asking questions during office hours, I recommend you purchase and install Stata on your personal computer. To do so, follow these instructions:

#### **OPTION 1** (*less expensive*, but verification of student status required)

1. Go to <http://www.stata.com/order>. Select the United States and click GO.
2. Click Student >> New purchase.
3. Select the software package you wish to purchase. If you only wish to have access to the software for use in this course, you should purchase a 6-month license for Stata/BE 17 for \$48. However, keep in mind that ECON 398, some of the 300-level economics electives, and senior seminars may require or encourage the use of Stata. If you would prefer to have access to the software beyond this course, then you may consider purchasing either an annual license for \$94 or a perpetual license for \$225. You will be required to upload a copy of your student ID to complete your purchase.

#### **OPTION 2** (*more expensive*, but no verification of student status required)

1. Go to <http://www.stata.com/order>. Select the United States and click GO.
2. Click Education >> New purchase >> Single user.
3. Select Dickinson College from the Prof+ Plan drop-down menu. Click GO.
4. Select the software package you wish to purchase. If you only wish to have access to the software for one year, you should purchase an annual license of Stata/BE 17 for \$125. However, keep in mind that ECON 398, some of the 300-level economics electives, and senior seminars may require or encourage the use of Stata. If you would prefer to have access to the software beyond this course, then you may consider purchasing a multiyear license of Stata/BE 17 beginning at \$245 (for a two-year license).

The default will be a download delivery. You will receive an email with download instructions once your order has been submitted. To complete installation, you will need your Activation Key, which will be separately emailed to you once your order is processed. See here, <http://www.stata.com/order/download-details/>, for details.

### **Class Meetings:**

You are responsible for the material covered in class. It is very important that you attend class every day. You will receive the largest benefit from the class meetings if you read the required material prior to class. Attendance is therefore necessary, and participation strongly encouraged!

### **Homework Assignments**

You will be required to complete six (6) homework assignments over the course of the semester. These homework assignments will focus on applications of the tools and concepts we cover in class and develop software skills necessary for you to succeed in this course and on your group project. Most of these assignments will include both an analytical and empirical component. When using Stata to complete the assignment you must also submit a clean log file via Moodle with your submission. You may work on these assignments with fellow classmates; but all final work **MUST** be your own. If any assignment is blatantly copied from someone, I will notice; please avoid this situation! These assignments are a great opportunity to deepen your understanding of the material. Your average grade on these homework assignments will account for 30% of your final course grade.

### **Group Replication Projects**

Later in the semester you will be assigned to groups of three (3) to complete a brief replication and extension report from a provided list of published papers in economics. I will provide you with the data (or a subset of the data) used in the study. As a group you will produce a 2,500 word single-spaced report (3-5 pages, including tables and figures) that (1) produces one motivating data visualization for the research question; (2) replicates the main quantitative finding; and (3) proposes a potential extension of the study. A more detailed prompt and grading rubric will be distributed later in the semester. This group project will account for 15% of your final course grade.

### **Workshop Exercises**

Over the course of the semester, we will complete six (6) in-class Stata workshops to develop the software skills necessary to complete your homework assignments and projects, of which five (5) will be graded. For each workshop, except for Workshop #1, you will be required to submit (1) an easily readable and commented do file including all commands used in the workshop; (2) a clean (no errors) log file that compiles all results from the workshop; and (3) the final dataset in Stata (.dta) format used/created in the workshop. These must be uploaded to Moodle by the assignment due date, unless otherwise noted. These exercises will be graded for completion (submission): 1 point for completed workshops and 0 points for workshops not completed for a total of 5 points and will account for 10% of your final course grade.

### **Exams:**

There will be one midterm exam on **Friday, October 21** and a cumulative final exam at the scheduled time: **Tuesday, December 13, 2pm**.

## COURSE POLICIES

**Grading System:** Your final course grade will be calculated as follows:

**Table 1: Grading System**

Assignment/Task	Percentage
Homework Assignments (6)	30%
Workshop Exercises (5)	10%
Group Replication Project	15%
Midterm Exam	20%
Comprehensive Final Exam	25%
Total	100%

The grading scale will be as follows:

**Table 2: Grading Scale**

Grade	Percentage
A	92.6-100%
A-	89.6-92.5%
B+	86.6-89.5%
B	82.6-86.5%
B-	79.6-82.5%
C+	76.6-79.5%
C	72.6-76.5%
C-	69.6-72.5%
D+	66.6-69.5%
D	62.6-66.5%
D-	59.6-62.5%
F	59.5% or below

