Quantitative Political Methodology
course syllabus*

Winter 2011

*For all sections, last updated on January 3, 2011.
Instructor Information

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A Note to the Student

Welcome to Political Science 328. The department deems this subject matter to be of great importance: the course is required for all political science majors. Statistical competence is increasingly important in the world (not to mention political science). For example, electoral campaigns are heavily reliant on polls that can only be thoroughly understood with a statistical background; public policy arguments—in all kinds of arenas—increasingly turn on statistical evidence; and cross-national comparisons and arguments over international affairs constantly rely on statistics. Every field of political science (from Political Philosophy to International Relations) requires some level of familiarity with the strengths and weaknesses of these tools, because in the modern world most any argument will be both attacked and defended via statistical methods (on some level). If you apply yourself, this course will give you the tools to both evaluate those arguments and begin to generate your own evidence and arguments. By the end of it you should be able to
- Analyze political and social behavior using statistical skills
- Explain and deploy regression analysis including some extensions like fixed effects models, probit and logit models
- Write clearly to explain all of this

By the way, this course fulfills the university’s general education languages of learning requirement. Consequently, this is not an easy course. There is a reason it is listed as a four credit hour class. You should be planning to spend approximately twelve to fifteen hours a week outside of class on reading and homework assignments (and as much as twenty hours on some weeks). Some of you may be able to get away with less, but others may require even more time. Please carefully consider your work and class schedule in light of this commitment.

Falling behind in this course can be fatal, so you need to plan to be working very hard each week. No student should take this course without having previously completed PL SC 200, and I strongly recommend previous experience with calculus at least at the level of MATH 112 or MATH 119 (a calculus course is not strictly required). Lastly, it is useful for students to have already had a 300-level theory course (e.g., PL SC 300, 310, 350 or 370) but it is not strictly required.

Having warned you about the difficulties, I think you will find this class rewarding. Much of what you see and hear in public discourse is, quite simply, thumb-sucking drivel. And only a minimal knowledge of statistics will allow you to quickly cut through much of the nonsense and find your way to the heart of the argument. That is a skill that everyone should learn. The “Aims of a BYU Education” states that students should acquire “the capacity to understand and explain the world in quantitative terms,” giving them the capacity to access the discourse and symbolic systems of multiple disciplines. Learn the material in this course and you will have taken a large step in that direction.

Because of the nature of this course, I prepared this syllabus—somewhat more detailed than the typical syllabus—to serve as a guide for the course. My aim is to offer students a clear and detailed picture of the course components: lecture, lab, homework and computing. Of course, the ultimate aim is to better help students excel in the subject. Read this document carefully, and take its guidance seriously.

The teaching assistants and I stand ready to help you learn the material. But the ultimate responsibility lies with you. This is not a course where anyone can simply “teach” you the material. You will need to learn the material (and learn it well if you want an “A”). In a statistics course the only way to accomplish that is through seemingly endless practice. Good luck, and I hope you find the subject matter as compelling as I find it. I know that in the long run you will find that effort in this course can pay significant dividends.—JCP

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1 Please see [http://saas.byu.edu/classSchedule/policy/winter/univcore.php#10.](http://saas.byu.edu/classSchedule/policy/winter/univcore.php#10)

2 Almost no one working more than twenty hours a week should even think about taking this class. I know some of you will do so anyway. I just want to warn you in advance, that you will almost certainly get a grade lower than you think you deserve.

3 Metaphorically speaking, of course.

4 Concurrent enrollment is not acceptable: there will be no exceptions.
Course Description

Each week consists of three lectures (Monday, Wednesday and Friday 10:00 - 10:50 or 11:00 - 11:50 am). These lectures will present the week’s topic, typically in three ways: conceptual definitions, mathematics behind the concepts, and, occasionally, computing examples of the particular concept or technique. In many respects lecture is the least important part of the class. Lecture’s function is simply to introduce the ideas that students will practice later.

The single most important part of the course is homework: students will need to apply the concepts taught in the classroom to assigned homework problems. This is—by far—the most important part of the course. Each week students receive a minimal homework assignment. The problems will cover some basic concepts for recent lectures. But the best students will seek out additional problems from the textbook to better practice the techniques and understand the concepts.

