ECON 398 (WiD)
ADVANCED ECONOMETRICS

DICKINSON COLLEGE
SPRING 2021 (hybrid remote/in-person format)

Professor: Tony Underwood
Office: Althouse 216
Office Hours ([via Zoom using this link](#) all semester <u>and</u> also in-person beginning in Week 3):
Monday, 3-4pm; Wednesday & Thursday, 11am-12pm ET; or by appointment.

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: Calvin Wirfel '21 (Quantitative Economics)
      QRA Office Hours: Wednesday, 5:30-6:30pm ET & Friday, 9:00-10:00am ET

Class Meets: MR, 1:30 – 2:45 pm ET, Althouse 204 (**[if attending remotely use this Zoom link](#)**)

Prerequisites:
- ECON 298 <u>and</u> 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 ($25).

     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. <u>free</u> online HTML 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 project. Stata 16 is available on campus, in Althouse 204, Stern 11, and Denny 112; therefore, <u>you are not required to purchase Stata</u> and it can also be accessed remotely by following these instructions:

REMOTE STATA ACCESS (*free*, but it is possible, although unlikely, that all computers are in use)
1. Open your favorite internet browser (Google Chrome, Mozilla Firefox, or Microsoft Edge)
2. Navigate to https://remotelab.dickinson.edu
3. Sign in with your Dickinson College Username and Password
   a. Note: just your username, you do NOT need your full email address
   b. Click Log in
4. Select which lab you need to log in to. Each "Pool" has specific software. The following three labs have Stata installed: Althouse 204, Denny 112, and Stern 11.
5. Click Make My Reservation
6. Click Connect to Remote Lab
7. Double click the downloaded file and click open
   a. Note: the .rdp file should open in Microsoft Remote Desktop
8. Click Connect
9. Enter your Dickinson College password and click OK.
10. Use your Dickinson College computer as usual. When you are done be sure to logout.

You can also click here for more detailed instructions on remote lab work or click this link that contains a video tutorial. However, if you would like to be able to work with Stata off-campus, on your project, without any potential disruptions, I strongly recommend you purchase and install Stata on your personal computer. To do so, follow these instructions:

OPTION 1 (*more expensive*, but no verification of student status required)
1. Go to http://www.stata.com/order. Select the United States and click View Pricing.
2. Click Education >> New purchase >> Single user.
3. Select Dickinson College from the Prof+ Plan (formerly GradPlan) 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 for Stata/IC 16 for **$125**. If you would prefer to have access to the software beyond this course and/or post-graduation then I suggest purchasing a perpetual license for Stata/IC 16 for $295.

OPTION 2 (*less expensive*, but verification of student status required)
1. Go to http://www.stata.com/order. Select the United States and click View Pricing.
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/IC 16 for **$48**. If you would prefer to have access to the software beyond this course then I suggest 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.

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 prompts 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, March 1** and **Monday, April 26.** These exams will be in a "take-home-asynchronous" format, given our hybrid format this semester. 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 **2pm ET on Tuesday, May 11** (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 25/April 29	May 11 at 2pm ET
Research Question & Annotated Bibliography	February 1	February 15 at 11:59pm ET
Proposal	February 18	March 4 at 11:59pm ET
Data Collection & Metadata Guide*	March 4	March 25 at 11:59pm ET
Literature Review	March 22	April 5 at 11:59pm ET
Data & Methods*	April 5	April 19 at 11:59pm ET
Results & Discussion*	April 19	May 3 at 11:59pm ET
Research Paper Compilation & Replication Documentation*	April 29	May 11 at 2pm 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 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/access, email access@dickinson.edu, call (717) 245-1734, or go to ADS in Old West (lower level), Room 005.

