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Fall Semester, 2016
Lecture: 8:30 – 9:45 a.m. MW, 116 Old Chem Bldg.
Office Hours: 3:00 – 5:00 p.m. Mondays or by Appt.
Last Revised: Nov. 14, 2016

Economics 608D **Introduction to Econometrics (Masters Level)** **Course Syllabus and Outline**

Course Objectives

This course is designed to be a graduate-level course in econometrics for M.A. students with a strong mathematics and statistics foundation. Students will be introduced to the major quantitative techniques that economists use to test models, study economic behavior, evaluate policies, and relationships between variables. Our goal is to learn enough methods and theory to be able to:

- **Read & understand** the econometric theory and arguments used in the economics literature.
- Determine which econometric technique is appropriate (inappropriate) in various circumstances.
- Conduct basic econometric analyses of various types of data using a standard software package (STATA)
- Take other MA level econometrics courses, including:

Econ 612 Time Series Econometrics (Masters Level)
Econ 613 Applied Econometrics: Micro (Masters Level)

MA students who want to go on to a Ph.D. in Economics or a related field are encouraged to take the required Ph.D. Econometrics sequence (Econ 703D and 707D) during their course of study at Duke. For those wanting to take one or both of the courses in the Ph.D. sequence but do not have adequate preparation, we encourage them to take Stat 601 (Bayesian and Modern Statistics) or Stat 611 (Introduction to Statistical Methods), rather than Econ 608D.

Requirements and Prerequisites

The *formal* prerequisites for this course are a strong background in Calculus and Probability and Statistics and an understanding of Matrix Algebra. Students that do not have these prerequisites should see me or the Head teaching assistant (TA). With respect to probability and statistics, please understand that neither the TAs nor I will devote much, if any, time in the lectures or discussion sessions to *teaching* or *extensively reviewing* material in basic statistics. I will provide some elementary reviews of concepts from probability and statistical theory at various points in the lecture as they arise in my discussions of aspects of regression analysis. With respect to Matrix Algebra, I will begin the course with a brief review of key aspects that we will use to formulate and characterize results in regression analysis. If you are totally unfamiliar with Matrix Algebra, you should work through Appendix A in the Greene textbook (more on the textbook below) and/or work through a Matrix Algebra text. (One is listed below under **Other Resources**.)

If you need a *permission number* to add this class, please contact the MA Staff Assistant in the

Ecoteach office (138 Social Science Building).

University Policies

Students are expected to familiarize themselves with University policies concerning grading and disabilities. Below are links to these policies:

Grading: <http://registrar.duke.edu/faculty-staff/grading>

Disabilities: <http://access.duke.edu/students/faculty.php>

Teaching Assistants, Discussion Section and TA Office Hours

Fu Ouyang (fu.ouyang@duke.edu) will be the head teaching assistant (TA) for this course and **Haoyang Yu** (haoyang.yu@duke.edu) and **Lizi Yu** (lizi.yu@duke.edu) also will serve as TAs for the course. Fu will run the Wednesday and Friday Discussion Sections and Lizi will run the Thursday Section. Haoyang will handle the collection and distribution of the problem sets for the course. (More on problem sets below.) All three TAs will hold weekly office hours given below. If you have questions about the lectures, problem sets or exams, do make use of these additional office hours; the TAs are there to help you learn the material in this course.

TA Office Hours:

Fu Ouyang: **Wednesdays, 4:00 – 5:00 p.m. in grad lounge.**

Haoyang Yu: **Thursdays, 4:00 – 6:00 p.m. in 308 Social Science Hallway.**

Lizi Yu: **Tuesdays, 1:45 – 2:45 p.m. in grad lounge.**

Course Structure

The **lectures** will introduce new materials and develop the key concepts of the course. I will lecture using *slides*, which are organized into *Lectures*, and a series of *handouts*. These materials are posted in appropriately labeled folders under **Resources** on course website, [ECON.608D.001.F16, Sakai](#). The slides and handouts for particular lectures should be available on Sakai at least 24 hours before the day I lecture on this topic in class. I recommend that you bring a copy to class. If I make major changes to the slides, either during or after class, I will post updated versions of them on Sakai.