Teaching assistants will hold office hours to help on problems, and a weekly lab section on Fridays, but this is no substitute for personal practice.

Course Resources

Texts

The course has one required text:


There is one additional recommended text:


Beyond these texts you may wish to consult another source (largely because it is useful to see principles explained in multiple ways). Some good ones include

- Agresti, Alan and Barbara Finlay. 2009. *Statistical Methods of the Social Sciences*. Pearson, Prentice-Hall.\textsuperscript{5}


Course lectures and homework will be geared to Stock and Watson. But the Weisberg text is probably a superior treatment of many of the topics. It is much more challenging and requires that a student strive to understand a more complex presentation of the material. But it is a valuable resource for those students willing to put in the extra effort for additional learning.

\textsuperscript{5}A couple of useful chapters from this text will be posted on blackboard, but the entire text is useful.
**Homework and Lab**

Every Friday all students attend a lab section (at 1:00, 2:00 or 3:00 pm) to receive additional instruction and help from the teaching assistants. The weekly lab section will review past homework assignments, introduce the homework problems that will be due the following Friday and discuss any remaining questions on the homework assignments that were due earlier that morning. Students should begin working on the introduced problems early (probably before the weekend is out) or they will find the problem set very difficult to complete.

It is best that students attend the assigned lab section. This is where grades are assigned and teaching assistants become most familiar with students. Consequently, this is where the best help is available. Sitting in one TA’s lab section and then submitting assignments to a different TA creates a slight disconnect that can affect grades.

All problem sets or paper assignments are to be submitted in class on the date noted in the calendar (or under Prof. Pope’s door earlier in the week). All problem sets are required but if you submit problem set 0 (in the first week) your lowest score will be replaced with twenty points. If circumstances arise where you find that you will be unable to finish a problem set on time, it is best to plan on that set being dropped. But since this exception is precious you should not use it early.

Students are encouraged to work together on problem sets and to visit the teaching assistants during office hours each week to get help. But all homework assignments must be the original work of the student. Each problem set must be submitted as a finished memo. Clarity will matter. Your answers need not always be in essay format (though sometimes they will need to be), but they must be clearly written in complete sentences. It is of no use to find the correct answer if you cannot present that answer clearly and logically. Students should treat each homework problem as a very brief paper that may require tables or graphics to best explain the concept and the answer. Sloppy homework assignments will receive significantly lower grades. All assignments must be typed, including equations and necessary tables and figures.

**Computing**

A central part of statistics is computing. There are computer labs available in the basement on the Spencer W. Kimball Tower (and in other locations on campus). These computers have several statistical programs loaded such as Stata, SPSS, S-Plus or R. While the choice

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6If we do not have it in class (or if it is not under Prof. Pope’s door earlier in the week) it is late: no excuses without Prof. Pope’s prior approval.

7I will make exceptions for things that are truly outside of your control: illness, accident, Turkish prison sentences, etc.. But bear in mind that I will probably ask for some evidence of the reason. You will not just be able to say “I didn’t feel well.” You will probably need visual evidence, a doctor’s note, or a pass from the warden.

8Cutting and pasting computer code or output is not an acceptable way to submit a homework assignment and will be penalized accordingly.

9We cannot guarantee that every computer on campus contains each of these programs. It has been my experience that they are loaded, but you cannot assume this and should do some investigating and planning in the first two weeks. You may also want to consider purchasing student versions of the programs (available
of a statistical package is ultimately left to the student, experience has shown that many prefer Stata. While other programs are sometimes more powerful, no other program combines the power, flexibility and user-ease of Stata. With its pull-down menus, the program can be deciphered quite quickly by first time users. But the program is also capable of all sorts of methods well beyond the scope of this class. Teaching assistants will be providing computing help and instruction for Stata (though Prof. Pope may occasionally demonstrate principles in other programs—particularly his favorite program: R). Occasionally an assignment will require you to use a different program (always one available in the computer labs). The purpose of this is to familiarize the student with additional programs.