### Quantitative Reasoning Center

Dickinson College provides additional support for students taking courses with quantitative content across the curriculum through the [Quantitative Reasoning \(QR\) Center](#). For the fall 2022 semester, the QR Center will offer in-person tutoring for COURSE NAME, in addition to general quantitative support (e.g., learning Microsoft Excel and other software packages, use of a graphing calculator). We strongly recommend making an appointment. The QR Center is also offering remote tutoring to any student who may need it this semester. [Click here](#) to make an appointment on WCONLINE. Then, **access the drop-down menu under "limit to" at the top of the scheduler** and select COURSE NAME, or the area of generalized QR support that you need. This will restrict the tutor list and schedule to only those tutors who can help with your need. When you make your appointment, please also paste or upload your assignment with any work that you have done (if applicable). The QR Center also provides in-person, drop-in tutoring, but you should check the [weekly schedule](#) and [list of tutors](#) to ensure a tutor can help with your specific need.

### Classroom Environment:

In the classroom, during lectures, discussions, and workshops, the goal is to develop and maintain an environment of mutual respect: respect for me, respect for your fellow classmates, and my respect for you. What this means is that I

will do all I can to teach effectively and listen to your questions, comments, jokes, or complaints; and respond as best I can. While at the same time you listen while I am talking, avoid talking amongst yourselves, keep your cell phones away, and keep computer usage to in-class topics. If we all abide by these policies, we can learn a great deal, have enlightening discussions, and hopefully have a little fun along the way!

**Academic Integrity:**

Students have an obligation to integrity in all academic work. In this course, submission of exams or homework assignments to be counted toward your course grade automatically implies a personal pledge that you have neither given nor received unapproved information about the assignment, whether by copying answers, exchanging unauthorized prior information (such as answer keys distributed in previous semesters), sending or receiving answers via test message, etc. Violation of this pledge in even the slightest degree is a violation of the Student Code of Conduct and may result in a failing grade for the assignment in question, an F for the course, suspension, expulsion, or other consequences. In other words, no cheating, it's just not worth it!

**Test Administration:**

There will be NO make-up exams. If you must unexpectedly miss an exam, you must present evidence of a medical or family emergency. If you know in advance that you will be unable to take an exam, contact me as soon as possible to make other arrangements. In general, with an acceptable reason, you may arrange to take an exam early, but never late.

**Accommodating Students with Disabilities:**

Dickinson values diverse types of learners and is committed to ensuring that each student is afforded equitable access to participate in all learning experiences. If you have (or think you may have) a learning difference or a disability – including a mental health, medical, or physical impairment – that would hinder your access to learning or demonstrating knowledge in this class, please contact Access and Disability Services (ADS). They will confidentially explain the accommodation request process and the type of documentation that Dean and Director Marni Jones will need to determine your eligibility for reasonable accommodations. To learn more about available supports, go to [www.dickinson.edu/ADS](http://www.dickinson.edu/ADS), email [access@dickinson.edu](mailto:access@dickinson.edu), call (717)245-1734, or go to the ADS office in Room 005 of Old West, Lower Level (aka "the OWLL"). If you've already been granted accommodations at Dickinson, please follow the guidance at [www.dickinson.edu/AccessPlan](http://www.dickinson.edu/AccessPlan) for disclosing the accommodations for which you are eligible and scheduling a meeting with me as soon as possible so that we can discuss your accommodations and finalize your Access Plan. If you will be using any test-taking accommodations in this class, be sure to enter all test dates into your Access Plan in advance of our meeting.

**Classroom Recording:**

This class, including lectures, classroom discussions and laboratory sessions, may be audio recorded as an accommodation granted by Access and Disability Services (ADS). If this is the case, the course instructor will inform all members of the class. The course instructor may, for pedagogical and/or assessment purposes, require that you be audio or video recorded during specific course activities. If such activities are a part of this course, this syllabus will indicate the purposes for recording, when recording will occur, how recordings will be used and how long they will be retained. In addition, the instructor will clearly announce to all participants when the recording is starting and when it ends. Audio or video recording of any lecture, classroom discussion, or laboratory session in this course other than for the above purposes is strictly prohibited and may be a violation of Pennsylvania's Wiretapping and Electronic Surveillance law (18 Pa. C.S. Section 5701 et seq.).

