ECON 374 – 01
ECONOMETRICS

DICKINSON COLLEGE
SPRING 2017

Professor: Tony Underwood
Office: Althouse 216
Office Hours: Tuesday, Thursday, & Friday, 2-3 pm, 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!

Class Meets: TR, 10:30 – 11:45 am, Denny 112

Prerequisites:
- ECON 268 (Intermediate Macro Theory) or ECON 278 (Intermediate Micro Theory)
- MATH 121 (Elementary Statistics) or ECON 214 (Statistical Methods in Economics)
- MATH 170 (Single Variable Calculus)

COURSE DESCRIPTION & OBJECTIVES

This course is a rigorous introduction to econometrics in which the tools of economic theory, mathematics, and statistical inference are applied to the analysis of economic data. We will study and apply multiple regression analysis to both cross-sectional and longitudinal (panel) data in order to familiarize students with the concepts of econometric modeling, estimation, prediction, and hypothesis testing. Students will conduct empirical research projects using Stata to enable students to understand and apply the conventions of empirical research in economics, including: technical writing, reviewing existing literature, data collection and organization, and file management for complete transparency and reproducibility. Throughout the semester students will:

- 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.
- Learn the basic assumptions of the classical linear regression model and identify and correct (if possible) any violations of these assumptions, such as serial correlation and heteroskedasticity.
- 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.
- Demonstrate the ability to place a research question in the context of existing scholarly discourse through an effective literature review.

COURSE STRUCTURE

Textbooks & Website:

Required

Wooldridge, Jeffrey M. (2013). *Introductory Econometrics: A Modern Approach*. 5th edition. South-Western/Cengage. ISBN: 9781111531041.

Long, Scott J. (2009). *The Workflow of Data Analysis Using Stata*. Stata Press. ISBN: 9781567180474.

Recommended (*highly recommended for those interested in Stata proficiency*)

Mitchell, Michael N. (2010). *Data Management Using Stata: A Practical Handbook.* Stata Press. ISBN: 9781597180764.

Moodle (via Gateway)
Most materials for this course – syllabus, reading assignments, problem sets, datasets, empirical 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 to complete problem sets, empirical exercises, and your project. Stata 14 is available on campus, in Althouse 204 and Denny 112; therefore, you are not required to purchase Stata. However, if would like to be able to work with Stata off-campus, in the library, or facilitate asking questions during office hours, I strongly recommend you purchase and install Stata on your personal computer. To do so, follow these instructions:

1. Go to http://www.stata.com/coursegp
2. Select the software package you wish to purchase. If you only wish to have access to the software during this semester, I suggest you purchase a 6-month license for Stata/IC 14 for $75. However, keep in mind that many 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 I suggest purchasing a perpetual license for Stata/IC 14 for $198.
3. The default will be a download delivery. If you wish to receive the DVD (additional $25), then select "Include DVD".
   - For delivery via electronic download, 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.
4. When checking out, using either option, you will be asked for a Student ID; in this field you must specify the Grad Plan ID for this course: **DC374**.

Lectures:

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!

Problem Sets:

You will be required to complete four (4) problem sets over the course of the semester, accounting for 20% of your final course grade. Problem set assignments will be posted to *Moodle* and will focus on applications of the tools and concepts we cover in class. Most of these problem sets will include both an analytical and empirical component. A **hard copy** of these assignments is due at the beginning of class on the date specified in the course schedule. If you turn the assignment in one minute after class begins, it will be considered late. I recommend coming to class early on the days assignments are due and anticipating printing issues. These problem sets must be printed and submitted. This includes a .do file and a clean log file. 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. If you object to the way one of your problem sets was graded, you may attach a <u>written</u> description of your objection and submit the item to me for re-grading. I will re-grade the entire item, and your score may go up or down.

Stata Empirical Exercises:

You also will be required to complete several empirical exercises using Stata to aid in your understanding of the material and develop the software skills necessary to succeed in this course and for your empirical research project. These exercises will account for 15% of your final course grade and will be due at the beginning of class on the specified date via email along with the necessary .do and log files.