Communication

The course website on Blackboard is also an important part of the course. Blackboard can be found by logging into Route Y and selecting Blackboard. From there, you can enter your BYU NetID and password to enter the site and access the site for this course. The site will contain some basic announcements about the class, homework assignments, occasional readings and exams. Students should check it regularly.

Students are required to maintain an active email account. It is your responsibility to ensure that the email address that is listed for you in the BYU directory is accurate.\textsuperscript{10} To update this address log into Route Y and select “Update Personal Information.” Here you can specify a current email address. Important and time-sensitive class announcements may come via email. Email is also the best way to reach Prof. Pope and the teaching assistants with questions.

Course Calendar

The following calendar lists the order of the topics and the (tentative) date that we will cover them. Courses sometimes do not go as planned and you should be ready to diverge from this syllabus. Any significant changes will be clearly announced in class and via email. You are responsible to stay up to date on course happenings. Students should skim the entire chapter before coming to class each week and then go back over it after lectures. Additionally students should always get an early start (Saturdays) on problem sets to avoid falling behind.

January 5 - 7—Quantitative Methods and Beginning Probability: What sorts of social science questions are amenable to quantitative investigation? How do we make causal arguments? What is a distribution and how does it relate to answering these questions? These lectures will also cover types of data available for investigation and some data summary techniques

- \textit{Introduction to Econometrics:} chapters 1 and 2, see also sections 13.1 - 13.2 on pp. 470 - 476 for some help deciphering how experiments work

\textsuperscript{10}“I did not receive an email” will never be a valid excuse.
• *Statistical Methods for the Social Sciences*, 4th edition: sections 2.1 - 2.3 and 3.1 - 3.4

• Homework 0 is due on Friday, January 7

January 10 - 14—Probability, Sampling and Large Sample Approximations:
What is the Normal Distribution? The Chi-Squared Distribution? The Student $t$ and the $F$ Distribution? How is random sampling important? What can be done without a random sample? Finally, what is the Central Limit Theorem?

• *Statistical Methods for the Social Sciences*, 4th edition: sections 4.1 - 4.6

• Homework 1 is due on Friday, January 14

January 19 - 21—Statistical Inference Hypothesis Tests and Confidence Intervals:
How do we make inferences about the population? What is the form of a hypothesis test or a confidence interval for that estimate? How do we compare different populations? Which distributions are we using in these comparisons? And what does it mean to say that data is correlated?

• *Introduction to Econometrics*: chapter 3

• *Applied Linear Regression*: chapter 2

• Homework 2 is due on Friday, January 21

January 24 - 28—Simple Linear Regression:
What is the linear regression model? How do we interpret the coefficients and measures of fit? What assumptions are necessary to fit a least squares model?

• *Introduction to Econometrics*: chapter 4

• *Applied Linear Regression*: chapter 2, sections one through five

• Homework 3 is due on Friday, January 28

January 31 - February 4—Regression, Hypothesis Testing and Confidence Intervals:
How do hypothesis tests and confidence intervals work for a simple linear regression model? How do we interpret binary predictors? What is heteroskedasticity and why is it important? What is the Gauss-Markov Theorem? These lectures will also cover small sample-size prediction and some graphical presentation of models.

• *Introduction to Econometrics*: chapter 5

• *Applied Linear Regression*: chapter 2, sections six through nine, and chapter 8

• Homework 4 is due on Friday, February 4

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11 These readings will be available on blackboard, and though the presentation may be novel the content should be a review of principles learned in PL SC 200.

12 These readings will also be available on blackboard.
February 7 - 11—Multiple Linear Regression: What can bias our model? Why is it important (typically) to have multiple regressors? What additional assumptions are we making? And what possible problems are likely to crop up in this type of model?

- *Introduction to Econometrics*: chapter 6
- *Applied Linear Regression*: chapter 3
- Homework 5 is due on Friday, February 11

February 14 - 18—Hypothesis Testing and Confidence Intervals for Multiple Regression: How do hypothesis tests and confidence intervals work in a multiple regression context? How do we test joint hypotheses? These lectures will also begin taking up the vital topic of model specification: how do we select variables to include in the model?

