

ECON 490 (A3)

Applied Econometrics: Informing Economic Policy Decisions Using Descriptive and Predictive Analytics

MSPE, Department of Economics

Spring 2019

Instructor:

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DKH 101-E

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Lectures: Monday/Wednesday, 11:00 am-12:20am in DKH 215

Office Hours: 1:30-2:00pm, 3:30-4:00pm Mon, 1:30-3:30pm Tues and 1:30-2:00pm, 3:30-4:00pm Wed. Schedule time [here](#). Students can also schedule alternative appointment if necessary.

Course Description: This course will cover ways that the combination of data and economics can be used to inform economic policy and business decisions, focusing on ways that data analysis can help us better describe the economic world around us, measure outcomes of interest, target programs towards the best uses, and improve policy decisions. We will start by covering how economic and decision theory can help us understand what types of data are most useful for informing policy in what situations. We will cover how we can apply a range of statistical techniques to informing public policy, including basic sample statistics, regression, and more modern machine learning techniques, including regularized regression. We will discuss the properties of each of these techniques and illustrate them using examples from urban economics, labor economics, public health policy, the economics of crime, and economic development. Students will gain experience applying the techniques to study different policies using real-data sets and evaluating others' work. They will also be taught to understand and think about the pitfalls and challenges when applying these techniques to actual policy settings. This course is designed to be complimentary with Econ 490: Topics in Program Evaluation, which focuses on how causal inference can be used to inform policy decisions.

Course Goals: This course has three goals:

- 1) Learn about the role of data and analysis in economic policymaking and which types of data are most useful in different circumstances
- 2) Give students experience conducting data analysis themselves.
- 3) Make students informed consumers of research and discussions of economic policy involving data

Prerequisites: Econ 202, Econ 203 are strongly recommended for individuals taking this course (and econ 471 would be helpful). Please schedule a meeting with me if you have not completed Econ 202 and 203. The course assumes that students have knowledge of calculus, linear algebra, and basic statistics and econometrics. In particular, students should be familiar with basic multivariate calculus (first and second derivatives and how to obtain them), matrices and matrix operations, basic properties of random variables, calculating expectations, variances, correlations, conditional expectations and conditional variances, and multiple linear regression.

Relationship to other economics courses: This course is designed to be complementary with the Econ 490 class that I and Assistant Professor Eunyi Chung sometimes teach on the econometrics of causal inference. Students are allowed and encouraged to take both courses.

Credits: 3 credits (option for 4 credits for masters students with additional research assignment described below)

Course structure: The course will be a lecture, along with discussion and activities. Students are expected to attend all classes and participate in all discussions and activities. I will cold call throughout the semester. To facilitate in class discussions, I will provide name placards on the first day that you all are expected to bring to class every day. Computers and phones are not allowed out during class unless the student has received prior approval from the instructor.

Learning Resources:

I will post lecture notes for each class on compass2G. These will form the basis for the course.

The main reference textbook for this course is:

- *An Introduction to Statistical Learning* by Trevor Hastie, Robert Tibshirani, and Gareth James (2017)
 - This textbook can be bought new and used on amazon, and is available for free online (and on compass2G)

Additional materials, as well as assignments and practice materials will be available on Illinois Compass (<http://compass.illinois.edu>). Announcements about assignments, readings, and other course items will be posted on Compass.

This course will use Python, which is a free statistical computing language. I strongly recommend using Anaconda (python 2.7): <https://www.continuum.io/downloads>. If you don't use Anaconda, make sure to install python, IPython, IPython, Pandas, NumPy, SciPy, and Matplotlib.

Additional background materials on Python will be provided throughout the course.

Requirements:

- **Assignments:** There will be 11 assignments that together will count for 25% of the grade. I will drop your three lowest assignment scores when computing this grade. The assignments will be due on:
 - Assignment 1: Jan 23
 - Assignment 2: Jan 30
 - Assignment 3: Feb 6
 - Assignment 4: Feb 13
 - Assignment 5: Mar 6
 - Assignment 6: Mar 13
 - Assignment 7: Mar 27
 - Assignment 8: Apr 10
 - Assignment 9: Apr 17
 - Assignment 10: Apr 24
 - Assignment 11: May 1
- **Quizzes:** There will be very short quizzes (~5 minutes) on every other Monday designed to make sure that you are keeping up with the course material. These will be worth 5% of the course grade. Your lowest two quiz scores will be dropped from your grade. They will be held on:
 - Quiz 1: Jan 28
 - Quiz 2: Feb 11
 - Quiz 3: Mar 4

- Quiz 4: Mar 25
- Quiz 5: Apr 15
- Quiz 6: Apr 29
- **Midterms:** There will be 2 midterms which each count for 17.5% of the grade
 - Midterm 1: Feb 20
 - Midterm 2: Apr 3
- **Final Exam:** There will be a closed book, 3-hour exam during finals week which will cover the entire course material and be worth 35% of the grade. The final exam is currently scheduled for 7:00-10:00pm on Thursday, May 9th. Location TBD.

Extra Assignments for Those Taking for 4 Credits: Research proposal due on March 4th, Final Analysis due on May 1st. See instructor for more details.

Assignments: Will be mixture of problem sets and other assignments.

Grading: Overall Grades will be on a +/- scale and may follow a curve.

Assessment Policies:

Assignment Policies:

Student grades on their lowest two assignments will be dropped. All assignments are to be turned in at the beginning of the class in which they are due. Late assignments receive *no* credit without an instructor approved excuse. Acceptable excuses include physical and mental illness, and personal or family emergencies. A written request for an extension must be submitted at least 48 hours in advance.