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 at the end of week 1 and detailed prompts will be administered for each subsection 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 **2 pm on 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 26, 2017	May 11, 2017 at 2:00 pm.
Research Question & Annotated Bibliography	February 2, 2017	February 14, 2017 at 10:30 am.
Proposal	February 16, 2017	March 2, 2017 at 10:30 am.
Data Collection & Metadata Guide*	March 9, 2017	March 23, 2017 at 10:30 am.
Literature Review	March 23, 2017	April 4, 2017 at 10:30 am.
Data, Methods, & Data Appendix*	March 30, 2017	April 13, 2017 at 10:30 am.
Results & Discussion*	April 13, 2017	April 27, 2017 at 10:30 am.
Research Paper Compilation & Replication Documentation*	April 27, 2017	May 11, 2017 at 2:00 pm.

Cells highlighted in red represent components of the final grade.
Cells highlighted in gray are components of the final paper.
Cells highlighted in blue are NOT components of the final paper but are counted in the project grade
*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.

Exams:

There will be one midterm exam on **Thursday, March 30.**

A final exam will *not* be given, emphasizing the significance of the final paper, as well as other assignments.

COURSE POLICIES

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

Table 2: Grading System

Assignment/Task	Points	Percentage
Written Problem Sets (4)	100	20%
Empirical Exercises (at least 3)	75	15%
Exam	100	20%
Empirical Research Project	225	45%
Total	500	100%

Note, the empirical research project grade consists of the components listed in Table 1. The grading scale will be as follows:

Table 3: Grading Scale

Grade	Total Points	Percentage
A	463-500	92.6-100%
A-	448-462	89.6-92.5%
B+	433-447	86.6-89.5%
B	413-432	82.6-86.5%
B-	398-412	79.6-82.5%
C+	383-397	76.6-79.5%
C	363-382	72.6-76.5%
C-	348-362	69.6-72.5%
D+	333-347	66.6-69.5%
D	313-332	62.6-66.5%
D-	298-312	59.6-62.5%
F	Less than 298	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 and discussions, 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 laptop 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, problem sets, or empirical exercises 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, 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.

Accommodations for Disabilities:

Dickinson values diverse types of learners and is committed to ensuring that each student is afforded an equal opportunity 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 impact your educational experience in this class, please contact the Office of Disability Services (ODS) to schedule a meeting with Director Marni Jones. She will confidentially discuss your needs, review your documentation, and determine your eligibility for reasonable accommodations. To learn more about available supports, go to www.dickinson.edu/ODS, email DisabilityServices@dickinson.edu, call (717) 245-1734, or go to ODS in 106 Dana Hall. 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 Form" Implementation Plan. If you will need test proctoring from ODS, 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 the Office of Disability Services (ODS). 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 (SUBJECT TO CHANGE)

The topics highlighted in gray are a basic statistics review. These are topics that were covered in MATH 121 (Elementary Statistics) or ECON 214 (Statistical Methods in Economics). You will need to use this information later in the course. Therefore, I have provided you with the relevant materials for you to review on your own time. You are not required to turn in any of the Review Practice Problem Sets; however, you will be assessed on your understanding of this material in Empirical Exercise #1. If you need additional help, please feel free to come see me or use the Quantitative Reasoning Center.

WEEK 1
- 1/24: Introductions & Discussion of Syllabus
  - Introduction to Stata
  - Basic Statistics Review Topic: Probability
    - Reading: Wooldridge, Appendix B, p.722-744
    - Practice Problem Set: Review 1
    - Lecture Slides: Probability

- 1/26: Discussion of Empirical Research Project
  - Wooldridge, Chapter 19
  - Varian, H. R. (2016). How to Build an Economic Model in Your Spare Time. *The American Economist*, *61*(1), 81-90.
  - Basic Statistics Review Topic: Probability Distributions and Sampling
    - Reading: Wooldridge, Appendix B, p.745-752 and Appendix C, p.755-767
    - Practice Problem Set: Review 2
    - Lecture Slides: Probability Distributions and Sampling

WEEK 2
- 1/31: The Nature of Econometrics and Economic Data
  - Wooldridge, Chapter 1
  - Angrist, J & Pischke, J. (2008). Chapter 1: Questions about Questions. In: *Mostly Harmless Econometrics: An Empiricists Companion.*
  - Basic Statistics Review Topic: Estimation
    - Reading: Wooldridge, Appendix C, p.768-777
    - Practice Problem Set: Review 3
    - Lecture Slides: Estimation