- *Introduction to Econometrics*: chapter 7
- *Applied Linear Regression*: chapter 4
- Homework 6 is due on Friday, February 18

February 19 - 25—Midterm Examination: There will be both a portion in the testing center (available on February 23 - 24) and a portion that is to be done at home over approximately this period (details to come). The final copy of the take-home portion will be due on Friday February 25 at 4:00 pm, under Prof. Pope’s door.

February 28 - March 2—Data Transformations and Nonlinear Functions: What about nonlinear relationships? What about situations where regressors interact?

- *Introduction to Econometrics*: chapters 8 and 11
- *Applied Linear Regression*: chapters 5, 6 and 7
- NOTE: lecture will be suspended on Friday, March 4 so that students may consult with Prof. Pope on projects. Additionally, there will be NO homework assignment this week. But it is expected that students will take this time to make significant progress on their class projects.

March 9 - 11—Internal and External Validity: How do we assess internal and external validity? Can we deal with those threats? How do we adjust our interpretations accordingly?

- NOTE: lecture will be suspended on Monday, March 7 so that students may consult with Prof. Pope on projects.
- *Introduction to Econometrics*: chapter 9
- *Applied Linear Regression*: chapter 8 and 10
- Homework 7 is due on Friday, March 11
March 14 - 18—Panel Data: What is “panel data” and why is it important? What are fixed effects? These lectures will also take up the question of specific assumptions necessary to make inferences from this type of model.

- *Introduction to Econometrics*: chapter 10
- Homework 8 is due on Friday, March 18

March 21 - 25—Binary Dependent Variables: What do we do with binary data? What is a probit model and how does it work?

- *Introduction to Econometrics*: chapter 11
- *Applied Linear Regression*: chapter 12
- Homework 9 is due on Friday, Friday March 25

March 28 - April 1—Logit: What is a logit model and how does it work? How can we use it to generate predicted probabilities?

- *Introduction to Econometrics*: chapter 12
- There is no homework assignment due this week so that students may focus on their final papers
- Rough drafts of projects are due on Friday, April 1

April 4 - 6—Review and discussion of advanced topics (e.g., Instrumental Variables, Quasi-Experiments, etc.): How can regressions be used to analyze experiments? Can it say something more concrete about causality?

- *Introduction to Econometrics*: chapter 13
- Homework 10 is due on Wednesday, April 6
- The take-home portion of the final examination will be available late in the day on April 6

April 7 - 13—Take-Home Final Examination: There will be no lectures or labs held in this period so that students may work on their final examinations.

- The out-of-class portion of the final examination is due on Wednesday, April 13 at 5:00 pm under Prof. Pope’s office door
- Please note that final drafts of the projects are also due under Prof. Pope’s door by 5:00 pm on April 19 (though they may be submitted earlier)

April 18 or 20—Final Examination (2:30 - 5:30 pm): This is the in-class portion of the final examination and may be taken at either time (though not at any other time).
Evaluation and Grading

This course is graded on a curve. This does not mean a set number of A’s, B’s and C’s. It simply means that I will look for the natural breaks between students and assign grades accordingly. You may have heard professors describe this process in the past. In this course, you will learn exactly what it means for a distribution of grades to be distinguishable from a particular value. But you should not worry too much about grades. Good marks accompany learning, which is the far more important goal.

With respect to the curve you should bear in mind that at the end of the course I use two methods to curve final grades:

1. I look at the complete point total for the course.

2. I look only at the final exam and your final paper.\(^{13}\)

The reasoning behind this is simple. Sometimes students take a while to “get” this course material. I find that some students need time to absorb the course concepts and techniques. For such students, it seems best to give them a chance to prove what they have learned at the end, without undue focus on their previous mistakes. Please do not take this system as license to avoid problem sets. A student who does not complete the required work will find it difficult—if not impossible—to do well in the course. It is true that some students simply need more time to understand the material. But no student is able to master this material without diligence and practice.