Assignments can be turned in early at your instructor's office or via email. You are encouraged to work as a group with your classmates on problems sets, although you have to hand in your own solutions.

Note that we cannot grade assignments that we cannot read. Consequently, please be careful to make all assignments legible.

Exam Policy:

In the event that a student misses one of the exams, the instructor reserves the right to give the student a zero on that exam. There are no make-up exams without an instructor approved excuse. Instructor approved excuses include 1) medical reasons, in which case you should bring a letter from a medical professional describing your reason for missing the exam, 2) death or serious illness of an immediate family member or close friend (documentation required), or 3) conflict with a religious holiday. Requests for exam make-ups should be made as far in advance as possible.

We will follow the University guidelines on student conflicts with final exams. For this year's student code, see http://admin.illinois.edu/policy/code/article3_part2_3-201.html .

Regrades:

All regrade requests must be submitted in writing no more than one week after the assignment or exam is returned. The request must be written and include a detailed summary of why the student believes the grade they received was incorrect. I generally regrade the entire exam or assignment, so the grade may go up or down. Consequently, students should only request a regrade if they are very confident that the original grade they received was incorrect.

Statement on Academic Integrity

We will follow Articles 1-401 through 1-406 of the *Student Code* (beginning at http://studentcode.illinois.edu/article1_part4_1-401.html). This rule defines infractions of academic integrity, which include, but are not limited to, cheating, fabrication, and plagiarism. You are responsible for following these guidelines (ignorance is no excuse). If you have any questions about whether something would be an infraction, consult with the instructor before proceeding.

Accessibility and Requests for Special Accommodations:

This is a classroom committed to access. If there are any changes that can be implemented to facilitate your greater participation and learning, please don't hesitate to contact me so that we can make arrangements.

To obtain disability-related adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call (217)-333-4603, email disability@illinois.edu or go to the DRES website.

Please also schedule a private meeting with the course instructor to discuss your needs and requirements. The instructor will attempt to meet all reasonable course accommodations once the student self-identifies. Please note that accommodations are not retroactive to the beginning of the semester, but begin the day you contact the instructor with a current letter of accommodation from DRES.

Emergency Response Recommendations:

The university maintains guidelines for emergency responses. A list of recommendations when to evacuate and when to find shelter are available at:

http://illinois.edu/cms/2251/general_emergency_response_recommendations_8_16_13_final.docx

Floor plans for specific buildings are available at: <http://police.illinois.edu/emergency-preparedness/building-emergency-action-plans/>

Course Schedule (tentative)

1	Jan 14	Course overview, logistics, and introduction to thinking about data and economic policy
	Jan 16	What data do we need to make decisions? Economic theory
2	Jan 21	<i>Martin Luther King Jr. Holiday (no class)</i>
	Jan 23	<i>No class. Rescheduled for date TBD, week of Feb 11 or 18</i>
3	Jan 28	Introduction to python and jupyter notebooks
	Jan 30	Introduction to version control
4	Feb 4	Descriptive Analysis for Policy Topic I: Measuring current economic conditions: case study of transportation modes and income: summary statistics and regression
	Feb 6	Descriptive Analysis for Policy Topic I continued: visualizing data and uncertainty
6	Feb 11	Descriptive Analysis for Policy Topic II: Measuring changes in economic conditions: stagnant (or not-so) stagnant median wages
	Feb 13	Descriptive Analysis for Policy II continued: adjusting for compositional changes

7	Feb 18	Descriptive Analysis for Policy Topic II continued: adjusting for price-changes and time-series visualization [REVIEW FOR EXAM #1 WILL BE SCHEDULED IN EVENING THIS WEEK OR PREVIOUS ONE]
	Feb 20	Midterm Exam # 1
8	Feb 25	Descriptive Analysis III: What if we want to describe too many things? Bias and variance tradeoff
	Feb 27	Descriptive Analysis III: What if we want to describe too many things? Regularization
9	Mar 4	Descriptive Analysis III: What if we want to describe too many things? Regularization with cross validation
	Mar 6	Descriptive Analysis III: What if we want to describe too many things? Shrinkage
10	Mar 11	Introduction to prediction and economic policy
	Mar 13	Predictive for Policy Topic I (resource allocation): predicting fires in San Francisco using lasso/ridge/best subset regression
11	Mar 18	<i>Spring Break (no class)</i>
	Mar 20	<i>Spring Break (no class)</i>
12	Mar 25	Predictive for Policy Topic I (resource allocation): predicting fires in San Francisco using k-nearest neighbor
	Mar 27	Prediction for Policy Topic III (risk assessment): choosing bail using decision trees
13	Apr 1	Review for exam
	Apr 3	Midterm Exam # 2
14	Apr 8	Prediction for Policy Topic III (risk assessment): choosing bail using bagging and random forests
	Apr 10	Descriptive Analysis for Policy Topic III (Advanced Measurement): Using predictive tools to get at hard to measure variables important for policy: measuring poverty with cell phone data
15	Apr 15	Descriptive Analysis for Policy Topic III (Advanced Measurement): Using predictive tools to measure hard to measure policy related variables: cluster analysis
	Apr 17	Challenges in Using Prediction for Policy I: sample selection
16	Apr 22	Challenges in Using Prediction for Policy II: omitted payoff bias
	Apr 24	Challenges in Using Prediction for Policy III: restricted inputs and disparate impacts on disadvantaged groups
17	Apr 29	Challenges in Using Prediction for Policy IV: responses to changes in the decision rule
	May 1	Final thoughts

