

ECON 398 (WiD) ADVANCED ECONOMETRICS

DICKINSON COLLEGE SPRING 2022

Professor: Tony Underwood

Office: Althouse 216

Office Hours: Monday & Thursday, 3-4pm EST; Wednesday, 11am-12pm EST; or by appointment.

- *NOTE:* I prefer you attend office hours in-person; however, if you need to, you can attend [via Zoom using this link](#).

Email: 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: Huy Trinh '22 (Quantitative Economics & International Studies)

QRA Office Hours: TBA

Class Meets: MR, 1:30 – 2:45 pm ET, Stern 11

Prerequisites:

- ECON 298 and ECON 268 or 278

COURSE DESCRIPTION & OBJECTIVES

This course covers some advanced topics in applied econometrics and causal inference. Students will apply multiple regression analysis to both cross-sectional and longitudinal (panel) data to gain familiarity with a variety of advanced econometric techniques including panel data models, differences-in-differences, instrumental variables, experiments and quasi-experiments, and regression discontinuity designs. Students will conduct individual empirical research projects using Stata to enable students to understand and apply the conventions of empirical research in economics. We will cover elements of technical writing, reviewing existing literature, data collection and organization, and file management for complete transparency and reproducibility. Students will be able to:

- Do regression analysis: choosing 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 evaluate goodness of fit.
- Demonstrate an understanding of Stata syntax, data management skills, and best coding and documentation practices for reproducibility.
- Demonstrate the ability to place a research question in the context of existing scholarly discourse through an effective literature review.
- Develop a working knowledge of causal inference methods for the analysis of observational (non-experimental) data, including their underlying assumptions, implementation, and interpretation.

COURSE STRUCTURE

Textbooks & Website:

Required

- Angrist, Joshua D. and Pischke, Jörn-Steffen. (2015). *Mastering 'Metrics: The path from cause to effect*. Princeton University Press. ISBN: 9780691152844. Paperback available [here](#) (\$23).
- Bailey, Michael A. (2020). *Real Econometrics*. 2nd edition. Oxford University Press. ebook available for rent (starting at \$53) via RedShelf [here](#).

Recommended (selected required chapters will be posted to Moodle)

- Cunningham, Scott. (2020). *Causal Inference: The Mixtape*. Yale University Press. free online HTML version of the book is available [here](#).
- Huntington-Klein, Nick. (2022). *The Effect: An Introduction to Research Design and Causality*. CRC Press. free online version of the book is available [here](#).
- Stock, James H. and Watson, Mark W. (2019). *Introduction to Econometrics*. 4th edition. Pearson. ebook available for \$60 [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 empirical 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 strongly 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. 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 five (5) homework assignments over the course of the semester. These homework assignments will follow directly from most workshops (with a few exceptions) and focus on applications of new methods, concepts covered in class, and software skills that will aid in completion of your empirical project. Most of these assignments will include analytical, empirical, and writing components. You must submit a clean do-file and homework (.docx) document via Moodle by the date/time specified on the course schedule. 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 25% of your final course grade.

Workshop Exercises

Over the course of the semester, we will complete seven (7) in-class workshops to develop your Stata skills as well as developing some of the research and writing skills necessary for completion of the empirical research projects. For most workshops you will submit your workshop tasks jointly with a homework assignment. Therefore, any responses needed to queries in the workshop will be included in your homework document and your do-file will include all commands to complete the workshop and homework assignment. Most workshops will be submitted via the homework submission links in Moodle. Unless otherwise specified, you'll be required to submit (1) an easily readable and commented do file including all commands used for the workshop and the homework assignment; (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 (if applicable). These must be uploaded to Moodle by the assignment due date/time, unless otherwise noted. The workshop component will be graded for completion/attendance: 1 point for completed workshops and 0 points for workshops not completed for a total of 7 points and will account for 10% of your final course grade.

Exams:

There will be two (2) midterm exams on **Monday, February 28** and **Monday, April 25**. A final exam will *not* be given, emphasizing the significance of the empirical research project, as well as other assignments.

Empirical Research Project

You will be required to complete an empirical research project using econometric methodology. You will choose your own topic and develop a well-defined, innovative research question. This question, should, in general, have some *implied causality*. That is, based on expectations derived from economic theory and existing empirical research you should explore whether changes in X lead to changes in Y , *ceteris paribus*. Your paper will examine an issue related to the current macroeconomic or microeconomic discourse, broadly defined. Good papers will apply the empirical tools in a rigorous and thoughtful manner. Your chosen econometric methodology need not be groundbreaking, just well done and complete, but you should be identifying and filling a gap in the literature and/or contributing to a scholarly discussion.

We will discuss this project in more detail on the first day of class and detailed prompts will be administered for each component of the project. The empirical research project will account for 45% of your final course grade. The final research paper and replication documentation will be due by **11:59pm ET on Tuesday, May 10** (our scheduled final exam time). The empirical research project consists of the following components, which will be submitted throughout the semester:

Table 1: Project Components

Task	Prompt Administered	Due Date
Final Paper	January 24/April 28	May 10 at 11:59pm ET
Research Question & Annotated Bibliography	January 31	February 14 at 11:59pm ET
Proposal	February 17	March 3 at 11:59pm ET
Data Collection & Metadata Guide*	March 3	March 24 at 11:59pm ET
Literature Review	March 21	April 4 at 11:59pm ET
Data & Methods*	April 4	April 18 at 11:59pm ET
Results & Discussion*	April 18	May 2 at 11:59pm ET
Research Paper Compilation & Replication Documentation*	April 28	May 10 at 11:59pm ET

*denotes that data (.xlsx or .dta) files and/or command (.do or log) files are due at this stage also.

