BOSTON COLLEGE
Department of Economics

EC 228.01: Econometric Methods (Spring 2012)
Carney Hall 106: T Th (12 – 1:15)

Christopher Maxwell
maxwellc@bc.edu
http://www.cmaxxsports.com

21 Campanella Way, 440N
Off Hrs: to be announced

This is an introductory course in the use of econometric methods, with an emphasis on empirical applications and cross-sectional analysis. Our focus will be on learning ***to do*** econometrics, not just learning econometrics. While the course will cover the development of the formal tools of econometric analysis (simple and multiple regression analysis, estimation, inference, qualitative variables, and so forth), we will also spend quite a bit of time on empirical methods (posing questions, building datasets, running regressions, supplementing datasets, running more regressions, etc etc … until we can confidently say something about the questions at hand). As such, an important part of the course will be five empirical Exercises and an empirical term paper in which students will be building their own datasets and applying the various econometric methods developed in the course.

Prerequisites: An introductory statistics course such as EC 151. No exceptions. I will also assume that students have an understanding of basic *Excel* (which will be used to assemble datasets and verify calculations) and basic calculus. I do not assume that anyone has previous exposure to *Stata*, the computer language that we will be using to run regressions. (See below for more about Stata.)

Course text: Jeffrey M. Wooldridge, *Introductory Econometrics: A Modern Approach*, Thomson South Western.

I have deliberately not listed the edition; if you decide to purchase the text, feel free to buy the 2nd (2002), 3rd (2006), or 4th (2008) editions. A copy of the text will be placed on reserve at the O'Neill Library. Note that I will also be distributing lecture notes.

Some additional texts: There is no need to purchase any of these (most are available at O'Neill). I list them just because sometimes it is useful to see a different presentation of the material.

- Angrist, Joshua and Jörn−Steffen Pischke, *Mostly Harmless Econometrics*, Princeton University Press, 2009.
- Hayashi, Fumio, *Econometrics*, Princeton University Press, 2000.
- Greene, William H., *Econometric Analysis*, 7th ed., Prentice Hall, 2000.
- Kennedy, Peter, *A Guide to Econometrics*, 6th ed., Wiley-Blackwell, 2008.
- Pindyck, Robert S., and Daniel L. Rubinfeld, *Econometric Models and Economic Forecasts*, 4th ed., McGraw-Hill, 2000.
- Stock, James H. and Mark W. Watson, *Introduction to Econometrics*, 3rd ed., Addison-Wesley, 2010.
- Studenmund, A.H., *Using Econometrics: A Practical Guide*, 6th ed., Addison-Wesley, 2011.

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Grading:

- Exercises (35%): There will be 5 Exercises over the course of the semester, each graded on a 10 point scale. These will focus on empirical applications of the tools developed in the course. Feel free to work together on these, but please submit your own write-up (unless it's a *team* assignment … more on this below). Course grades on Exercises will be curved.
- Term paper (25%): There are four requirements: Prospectus, interim bragging, presentation, and final paper. See below for details.
- Mid-Term Exam (15%): This will cover Simple Linear Regression (SLR) models. You will have at least one week's notice of the actual exam date.
- Comprehensive Final Exam (25%): Monday, May 14th @ 9:00 AM.

Only in extraordinarily compelling situations will I even consider the possibility of a "make up" exam. It is your responsibility to plan your schedule accordingly.

BlackboardVista: All handouts, exercises, exams, and answers will eventually be posted on the course's BlackboardVista site. Let me know if you have trouble accessing that material.

Academic Integrity: You will be held to Boston College's standards of academic integrity. If you have any questions as to what that means, please go to http://www.bc.edu/integrity.

Exercises: The course is structured around a set of five empirical exercises, which count towards 35% of your course grade. These will often be team assignments (with 2-3 students per team) depending on how much work is required. (I will assign teams in those cases.) Final grades on Exercises are curved.