There are four major components to the course assessment (listed in the table below): weekly assignments, a midterm, a final and a research project:

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Points</th>
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<tbody>
<tr>
<td>Weekly Assignments</td>
<td>200</td>
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<tr>
<td>Midterm Exam</td>
<td>75</td>
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<tr>
<td>Final Exam</td>
<td>125</td>
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<tr>
<td>Research Project</td>
<td>100</td>
</tr>
</tbody>
</table>

Each of the course assessment components are discussed below.

Weekly Assignments

Assignments are typically due each Friday in class or under Prof. Pope’s door earlier in the week (see the course calendar for specific due dates and deviations from this pattern). There are no exceptions, except for circumstances truly outside of your control. However, if you complete assignment 0 your lowest assignment score is replaced with twenty points in your overall homework total. But, do not use this exception lightly. If you have used this up before the middle of February you will have a long two months without any security. I strongly recommend that all students do every problem set, even if the score is one that will eventually be dropped from your overall grade. To give you plenty of time, each homework

\(^{13}\)This option is available regardless of how many homework assignments you have completed.
assignment will be posted on Blackboard at least one week before it is due. There is simply no way to master this material without practice.

Though you may work in groups (indeed I think this is best), all homework assignments should be your own work. Students sometimes want to know where to draw the line on this issue. Groups should work together to discuss the assignment and help each other generate .do files\(^\text{14}\) to create computer output. But the actual submission should be the student’s own work. Tables and figures will obviously be slightly different.\(^\text{15}\) The language used to describe the output will be slightly different. If this is not true (i.e., assignments are written up in exactly the same way) then students have clearly stepped over the line and may expect to fail at least that assignment and possibly the course.

Submitted assignments should be clearly and carefully written. This class is not PL SC 200 and we will not grade to exactly the same standard that they do. However, we expect citations that are clear and formatting that is sensible. All homework assignments must be turned in with a cover sheet to facilitate blind grading. Beyond these preliminaries we have high expectations for grammar and style. Getting the correct answer is not enough. Part of each assignment is learning how to explain the concepts to a lay audience. If it helps, imagine you are writing to your sainted aunt Edna. Though spry for age 91, Edna has never had a statistics class and needs clear explanations. Do not simply submit computer output. Carefully select the most important information and place it into clear tables and figures that answer each part of the question.

Exams

The midterm exam will have two components. Half of it will be a take-home assignment that requires computing and analysis. The second half of the midterm will be given in the testing center (on February 23 and 24). This portion of the test will require analytical skill but no computing.

Though students may work in groups on homework assignments, on the midterm (and the final) you are not allowed to work in groups. Assume that any violation of this policy will result in a failing grade in the course.

The final exam will similarly be given in two parts (the in-class portion will be held on either April 18 or April 20, the choice is yours) and the same rule applies: everything must be your own work.

Course Project

During the course of the semester students should obtain an original dataset on a subject that interests them—but the dependent variable must be a continuous, quantitative variable—no exceptions: you walk before you run. The project is designed to move in stages according to the following calendar:

\(^\text{14}\)You will shortly learn what this term means.

\(^\text{15}\)This is because you will never simply submit computer output or the work will be severely penalized.
<table>
<thead>
<tr>
<th>Assignment</th>
<th>Date</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Proposal</td>
<td>Friday, February 4</td>
<td>10</td>
</tr>
<tr>
<td>Evidence</td>
<td>Friday, March 11</td>
<td>10</td>
</tr>
<tr>
<td>Rough Draft</td>
<td>Friday, April 1</td>
<td>10</td>
</tr>
<tr>
<td>Final Draft</td>
<td>Tuesday, April 19</td>
<td>70</td>
</tr>
</tbody>
</table>

The *project proposal* should be single double-spaced page of text with 1-inch margins, in at least an 11 point font. It should explain the research question and give a couple of literature citations to make clear why the topic is important and interesting. Following the page of text, the proposal should have at least one table summarizing the key points about the data and a figure or two of any relevant distributions (i.e., histograms), each of these tables and figures placed on a separate page. It should also clarify the source of the data: is it a random sample or an exhaustive sample, or something else? How are the key variables distributed? The proposal is worth 10 points, but the real benefit is finding the data and getting a start on the project.