Evaluation Policies for Writing Assignments

In general, I will evaluate your writing by considering how well you have achieved the following goals (developed by the Writing Program):

- The author crafts an introduction that identifies a question, frames the question, and states a thesis.
- The author organizes the writing, demonstrates a progression of ideas, and maintains a consistent focus or thread.
- The author contextualizes the question and supports it with evidence.
- The author sustains analytical inquiry throughout the assignment.
- The author effectively incorporates relevant outside information.
- The author engages the intended audience with a consistent, distinctive voice appropriate to the task.
- The author adheres to appropriate standards for language use.
- The author conforms to appropriate formats for citation of source material

Each part of the final paper will go through the invention, drafting, feedback, and revising process. The process of revision and the ultimate success of the paper depend upon a thoughtful first draft, as well as a polished final draft.

COURSE POLICIES

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

Table 2: Grading System

Assignment/Task	Percentage
Homework Assignments (5)	25%
Workshop Exercises (7)	10%
Midterm Exam 1	10%
Midterm Exam 2	10%
Empirical Research Project	45%
Total	100%

The grading scale will be as follows:

Table 3: 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

No “extra credit” will be offered. The way to improve your grade beyond what it otherwise would be is to work hard to understand the material and to seek additional help when needed.

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!

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, email 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 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 test proctoring will be needed from ADS, remember that we will need to complete your Access Plan in time to give them at least one week's advance notice.

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.).

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 spring 2022 semester, the QR Center will offer **both in-person and remote tutoring** for ECON 398, 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. [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 ECON 398, 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) and indicate if this will be an in-person or online appointment.

COURSE SCHEDULE (subject to change)

WEEK 1: Introduction

1/24: Introductions and Discussion of Syllabus

- *Empirical Research Project Prompt*

1/27: Causality, Endogeneity, and Multivariate OLS: A Review

- **Workshop #1: Review of Multiple Regression w/ Homework #1**
- *Mastering Metrics*, Chapter 2
- Bailey, Chapters 2-7 (ECON 298)

WEEK 2: Panel Data

1/31: Pooled OLS and Fixed Effects

- *Research Question & Annotated Bibliography Prompt*
 - *The Effect*, Chapters 1 & 2 (available [here](#))
- Bailey, Chapter 8.1 & 8.2

2/3: Fixed Effects Models

- Bailey, Chapter 8.3 & 8.4
- **WS1/HW1 DUE**

WEEK 3: Panel Data (cont'd)

2/7: Random Effects Models

- Bailey, Chapter 15.3

2/10: Panel Data Workshop

- **Workshop #2: Panel Data w/Homework #2**

WEEK 4: Foundations of Causal Inference

2/14: Causality, Potential Outcomes, and the Differences Estimator

- Cunningham, S. *The Mixtape*, [Chapter 3: Directed Acyclic Graphs](#)
- Stock & Watson, Chapter 13.1
- **Research Question & Annotated Bibliography DUE**

2/17: Finding Data Workshop

- *Proposal Prompt*
- **Workshop #3: Finding Data**
- **WS2/HW2 DUE**

WEEK 5: Instrumental Variables (IV) Regression

2/21: IV Model and Two-Stage Least Squares

- Bailey, Chapter 9.1 & 9.2

2/24: IV Model Diagnostics

- Bailey, Chapter 9.2 – 9.6
- **WS3 DUE**

WEEK 6: IV (cont'd)

2/28: **MIDTERM EXAM 1**

3/3: IV Workshop

- *Data Collection and Metadata Guide Prompt*
- **Workshop #4: IV Workshop w/Homework #3**
- **Proposal DUE**

WEEK 7: Cleaning Data and Project Workshop

3/7: Cleaning Data Workshop

- **Workshop #5: Cleaning Data Workshop**

3/10: Cleaning Data (and Project) Workshop***

- **WS4/HW3 DUE**

WEEK 8: SPRING BREAK

3/14 & 3/17: **NO CLASS**

WEEK 9: Quasi-Experiments

3/21: Writing Conventions in Economics

- *Literature Review Prompt*
- additional readings TBA
- **WS5 DUE**

3/24: Quasi-Experiments and the Difference-in-Differences Estimator

- Bailey, Chapter 8.5
- *Mastering Metrics*, Chapter 5
- **Data Collection and Metadata Guide Due**

WEEK 10: Difference-in-Differences

3/28: Difference-in-Differences in Practice

- *Mastering Metrics*, Chapter 5

3/31: Diff-in-Diff Workshop***

- **Workshop #6: Diff-in-Diff Workshop w/Homework #5**

WEEK 11: Regression Discontinuity (RD) Designs

4/4: Basic RD Model and Extensions

- *Data and Methods Prompt*
- Bailey, Chapter 11.1 & 11.2
- *Mastering Metrics*, Chapter 4
- **Literature Review DUE**

4/7: RD Model Diagnostics

- Bailey, Chapter 11.3 & 11.4
- **WS6/HW4 DUE**

WEEK 12: Regression Discontinuity (RD) cont'd

4/11: Project Workshop

4/14: RD Workshop

- **Workshop #7: RD Workshop w/Homework #5**

WEEK 13: Projects

4/18: Project Workshop

- *Results and Discussion Prompt*
- **Data and Methods DUE**

4/21: Project Workshop

- **WS7/HW5 DUE**

WEEK 14: Projects

4/25: **MIDTERM EXAM 2**

4/28: Project Workshop

- *Final Paper Compilation Prompt*

WEEK 15: Masters of Metrics?

5/2: The Wages of Schooling

- *Mastering Metrics*, Chapter 6
- **Results and Discussion DUE**

5/5: Project Workshop

FINAL PAPER & REPLICATION DOCUMENTATION DUE: Tuesday, May 10, 11:59pm ET