Resource Economics 312
Introductory Econometrics

*Instructor***:**   Dr. Emily Wang
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*Class Meetings***:**   MW 1:10 – 11:25 (Stockbridge Hall 124)
Office Hours: TTH 11:30 – 12:30 (Stockbridge Hall 223)
TA Office Hours: (TBA)

*Course Description***:**

The purpose of this course is to teach students how data analysis can inform strategy, within a framework centered on logical reasoning and practical communication. In doing so, we will develop the analytical tools and hands-on experience with data and economic models to optimally utilize information in decision-making, often in the context of economic consulting. The focus of the material will be on a subdivision of predictive analytics, called active prediction, which is most appropriate when evaluating business strategies. In addition, students will learn valuable, targeted computer programming skills. Finally, students will learn the basics of identification in order to better understand which data is most useful to collect when answering a given empirical question.

Goals & Objectives:

My goal is to guide you as you develop valuable econometric skills and a deeper understanding of empirical methods applicable to business settings. These are skills that you can and should add to your resume. Many of our graduates have gone on to apply econometrics in business and government to estimate or predict impacts of changes. Our alums use the tools they learned to estimate how advertising and shelf-position in stores affects sales, the market potential of new drugs, enrollment rates at academic institutions, how costs affect firm pricing decisions, and the effects of EPA polices on consumer welfare to name a few applications. More broadly, we want you to develop key critical thinking skills that all employers seek in their applicants. When you read reports as part of your first job, you will understand what analysts did to generate their results and you will be prepared to think critically about the methods they used, whether they were appropriate, and what those results mean.

Below is a list of learning outcomes for this course.
1. Students will be able to distinguish correlation from causality in regression analysis.
2. Students will be able to describe the business analytics model for a firm and the Analyst's place within it.
3. Students will be able to describe the scientific method and articulate how and why it is well suited for establishing causality.
4. Students will be able to perform and explain both deductive and inductive reasoning in the context of data analysis.
5. Students will be able to distinguish data mining from causal analysis, as well as passive prediction from active prediction.

6. Students will be learn Excel VBA.
7. Students will be able to write clearly and concisely about data analysis utilizing regression techniques to establish causal relationships among strategic variables and outcomes.

*Class Material***:**

Required
- *Excel: Applying statistics or econometrics requires the use of computers. I expect that you are proficient with* **Word** *and* **Excel***, which we use regularly for exercises and assignments. We will learn VBA (Visual Basic for Applications), which will help manage and manipulate data sets. Your term project will require that you use software to estimate your econometric model and correct problems. You will be required to demonstrate knowledge of econometrics (theory and interpretation) and your ability to estimate models on exams. I would also encourage you to learn to use the software package such as R or Stata, which is widely used in private industry and government.*

Recommended
I recommend several textbooks for your use. Lecture slides with the material you need to master will be provided for each lecture.

- *Introduction to Econometrics, by James Stock & Mark Watson*
- *Predictive Analytics for Business Strategy, by Jeffery Prince*
- *Introductory Econometrics, by Jeffrey Wooldridge*

Grades

Grades will be determined on the basis of homework, exams, and a project.

Homework (20% of your grade)

We will have roughly 6 homework assignments. Out of these, I will drop the lowest homework grade. Late homework will be assessed 5 penalty points per day (including weekend days) out of a total of 25 points (i.e. if you turn your homework 5 days late, you will not receive credit for it).

Exams (45% of your grade, 15% each)

There will be three mid-term exams. All three will be comprehensive. That is, you will need the knowledge gained over the course of the semester in each exam. Exams will be held in the Willis Lab (our classroom) during class time. You will be required to apply theory and methods from lectures, possibly use software to estimate a model, complete analyses, and interpret the results. The exam dates are tentatively set on:
1. **10-09**
2. **11-04**
3. **12-11**

Project (35% of your grade)