The weekly **discussion sections** are intended to help you get answers to questions about concepts from the lectures, the problem sets and, later in the course, about past exams. These sessions are **not** intended to be additional lectures. Students should come to the sessions to which they are assigned prepared with questions to ask or send them to the TAs in advance of a session so they can prepare responses to them. The discussion sections will start the week of September 5-9.

There will be **7 problem sets** distributed out during the course. They will be posted on Sakai, in the “Problem Sets” folder under **Resources**. This folder contains a schedule for when each problem set will be posted and when they are due. The problem sets will be *turned in* to Haoyang Yu on or before the date they are due.

I strongly encourage you to complete the problem sets. Working problems is an effective way of learning the theoretical aspects of econometric methods. Each problem set will include at least one

empirical problem in which you will be asked to conduct some analyses on a data set. These data sets will be made available on Sakai and most of them will be in STATA format. (More on STATA below.) You are encouraged to work on the analytic problems together. You will probably find it easier to work on the empirical exercises individually, but that is up to you.

The schedule for the release and due dates for the problem sets is as follows:

<u>Problem Set</u>	<u>Release Date</u>	<u>Due Date</u>
Problem Set #1	9/1/2016	9/12/2016
Problem Set #2	9/12/2016	9/21/2016
Problem Set #3	9/21/2016	10/3/2016
Problem Set #4	10/5/2016	10/12/2016
Problem Set #5	10/13/2016	10/26/2016
Problem Set #6	10/31/2016	11/16/2016
Problem Set #7	11/17/2016	11/28/2016

The problem sets and any associated data files will be released on the Sakai course site and Haoyang will send you an email when they are available and tell you where the materials are located. You need to turn them in by placing them in Haoyang Yu's Mailbox on the 2nd floor of the Social Science Building by 11:59 a.m. of the Due Date. ***No late problem sets will be accepted.*** The problem sets will be graded within a week after the Due Date and will be returned at the end of class on that day. Students not picking up their graded problem sets must arrange to secure it from Haoyang within a week of their being returned.

There will be a **mid-term exam** and a **final exam** in the course. The **schedule** for these exams is as follows:

<u>Exam</u>	<u>Day and Time</u>	<u>Location</u>
Mid-Term Exam	Monday, October 17 (in class)	116 Old Chem Bldg.
Final Exam	Sunday, December 18 (9 a.m. – 12 noon)	116 Old Chem Bldg.

Grading

Your Course Grade will depend on your performance on the problem sets, mid-term exam and final exam in the following way:

<u>Course Activity</u>	<u>Share of Course Grade</u>
Problem Sets	5%
Mid-Term Exam	40%
Final Exam	55%
Total	100%

Concerning ***grading of problem sets, exams and class attendance***, I maintain the following grading policies and practices:

1. **Problem Sets**: The problem sets will be graded as follows. The TA will check whether students submitted a problem set and whether they provided answers to all of its parts. Credit on each

problem set will be assigned as follows: *0 credit if student does not hand-in problem set on time; 1/2 credit if student turned in problem set but didn't complete all parts; full credit if student completed all parts.*

2. **Makeup Exams**: There will be **no makeup exams** and there are **no exceptions to this rule**. If you miss the midterm, the weight of the missed exam will be placed on the final. If you miss the final exam, you will need to retake the course next year.
3. The final exam is ***comprehensive***. As you will see, it could not be otherwise, given that everything we do in this course builds on previous material.
4. The ***exams*** will be ***closed book***, but you will be allowed to bring a ***cheat sheet*** to each of the exams. There will be page limits on the cheat sheets. More on this in a couple of weeks.
5. **Class Attendance**: Class attendance is strongly encouraged, but it is not required. I will not take attendance. Please arrive on time.

Data Analysis, Computer Labs, and Statistical Software

As noted above, most of the empirical problems included in problem sets will use data sets set up in STATA. I also will use STATA for some empirical examples in my lectures. The data for these examples will be made available on Sakai, so you can replicate the results I present in class. STATA is available on the computers in the Basement (Room 01) of the Old Chem Building. You also can download and install a version of STATA on your PC/laptop for use in this course. The instructions for doing this can be found [here](#). The Activation Codes for students in this course can be found in the “STATA Activation Codes” folder in **Resources** on the course website on Sakai.

