James W. Roberts   Spring 2016
228B Social Sciences
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Econ 208D: INTRODUCTION TO ECONOMETRICS

Econometrics is the application of mathematical and statistical techniques to economic data. Econometrics attempts to do more than simply document an association between two variables (e.g., people with more years of education, on average, have higher incomes than those with less). It attempts to estimate the *causal* effect of a variable of interest on the outcome (e.g., if an individual acquires an additional year of education, she will have a higher income, on average). Finally, econometrics also attempts to quantify the degree of accuracy of the estimated causal effect. In other words, hypotheses are formulated and tested.

This course will introduce you to the basic econometrics toolkit. We begin with a review of some probability and statistics material that you should have seen in previous coursework. We then turn to the notion of causality, and explore the extent to which randomized control trials can establish it under certain conditions. Although randomized experiments, in society and in classroom "laboratories," are now common, economics is still primarily a non-experimental science, unlike some natural sciences. That is, for many questions of interest, it is not feasible, or ethical, to control scientifically who gets a treatment (say, an extra year of education) and who does not. Therefore, the majority of the class will then be spent on learning what how to establish and measure causal effects in data not generated by a randomized experiment.

This course is deeply linked to the other economics courses you have and will continue to take as at its core, it is the course that teaches the methods to measure and evaluate economic models. Econometrics requires developing and implementing a wide skill set: mathematics, statistics, economic theory, computer programming, writing, and (not least of all) intuitive sense. Be prepared for an engaging and rigorous semester.

Lectures: Tuesdays and Thursdays, 10:05AM-11:20AM, Social Sciences 139.

Discussion Sections: There are six discussion sections. You have each been assigned to one. The purpose of these discussion sections is to (i) answer any of your questions from class, (ii) go over problem sets and midterms, (iii) do additional problems to increase your understanding of class material, and (iv) give help with *STATA* (see below for more on this).

Attendance: You are not required to attend either lectures or discussion sections. You are almost done with your basic formal education, so at this point you have hopefully figured out how to manage your time appropriately to achieve your goals. But be forewarned, attendance at both lectures and discussion sections is highly recommended. The class is hard. Do yourself a favor and make the proper investments so that you can have a fulfilling semester. I also cannot rule out the possibility that I will, from time to time, give pop-quizzes in class. If absent, your grade on any such quiz will be a zero.

Teaching Assistants: We have Teaching Assistants for the course. All are economics PhD students here at Duke. These teaching assistants will run the discussion sections and have their own office hours.
1. Roman Levkin, Head TA (romanlevkin@gmail.com)
2. Rui Chen (rui.chen@duke.edu)
3. Zachary Nolan (zach.nolan@duke.edu)
4. Daniel Garrett (daniel.garrett@duke.edu)

Office Hours: My office hours - Tuesdays and Thursdays, 11:30AM-12:30PM, Social Sciences 228A. The TAs will also hold office hours shown in the weekly class calendar below.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	10:05am -11:20am Lecture, Prof. Roberts Soc Sci 139		10:05am -11:20am Lecture, Prof. Roberts Soc Sci 139	10:20am -11:20am Section, Daniel Languages 207		
	11:30am -12:30pm Off. Hrs., Prof. Roberts Soc Sci 228A		11:30am -12:30pm Off. Hrs., Prof. Roberts Soc Sci 228A	12:00pm -12:50pm Section, Rui Languages 207		
1:00pm -3:00pm Off. Hrs., Daniel Soc Sci 316	1:00pm -3:00pm Off. Hrs., Zachary Grad Lounge					2:00pm -4:00pm Off. Hrs., Roman Soc Sci 308C
	4:55pm -5:45pm Section, Zachary Bio Sci 155	4:55pm -5:45pm Section, Zachary Languages 211				
		6:30pm -7:20pm Section, Daniel Allen 318	6:30pm -7:20pm Section, Rui Allen 318			
7:00pm -9:00pm Off. Hrs., Rui Grad Lounge						

Grad Lounge is a common area on the third floor of the Social Sciences Building. Please, proceed to the third floor and turn to the left as you exit the staircase. Grad Lounge is in the end of the hallway (in the North-Eastern wing of the building).