There is no shortage of interesting questions to address or datasets to work with (see links to Stata datasets below). I have not finalized the set of Exercises… but here's my candidate list at the moment:

1. Moneyball: estimating %wins in baseball
   http://en.wikipedia.org/wiki/Pythagorean_expectation
2. S&P sovereign debt ratings: looking at Nate Silver's recent regression analysis
   http://fivethirtyeight.blogs.nytimes.com/2011/08/08/why-s-p-s-ratings-are-substandard-and-porous/#more-14347
3. Ticket prices in the NFL: Pats @ $118 v. Jaguars @ $57
   https://www.teammarketing.com/public/files/2010_NFL_FCI.pdf
4. Working with dummies (with applications to Exercises 1 and 2)
5. Jobs @ Zillow - Hedonic models of recent home sales prices
   http://zillow.hrmdirect.com/employment/view.php?req=64675&

In some cases, the Exercises are designed to give you practice with the techniques and tools we have developed in class… other times, they are designed to introduce you to new material, which we have not yet covered in class.

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Term Papers: The term paper is an empirical project and counts towards 25% of your course grade. I will assign teams of three students to work together on this assignment. Topics should showcase interesting and compelling econometric analysis, and need not be restricted to topics in Economics.

Term papers should have six parts:

1. Introduction (description of topic and summary of results)
2. Literature review
3. Description of model and nature of analysis
4. Discussion of data
5. Presentation of results
6. Conclusion

There is no page requirement, though it is hard to do a good job covering all of these dimensions of the assignment without writing at least 12-15 pages. In the past, term papers have typically been 18-20 pages in length (including tables, charts, figures, etc.).

Empirical work is slow going. Be sure to leave yourself enough time to complete the assignment to your satisfaction.

There are several milestones to keep everyone on schedule:

- Teams will be assigned in the 3rd week of classes.
- February 21st (Tu): Term Paper Prospectus due
  The prospectus should be 1-2 pages in length, describe the topic in some detail, briefly discuss the relevant literature (specifically identifying at least three relevant studies), and describe the specific data sets that will be used in the analysis. The more detailed the prospectus, the less work you will have left to do for the Term Paper. In-class presentations on the 21st. (These prospecti will be graded Pass/Fail. If you Fail, you must resubmit your prospectus until you Pass.)
- March 20th (Tu): Bragging time! Everyone gets to brag about at least one regression result… which of course means that you'll need to have at least one regression result by this date.
- April 12th (Th): Optional: Term papers may be submitted for conditional grades and comments. Students may then revise these papers if they wish.
- May 1st and 3rd (T-Th): In class presentations of term paper results.
- May 4th (F): Term papers due for grading.

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Class Topics [Wooldridge 4th ed. chapter numbers are in square brackets.]

Part A: Introduction to Econometrics and Empirical Research

1. The Nature of econometrics and economic data [Chapter 1]
    - Estimating the relationship between x and y; causality v. correlation; data types; economic v. statistical significance; robust analysis (how many regressions did you run?); art v. science
2. Carrying out an empirical project [Chapter 19]
    - The scientific method: testing hypotheses; collecting data; running regressions; doing it all again; and again; until… conclusions
3. Review of foundational basics: mathematical tools, probability and statistics [Appendices A-C]
    - Mathematical tools: Sigma notation; functional forms
    - Probability: Probability distributions (probability density functions (pdfs) and cumulative distribution functions (CDFs); measures of central tendencies (expectations) and variability (variances); joint and conditional distributions; measures of association (covariance and correlation); conditional expectations and variances
    - Statistics: Populations; estimators; sampling distributions; unbiasedness; consistency; interval estimation; confidence intervals; hypothesis testing
        - Focus on estimation of a population mean

Part B: Simple Linear Regression (SLR) Analysis

4. The SLR model: Estimation [Chapter 2]
    - Single explanatory variable; *in the beginning* (data generation process); conditional means; Population Regression Function (PRF); OLS (ordinary least squares); Sample Regression Function (SRF); sum squared residuals; goodness of fit (R^2); means and variances of OLS estimators (intercepts and slopes); Gauss-Markov assumptions (unbiasedness; homoskedasticity)
5. The SLR model: Inference [Chapter 4, portions]
    - Errors with Normal distributions; t statistics; t tests and p values; confidence intervals; F-tests; economic v. statistical significance (elasticities)
6. SLR further issues [Chapter 6, portions]
    - Scaling data; functional forms (linear and log)

Mid Term Exam on Parts A and B.