## COURSE SCHEDULE

### WEEK 1: Introduction

8/29: Introductions and Discussion of Syllabus

8/31: Defining Econometrics & Economic Data

- SW, Chapter 1

9/2: **Workshop #1: Introduction to Stata**

- Bailey, Chapter 2

### WEEK 2: Review of Probability & Statistics

9/5: Probability

- SW, Chapter 2.1 – 2.3

9/7: Probability (cont'd)

- SW, Chapter 2.1 – 2.3

9/9: **Workshop #1: Introduction to Stata (cont'd)**

### WEEK 3: Causal Inference & the Core Model

9/12: Probability Distributions and Sampling

- SW, Chapter 2.4 – 2.6

9/14: Difference of Means &  $t$  statistics

- SW, Chapter 3.4 – 3.6

9/16: **Workshop #2: Scatterplots, Covariance, and Correlation in Stata**

- SW, Chapter 3.7
- **Homework #1 Due**

### WEEK 4: Bivariate OLS

9/19: The Core Model, Linear Regression, and the OLS Estimator

- Bailey, Chapter 1 & Chapter 3.1

9/21: Randomness, Endogeneity, and Precision of the OLS Estimator

- Bailey, Chapter 3.2 – 3.5

9/23: Solvable Problems & Goodness of Fit

- Bailey, Chapter 3.6 – 3.8
- **WS2 Due**

### WEEK 5: Hypothesis Testing and Confidence Intervals

9/26: Hypothesis Testing Basics

- Bailey, Chapter 4.1

9/28: Hypothesis Testing Basics (cont'd)

- Bailey, Chapter 4.1

9/30: **Workshop #3: Linear Regression in Stata**

- **Homework #2 Due**

## **WEEK 6: Hypothesis Testing (cont'd)**

10/3:  $t$  tests and confidence intervals

- Bailey, Chapter 4.2 – 4.6

10/5:  $t$  tests and confidence intervals (cont'd)

- Bailey, Chapter 4.2 – 4.6

10/7: **Workshop #4: Reproducible Research Practices – Alcohol Exercise**

- **WS3 Due**

## **WEEK 7: Multivariate OLS**

10/10: Omitted Variable Bias and Multivariate OLS

- Bailey, Chapter 5.1 & 5.2

10/12: Measures of Fit, Multicollinearity, and Variance Inflation

- Bailey, Chapter 5.3 – 5.5
- **Homework #3 Due**

10/14: **Workshop #4: continued** (Prof. U out of town – attendance optional)

- use this time to finish up and submit WS4
- **WS4 Due**

## **WEEK 8: MIDTERM**

10/17: **FALL PAUSE – NO CLASS**

10/19: Midterm Review

10/21: **MIDTERM EXAM**

## **WEEK 9: Dummy Variables: Smarter than You Think**

10/24: Measures of Fit, Multicollinearity, and Variance Inflation (cont'd)

- Bailey, Chapter 5.3 – 5.5

10/26: Tests of Joint Hypotheses & Multiple Coefficients

- Bailey, Chapter 5.6

10/28: **Workshop #5: Multiple Regression in Stata**

## **WEEK 10: Dummy Variables: Still Smarter than You Think**

10/31: Using Bivariate OLS for Difference of Means

- Bailey, Chapter 6.1

11/2: Dummy Independent Variables in Multivariate OLS

- Bailey, Chapter 6.2 – 6.3

11/4: Interaction Variables & Interactions in Stata

- Bailey, Chapter 6.4
- **Homework #4 Due**
- **WS5 Due**

### **WEEK 11: Nonlinear Regression Functions**

11/7: Quadratic and Polynomial Functions

- Bailey, Chapter 7.1

11/9: Logarithmic Regression Functions

- Bailey, Chapter 7.2

11/11: **Workshop #6: Dummy Variables and Interactions in Stata**

### **WEEK 12: Model Specification**

11/14: Internal and External Validity

- SW, Chapter 9.1 & 9.2

11/16: External and Internal Validity of California Test Score Data

- SW, Chapter 9.4 & 9.5

11/18: Regression Specifications and Results Tables

- **WS6 Due**
- **Homework #5 Due**

### **WEEK 13: THANKSGIVING**

11/21: **NO CLASS** ([SEA Conference](#))

11/23: THANKSGIVING – NO CLASS

11/25: THANKSGIVING – NO CLASS

### **WEEK 14: Limited Dependent Variables**

11/28: The Linear Probability Model

- Bailey, Chapter 12.1

11/30: Probit and Logit Regression

- Bailey, Chapter 12.2 & 12.3

12/2: Estimation and Inference in Logit and Probit Models: Maximum Likelihood Estimation

- Bailey, Chapter 12.4
- **Homework #6 Due**

### **WEEK 15:**

12/5: **Group Projects**

12/7: **Group Projects**

12/9: Looking Forward: a brief survey of additional topics (what to expect in ECON 398)

- **GROUP REPORT & REPLICATION FOLDER DUE (by noon)**

**FINAL EXAM REVIEW SESSION:** Sunday, December 11, TBA

### **FINAL EXAM**

**Tuesday, December 13, 2pm**