The *evidence* is merely a series of finished tables and figures that consists of at least the following.

- One table should describe the project variables (similar to the proposal).
- Each project must include two figures.
- One table or figure must involve model diagnostics (i.e., checking on heteroskedasticity, multicollinearity, the quality of the fit, etc.).

Each table or figure should be accompanied by a brief accompanying paragraph on the same page that describes what is important about the table. The tables will be graded on clarity and analysis (both in this portion of the assignment and in the final version). Part of clarity is producing enough tables to be convincing, but not so many that the point is lost. This assignment is worth 10 points.

The *rough draft* should be a short essay consisting of no more than five pages of text (double-spaced with 1-inch margins, in at least an 11 point font) describing the problem, the literature (this first part should be no more than a paragraph or two at most) and then focusing on the empirical analysis (including a discussion of the methods you used and any limitations on your analysis). The five-page limit does not apply to a title-page, bibliography or the tables and figures. The rough draft is worth 10 points, but the real value is producing a document that helps you clarify your thinking and prepare for the final draft. It is due in class on April 1.

The *final draft* is merely a revision of the rough draft. However, it is worth 70 points. This won’t be due in in class, but should be slipped under Prof. Pope’s door by 5:00 pm on Tuesday, April 19 during finals week.

Professor Pope will be discussing additional points about the project as the class moves along.
Academic Integrity

Academic honesty is at the heart of academic life and the honor code at this university. Some students who would never think of a violation of the Word of Wisdom will not hesitate to cheat on an exam or plagiarize a paper. See the section of the BYU homepage devoted to the honor code for details on the academic honesty policy. Assume that clear cases of dishonesty may result in a failing grade in the course.

Course Logistics

Incompletes

This course adheres to University policy on incompletes, which is that an incomplete (I) is given only when circumstances beyond the student’s control make it impossible to complete the required work within the prescribed time. Arrangements must be made between the course coordinator and the student prior to the end of the semester. The “I” is never given when a student is failing or has failed the course.

Preventing Sexual Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education. Title IX covers discrimination in programs, admissions, activities, and student-to-student sexual harassment. BYU’s policy against sexual harassment extends not only to employees of the university but to students as well. If you encounter unlawful sexual harassment or gender based discrimination, please talk to your professor; contact the Equal Employment Opportunities Office at 422-5895 or 367-5689 (24-hours); or contact the Honor Code Office at 422-2847.

Students With Disabilities

Brigham Young University is committed to providing a working and learning atmosphere which reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (422-2767). Reasonable academic accommodations are reviewed for all students who have qualified documented disabilities. Services are coordinated with the student and instructor by the UAC office. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures. You should contact the Equal Employment Opportunity Office at 422-5895, D-282 ASB.

How to Study for Quantitative Political Methods

You probably want to do your best in this course—a laudable goal. To that end I suggest that you can improve your chances significantly if you heed the following advice.
Read the text before you come to class, but bear in mind that you will need to refer back to the texts often in your study. It is not enough to read the material once. Your textbook is not just to prepare you for lecture, but also a reference on the material.

Attend lectures faithfully and take careful notes on the concepts. In lecture, focus more on understanding the concepts, rather than on computing or copying down each slide. Remember that your class notes are also a reference that you will need later in the course. So keep your notes legible.

Finally, as is emphasized above, there is no substitute for practice. Begin each week’s homework assignment early (you should at least look at it on Saturday). Be ready to come see Prof. Pope and the teaching assistants with questions by the middle of the week and have a draft of your finished assignment ready before you come to lab on Fridays. If you do these things you won’t fall behind. Additionally, students should be trying out other problems that they find in the textbook or that they make up on their own. You should always be trying to familiarize yourself with the practice of analyzing data.

Mental exercise is like physical exercise in that no one else can do it for you. Because you were admitted to this highly competitive university in the first place, I assume that you are bright, willing, responsible and eager to learn. Life will confront you with similar assumptions.