Sakai: I will use Sakai to distribute class materials like lecture slides and problem sets. It is your responsibility to see that you can log on to Sakai to access the course site.

Text: To try to save you a little $ I am only requiring that you buy the online version of Stock and Watson 3e. It is available from the bookstore. To help familiarize you with the online version of the textbook, a representative from Pearson will attend the first day of class to walk you through the course website. If you have a hard copy of the book that should be fine as well. Just make sure it is the correct edition.

Slides: I will post lecture slides after each lecture. Thus, you won't have all the formulas written down for you in class as would be the case if I posted slides before class. That should tell you something – memorizing formulas is not important for this class. Understanding them is. So you can decide how you want to take notes for this course, but I would suggest focusing on making sure you understand the intuition and processes we appeal to and use, not memorizing facts and formulas.

Policy Re Technology in Class: Cellphones are not permitted in class. If you have to take a call during class then you may excuse yourself and take the call outside. Computers, tablets, etc. are not permitted in class. Get out the old pen and paper. I promise: shutting this stuff off for (not even) an hour and a half twice per week will feel good and do wonders for your mind.

STATA: All problem sets will require you to use a statistical software program called *STATA*. To help you with this program we will have a representative from Duke's Data and Visualization Services group give a short tutorial on the program in class during one of the first classes of the semester. The TAs will also go over how to use *STATA* in the discussion sections. The installation instructions for *STATA* can be found at: https://public.econ.duke.edu/stata. Here is some more useful information:
- Serial number: 401409002291
- Code: 6ygz hyci ntyz $11y vng1 n8v5 hty0 0zxu Ldyo
- Authorization: sokf

Grading: Evaluation will be based on six problem sets, two midterm exams, a final exam and class participation. The problem sets are due at the *beginning of class* (must be turned in within 5 minutes of class starting) on the day they are due. Midterms and Exams must be turned in at the end of the class in which they are given. If they aren't turned in within 5 minutes of class officially ending the grade on that midterm or final may lowered as a result.

The final grade for person *i* will be determined as follows:

$$Final\ Grade_i = 0.05CP_i + 0.20AVGTOP4PS_i + 0.25BESTMT_i + 0.50FINAL_i$$

where: *CP* is class participation score, *AVGTOP4PS* is the average of the best four out of six problem sets, *BESTMT* is the best of two midterm grades, and *FINAL* is the grade on the final exam.

So you'll note that you can drop the lowest two problem set grades, and the lowest midterm grade.

Due Dates:
- Problem Sets (all due at the beginning of class on the following days)
    1. 1/28/16
    2. 2/25/16
    3. 3/3/16
    4. 3/24/16
    5. 4/14/16
    6. 4/21/16
- Midterms (taken in class on the following days)
    1. 2/16/16
    2. 3/29/16
- Final Exam (7:00-10:00PM, Room TBD, on the following day)
    1. 5/3/16

Re-grading: any requests for a re-grade must be made after 2 days but before 5 days have passed since the graded item was returned to you. All re-grade requests should be made in person to the Head TA (see above for who that is). The Head TA has the full authority to grant or deny re-grade requests. If the Head TA grants a re-grade request, the entire document will be re-graded, even if this means that the item being re-graded ends up with a lower grade than it started with.

Late Work: Anything turned in late, as defined above, receives a 0. There are no opportunities to re-take tests or turn in problem sets late since you are allowed to drop some of these. If you miss the final exam, then you can take the final exam offered by whomever teaches this course next semester. We can go over the nuances of this procedure if the need arises, which hopefully it will not.

Special Needs: If you require extra time or have special needs it is your responsibility to let me know at least two weeks in advance of any graded item's due date. Do not rely on Duke's own internal procedures for letting me know this stuff. Those procedures may work fine, but you are responsible to make sure I know about such needs or issues.