Part C: Multiple Linear Regression (MLR) Analysis

7. The MLR model: Estimation [Chapter 3]
    - OLS Take II (topics similar to Chapter 2): multiple explanatory variables; *ceteris paribus* (partial effects); omitted variable bias; multicollinearity; Gauss-Markov Theorem: BLUE (Best Linear Unbiased Estimator)
8. The MLR model: Inference [Chapter 4, portions]
    - As with SLR analysis: Errors with Normal distributions; t statistics; t tests and p values; confidence intervals; F-tests; economic v. statistical significance

Part D: MLR Analysis II

9. MLR further issues [Chapter 6]
    - Scaling data revisited; functional forms (polynomials; logs; interaction effects; etc); adjusted R^2
10. Qualitative information: Binary/categorical variables [Chapter 7]
    - Binary and categorical independent variables; binary dependent variables; linear probability models; logit and probit [sneaking a bit of Chapter 17 in here]

Part E: MLR Analysis III

11. OLS asymptotics [Chapter 5]
    - Large sample properties; consistency
12. Heteroskedasticity [Chapter 8]
    - Differing conditional variances of errors; testing; White-corrected standard errors (*robust inference*)
13. Specification and data problems [Chapter 9]
    - Misspecified models; proxy variables; measurement error in dependent and independent variables; missing data; outliers; non-random samples
14. Endogeneity: Instrumental variables and Two Stage Least Squares (TSLS) [Chapter 15]
    - Omitted variables; endogenous explanatory variables; single instrumental variables (IVs); multiple IVs and TSLS; errors in variables
15. Simultaneous equations [Chapter 16]
    - Simultaneity bias in OLS; supply and demand; identification and TSLS

This is the likely end of the semester. … but if there is time, we will continue with selections from the time series chapters in the text.

Stata (at Boston College)

There are a large number of statistical software packages that you can use to do econometric analysis. We will use Stata, one of the more popular packages and the package that receives the most support at Boston College. I will be providing more details as the semester develops, but for now:

Stata is available to BC students through the "application server", which can be accessed at https://apps.bc.edu … once a Citrix Server has been installed on your computer (you should be able to skip this step if you are using a CTRC computer). To learn how to access Stata, go to http://www.bc.edu/offices/help/teaching/app_server.html .

We will devote some time to learning how to use Stata to run regressions. (You will discover that building datasets is long, hard, tedious and unrewarding work… and running regressions is relatively quick, easy and fun.) Additionally, there are two Stata Teaching Assistants (both graduate students in Economics) with the specific responsibility of assisting students in EC 228 and in running Stata at BC. I'll provide more details when I know more.

You may also find the following resources of interest:

Getting started with Stata… just *Google* it; here are a few sites:

- http://fmwww.bc.edu/GStat/docs/StataIntro.pdf
- http://www.stat.ucla.edu/labs/pdflabs/started.pdf
- http://dss.princeton.edu/training/StataTutorial.pdf
- http://isites.harvard.edu/fs/docs/icb.topic515962.files/GettingStartedWithStata.2109.pdf
- http://www.ats.ucla.edu/stat/stata/default.htm
- There are a number of texts that might help… including:
  - Christopher Baum (2006): *An Introduction to Modern Econometrics Using Stata*
  - Lawrence Hamilton (2008): *Statistics with Stata*

Examples and datasets that accompany Wooldridge's text:

- http://fmwww.bc.edu/gstat/examples/wooldridge/wooldridge.html
- http://fmwww.bc.edu/ec-p/data/wooldridge/datasets.list.html
- http://ideas.repec.org/s/boc/bocins.html
- http://fmwww.bc.edu/ec-p/data/ecfindata.php
- http://www.ucm.es/info/ecocuan/Ectr_Ap/DATA_SET_HANDBOOK.pdf

Lots of other examples:

- http://www.ats.ucla.edu/stat/examples/