Form a team of two or three and think about a project for the semester. You may encounter econometric analyses in your other courses. I have some data sets that you may use if interested. If you do not find an idea that strikes you quickly, talk with me and we'll find a project for you. Begin your project immediately

by reviewing the literature related to your topic. Synthesize the literature you read to help formulate an economic model. Once you have specified your model, gather data, use statistics to describe the data, and estimate your econometric model. Mid-semester project installments are due: (1) October 2nd - a review of the economic literature on your topic, a discussion of the economic theory relevant to your research problem, your empirical model specification, parameter expectations, and a description of the data you will use (10% of your grade); (2) November 4th – add to your first installment by including additional sections describing your data, tables and charts presenting descriptive statistics, presentation of your multiple regression results including interpretations and inference (10% of your grade). Throughout the semester, you should regularly apply methods/tools we cover in class to your project data. Your final project, a revision of your prior installments plus your final analysis, interpretations and inference, is due **Dec 13th** at 11:55 PM. Installment grades are based on the organization, content, quality of your work, and your writing. The term project is 35% of your final grade. This project is a great way to build your portfolio for prospective employers!

Summarizing your Grade Calculation

As indicated earlier your exam weight (EW) can vary between 60% and 70%, depending on whether you your in-class work grade is good enough (or poor enough, depending how you look at it).

Coursework	Dates	Weight
Exams	Midterm 1: 10-09 (in class) Midterm 2: 11-04 (in class) Midterm 3: 12-11 (in class)	15% each, total of 45%
Homework (excluding the assignment with lowest grade)	Will notify you at least a week in advance	20%
Project	10-02: Review of Econ Lit 11-04: Include Data 12-12: Final Due Date	35%

Final grades will be calculated according to the following minimum cutoff points:

A = 93, A- = 90, B+ = 87, B = 83 B- = 80, C+ = 77, C = 73, C- = 70, D+ = 67, D = 60 and F<60

On-Line Material

Where is material posted? *All class materials will be posted on Moodle:*

1. General course materials: **Syllabus**, **Reading Material**.
2. **Class Lectures**.
3. **Homework**.
4. **Projects**: Will be posted throughout the semester under this title.
5. **Grades**

IMPORTANT: Moodle is where you should ALWAYS go to learn about announcements, upcoming exams, cases and anything important about the class. This means that you have no excuse such as: "I did not know we had an exam today" or "I did not know where to get the class notes". Please check Moodle before you email me asking me questions about the course.

This syllabus is subject to change. I will post any changes on Moodle.

University Statements:

Academic Honesty Statement
Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent.

Accommodation Statement
The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

Outline of Course Topics

I. The Business Analytics Model
II. The Roles of Data and Predictive Analytics in Business
    a. Data Uses in Business
    b. Data Features
    c. Basic Uses of Data Analysis for Business
    d. Data Analysis for the Past, Present, and Future
    e. Active and Passive Prediction
III. Reasoning with Data
    a. What is Reasoning?
    b. Deductive Reasoning
    c. Inductive Reasoning
IV. Reasoning from Sample to Population
    a. Confidence Intervals
    b. Hypothesis Testing
    c. The Interplay between Deductive and Inductive Reasoning in Active Predictions
V. The Scientific Method
    a. Definition and Details
    b. The Scientific Method and Causal Inference
    c. Data Analysis Using the Scientific Method
    d. Experimental vs. Non-Experimental Data
VI. Linear Regression as a Fundamental Predictive Tool
    a. The Regression Line for a Dichotomous Treatment
    b. The Regression Line for a Multi-Level Treatment
    c. Sample Moments and Least Squares
    d. Regression for Multiple Treatments
VII. Correlation vs. Causality in Regression Analysis
    a. Regression Analysis for Correlation
    b. Passive Prediction Using Regression
    c. Regression Analysis for Causality
    d. Active Prediction Using Regression
    e. The Relevance of Model Fit for Passive and Active Prediction
VIII. Making Real Data Work: Data Management in Excel
    a. VBA Objects and Meta-objects
    b. VBA Variables
    c. Program Decision-making in VBA
    d. Program Looping in VBA
    e. Nested Looping inVBA
    f. Debugging in VBA
    g. Useful VBA Functions