- 2/2: Finding Sources, Annotated Bibliographies, and Literature Reviews
  - Theresa Arndt, Research Librarian
  - Dudenhefer, P. (2014). A Guide to Writing in Economics. Parts I & II, p. 6-30
  - **Empirical Exercise #1 DUE**
  - Basic Statistics Review Topic: Hypothesis Testing
    - Reading: Wooldridge, Appendix C, p.777-790
    - Practice Problem Set: Review 4
    - Lecture Slides: Hypothesis Testing

WEEK 3
- 2/7: Data Workflow and Replication
    - Long, Chapters 1 & 2
- 2/9: Simple Linear Regression Model
    - Wooldridge, Chapter 2, p. 22-44

WEEK 4
- 2/14: Simple Linear Regression Model
    - Wooldridge, Chapter 2, p. 45-59
    - **Research Question & Annotated Bibliography DUE**
- 2/16: Multiple Regression Analysis: Estimation (Stata workshop)
    - Wooldridge, Chapter 3, p. 68-83
    - **Empirical Exercise #2 DUE**

WEEK 5
- 2/21: Multiple Regression Analysis: Specification
    - Wooldridge, Chapter 3, p. 83-105
- 2/23: Hypothesis Testing in Multiple Regression
    - Wooldridge, Chapter 4, p. 118-143
    - **Empirical Exercise #3 DUE**

WEEK 6
- 2/28: Stata workshop: Multiple Regression, Outreg2, Summary Stats, Table Presentations
    - Wooldridge, Chapters 6 & 9
- 3/2: Testing Multiple Linear Restrictions
    - Wooldridge, Chapter 4, p. 143-158
    - **Research Proposal DUE**

WEEK 7
- 3/7: Multiple Regression with Dummy Variables
    - Wooldridge, Chapter 7, p. 227-247
- 3/9: Data Management Using Stata (Dummies, Merge, Append, Do-files, Read me files)
    - Long, Chapter 3
    - Mitchell, Chapter 6
    - **Problem Set #1 DUE**

WEEK 8
- 3/13 – 3/17: **SPRING BREAK**: NO CLASS

WEEK 9
- 3/21: Heteroskedasticity
    - Wooldridge, Chapter 8
- 3/23: Heteroskedasticity (cont'd)
    - **Data Collection & Metadata Guide DUE**

<u>WEEK 10</u>
- 3/28: In-class facilitated peer review
  - **Bring completed draft of Literature Review to class**
- 3/30: **EXAM**

<u>WEEK 11</u>
- 4/4: Basic Regression Analysis with Time Series Data
  - Wooldridge, Chapter 10, p.344-363
  - **Literature Review DUE**
- 4/6: Trends and Seasonality
  - Wooldridge, Chapter 10, p. 363-374
  - **Problem Set #2 DUE**

<u>WEEK 12</u>
- 4/11: Stata workshop: time series data
- 4/13: Serial Correlation: Detection
  - Wooldridge, Chapter 12, p. 412-423
  - **Data & Methods (including Data Appendix) DUE**

<u>WEEK 13</u>
- 4/18: Serial Correlation: Correction & Robust Estimation
  - Wooldridge, Chapter 12, p. 423-440
- 4/20: Simple Panel Data Methods: Pooled Cross-Sections & Policy Analysis
  - Wooldridge, Chapter 13, p.448-474
  - **Problem Set #3 DUE**

<u>WEEK 14</u>
- 4/25: Difference-in-Differences
- 4/27: Advanced Panel Data Methods: Fixed Effects
  - Wooldridge, Chapter 14, p. 484-492
  - **Results & Discussion (including analysis command file) DUE**

<u>WEEK 15</u>
- 5/2: Advanced Panel Data Methods: Random Effects
  - Wooldridge, Chapter 14, p. 492-501
- 5/4: Catch up and Review
  - **Problem Set #4 DUE**

FINAL RESEARCH PAPER & REPLICATION DOCUMENTATION DUE
Thursday, May 11, 2pm