If you've already been granted accommodations at Dickinson, please let me know as soon as possible so that we can meet to review your Accommodation Letter and complete your Blue Forms. If you will need test proctoring from ADS, remember that you will need to provide them with at least one week's 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 (Remote):

Dickinson College provides additional support for students taking courses with quantitative content across the curriculum through the [Quantitative Reasoning (QR) Center](). For the spring 2021 semester, the QR Center will offer remote tutoring for Advanced Econometrics in addition to general quantitative support. 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 Advanced Econometrics. This will restrict the tutor list and schedule to only those tutors approved for this course. When you make your appointment, **please also paste or upload your assignment** and any work that you have done. Before your appointment begins, you will go to the appointment on the scheduler, open it up, and click "Start or Join Online Consultation." The remainder of the online tutoring session will take place via WCONLINE or Zoom, depending on the tutor and tutee's preferences. More instructions on how to use the online tutoring platforms can be found on the QR Center webpage.

COURSE SCHEDULE (subject to change)

WEEK 1: Introduction

1/25: Introductions and Discussion of Syllabus**

- *Empirical Research Project Prompt*

1/28: 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

2/1: Pooled OLS and Fixed Effects*

- *Research Question & Annotated Bibliography Prompt*
- Bailey, Chapter 8.1 & 8.2

2/4: Fixed Effects Models*

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

WEEK 3: Panel Data (cont'd)

2/8: Random Effects Models*

- Bailey, Chapter 15.3

2/11: Panel Data Workshop***

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

WEEK 4: Foundations of Causal Inference

2/15: 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**

2/18: Finding Data Workshop***

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

WEEK 5: Instrumental Variables (IV) Regression

2/22: IV Model and Two-Stage Least Squares*

- Bailey, Chapter 9.1 & 9.2

---

* = asynchronous remote (recorded lecture – no attendance expected)
** = synchronous remote (live and usually recorded unless it's a workshop day – attendance expected)
*** = synchronous in-person/remote (live, in-person, and usually not recorded – attendance expected)

2/25: IV Model Diagnostics*
- Bailey, Chapter 9.2 – 9.6
- **WS3 DUE**

WEEK 6: IV (cont'd)

3/1: **MIDTERM EXAM 1**

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

WEEK 7: Cleaning Data and Project Workshop

3/8: Cleaning Data Workshop***
- **Workshop #5: Cleaning Data Workshop**

3/11: Cleaning Data (and Project) Workshop***
- **WS4/HW3 DUE**

WEEK 8: SPRING BREAK

3/15 & 3/18: **NO CLASS**

WEEK 9: Quasi-Experiments

3/22: Writing Conventions in Economics*
- *Literature Review Prompt*
- additional readings TBA
- **WS5 DUE**

3/25: 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

3/29: Difference-in-Differences in Practice*
- *Mastering Metrics*, Chapter 5

4/1: Diff-in-Diff Workshop***
- **Workshop #6: Diff-in-Diff Workshop w/Homework #5**

WEEK 11: Regression Discontinuity (RD) Designs

4/5: Basic RD Model and Extensions*
- *Data and Methods Prompt*
- Bailey, Chapter 11.1 & 11.2
- *Mastering Metrics*, Chapter 4
- **Literature Review DUE**

4/8: RD Model Diagnostics**
- Bailey, Chapter 11.3 & 11.4
- **WS6/HW4 DUE**

WEEK 12: Regression Discontinuity (RD) cont'd

4/12: Project Workshop***

4/15: RD Workshop***
- **Workshop #7: RD Workshop w/Homework #5**

WEEK 13: Projects

4/19: Project Workshop***
- *Results and Discussion Prompt*
- **Data and Methods DUE**

4/22: Project Workshop***
- **WS7/HW5 DUE**

WEEK 14: Projects

4/26: **MIDTERM EXAM 2**

4/29: Project Workshop***
- *Final Paper Compilation Prompt*

WEEK 15: Masters of Metrics?

5/3: The Wages of Schooling***
- *Mastering Metrics*, Chapter 6
- **Results and Discussion DUE**

5/6: Project Workshop***

FINAL PAPER & REPLICATION DOCUMENTATION DUE: Tuesday, May 11, 2pm

---

*   = asynchronous remote (recorded lecture – no attendance expected)
**   = synchronous remote (live and usually recorded unless it's a workshop day – attendance expected)
***   = synchronous in-person/remote (live, in-person, and usually not recorded – attendance expected)