Honor Code: I take the honor code very seriously and I expect you all to as well. I expect all students to adhere to the Duke Community Standard, repeated here in order to refresh your memory:

> *"Duke University is a community dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Citizens of this community commit to reflect upon and uphold these principles in all academic and nonacademic endeavors, and to protect and promote a culture of integrity.*
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> *To uphold the Duke Community Standard:*
> - *I will not lie, cheat, or steal in my academic endeavors;*
> - *I will conduct myself honorably in all my endeavors; and*
> - *I will act if the Standard is compromised."*

Course Outline

Class #	Notes	Date	Graded Item Posted	Graded Item Due	Topic - General	Topic - Detail
1		Thursday, January 14, 2016			Intro, Syllabus	Intro, Syllabus, Pearson Rep.
2	Discussion sections begin today	Tuesday, January 19, 2016			Stata Review & P&S 1	Stata Review and Start P&S 1
3		Thursday, January 21, 2016	HW1		P&S 1	Stats 1
4	Drop/Add Ends Tomorrow	Tuesday, January 26, 2016			P&S 2	Stats 2
5		Thursday, January 28, 2016		HW1	P&S 3	Stats 3
6		Tuesday, February 2, 2016			P&S 4	Stats 4
7		Thursday, February 4, 2016			Randomization	Conditional Expectation, Causation, begin Randomization
8		Tuesday, February 9, 2016			Randomization	Randomization through example, Threat to Experimental Validity
9		Thursday, February 11, 2016			Catch up and Review	Catch up and Review
10		Tuesday, February 16, 2016		Midterm 1	Midterm 1	Midterm 1
11		Thursday, February 18, 2016	HW2		OLS	Return to Causation and Intro to OLS
12		Tuesday, February 23, 2016			OLS	The OLS assumptions and properties of the estimators, sampling distribution, Goodness of Fit.
13		Thursday, February 25, 2016	HW3	HW2	OLS	Tests and confidence intervals, Homoskedasticity vs. Heteroskedasticity, Weighted Least Squares.
14		Tuesday, March 1, 2016			MVR	Omitted variables, introduction to multivariate OLS
15		Thursday, March 3, 2016		HW3	MVR	Multivariate OLS, assumptions and properties
16		Tuesday, March 8, 2016			MVR	Imperfect multicollinearity, tests and confidence intervals for single coefficients, goodness of fit, Testing joint hypotheses
17		Thursday, March 10, 2016	HW4		Basic Extensions	Extensions to OLS: nonlinearities, estimation of elasticities, dummy variables and interactions
	No Class, Spring Break	Tuesday, March 15, 2016				
	No Class, Spring Break	Thursday, March 17, 2016				
18		Tuesday, March 22, 2016			Basic Extensions	Extensions to OLS: nonlinearities, estimation of elasticities, dummy variables and interactions
19		Thursday, March 24, 2016		HW4	Catch up and Review	Catch up and Review
20	Last day to withdraw with W is Tomorrow	Tuesday, March 29, 2016		Midterm 2	Midterm 2	Midterm 2
21		Thursday, March 31, 2016			LimDep	Regression with limited dependent variables; Linear probability model, logit and probit.
22		Tuesday, April 5, 2016			LimDep	MLE, MLE with LimDep
23		Thursday, April 7, 2016	HW5		Panel Data	Linear models and panel data
24		Tuesday, April 12, 2016			IV	Endogenous regressors; simultaneity, and Instrumental Variables
25		Thursday, April 14, 2016	HW6	HW5	IV	Two Stage Least Squares, empirical example
26		Tuesday, April 19, 2016			IV	Instruments: Strength and Exogeneity, Weak Instruments, Test of Over-identifying Restrictions, 2SLS in Stata
27		Thursday, April 21, 2016		HW6	Causality	Diff in Diff, RDD
28	Last Class	Tuesday, April 26, 2016			Catch up and Review	Catch up and Review
	Final Exam	Tuesday, May 3, 2016		Final Exam	Final Exam	Final Exam: 7:00-10:00PM, Room TBD