I will use Stata 14 for the empirical examples I present in class.

Course Textbook

The recommended textbook for this course is:

Greene, William H. 2012, *Econometric Analysis*, 7th Edition. Prentice Hall.

It is available in the Duke Bookstore. You also can purchase it, new or used, or rent a copy at [amazon.com](#) or [valorebooks.com](#), and [BarnesandNoble.com](#). I would note that you can obtain used copies of previous editions of this book and, by and large, using those previous editions (at least back to the 5th Edition) should be fine for this course. That said, it is up to students to “translate” the reading assignments below, which are given for the 7th Edition, to the earlier editions.

Other Resources

Other good undergraduate econometrics texts:

- Wooldridge, J. *Introductory Econometrics: A Modern Approach*.
- Stock, J., Watson, M. *Introduction to Econometrics*.

- Goldberger, A.S. *Introductory Econometrics*

More Advanced econometrics texts:

- Wooldridge, J. *Econometric Analysis of Cross Section and Panel Data*.
- Hayashi, F. *Econometrics*.
- Hamilton, J. *Time Series Analysis*.
- Gallant, A.R. *An Introduction to Econometric Theory*.

Texts for Linear Algebra and Statistics:

- Strang, G. *Linear Algebra and Its Applications*.
- Casella, G., Berger, R. *Statistical Inference*.

STATA

- STATA reference manuals
- STATA website: www.stata.com (See Support/Statalist)

MATLAB

- MATLAB reference manuals
- <http://www.mathworks.com/>
- Duke Econ computing site provides many helpful links:
<https://help.econ.duke.edu/wiki/help:linuxmatlab> and <http://dialog.econ.duke.edu/help/>

Course Outline

<u>Lecture</u>	<u>Topic</u>	<u>Readings from Greene</u>
<i>Introduction</i>		
Lec. 1	Brief Intro to Matrix Algebra	Chapter 1 & <i>Appendix A</i>
<i>Algebra of Least Squares</i>		
Lec. 2	Bivariate Regression & Properties	<i>Chapter 3</i>
Lec. 3	Multiple Regression & Properties	<i>Chapter 3</i>
Lec. 4	<i>Ceteris Paribus</i> & Interpreting Multiple Regression Coefficients	Sections 3.3 & 3.4
<i>Brief Review of Probability, Distribution Theory & Statistical Inference</i>		
Lec. 5	Probability & Distribution Theory	Appendix B
Lec. 6	Forms of Statistical Dependence	Lecture Notes
Lec. 7	Key Issues in Statistical Inference	Appendix C
<i>Statistical Distribution Theory for Linear Regression Model</i>		
Lec. 8	Linear Regression Model (LRM)	Chapter 2
Lec. 9	Properties of OLS Estimation for LRM in Small Sample	Chapter 4 & Appendix D
<i>Hypothesis Testing for Linear Regression Model</i>		
Lec. 10	Hypothesis Testing & Confidence Intervals	Appendix C.6 & C.7
Lec. 11	Hypothesis Testing for Regression Coefficients under Normality Assumption	Chapter 5
Lec. 12	Testing Joint Hypotheses and Linear Restrictions on Regression Coefficients	Chapter 5
<i>Additional Topics for Linear Regression Model</i>		
Lec. 13	Functional Forms within Linear Regression	Chapter 6
Lec. 14	Heteroskedasticity	Sections 9.4 – 9.6
<i>Sources of Bias & Ways to Deal with Them</i>		
Lec. 15	Omitted Variable, Endogeneity & Other Biases	Chapter 8
Lec. 16	Endogeneity, Causal Effects, Instrumental Variables (IV) & Two-Stage Least Squares (2SLS)	Chapters 8 and Section 10.6
<i>Estimation Methodology</i>		
Lec. 17	Minimum Distance & Generalized Method of Moments (GMM)	Chapters 12 & 13
Lec. 18	Maximum Likelihood	Chapter 14
<i>More on Testing</i>		
Lec. 19	Three Alternative Tests	Chapter 5