

# PUBP 602 Quantitative Methods I

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Professor Paul Manna  
Department of Government  
Thomas Jefferson Program in Public Policy  
30 Morton Hall

<http://pmanna.people.wm.edu/>  
[pmanna@wm.edu](mailto:pmanna@wm.edu)  
221-3024

*Course meetings:* 201 Morton Hall, MW 9:30-10:50

*Office hours:* T 3:30-5:00, F 2:00-3:30, and by appointment

*TA:* Mackenzie Doss, [mcdoss@email.wm.edu](mailto:mcdoss@email.wm.edu); office hours: MW 3:30-5:00 and Th 3:00-4:30

## 1. Course overview

Quantitative evidence has become increasingly important for informing solutions to challenging policy problems. However, statistics do not “speak for themselves.” If poorly generated they mean nothing or can do great harm. If poorly presented or explained they can misinform, mislead, or confuse their audiences. Thus, possessing the ability to create, interpret, and present quantitative evidence is essential for anyone beginning a career in public policy. Even if you never personally generate statistical results after you leave William & Mary you will inevitably have to evaluate the quantitative findings of others.

With that preface let me welcome you to PUBP 602. This class serves four important purposes. First, it provides an introduction to applied statistical methods. Second, it prepares students for more advanced statistics courses. Third, it emphasizes writing about and communicating statistical results to readers who may lack statistical training. Finally, it will help you develop the habits of mind that will make you careful users of data and statistical computing. To serve those ends, in this class you will develop quantitative skills by actually practicing them.

Some of you may possess little or no quantitative background. That’s okay. The work is challenging, but not impossible. If you already have statistical experience, please talk with me immediately to determine whether you should take this course.

## 2. Course materials

### 2.1 Readings

We will use the following required text in PUBP 602 and PUBP 603.

- Jeffrey M. Wooldridge. 2013. *Introductory Econometrics, A Modern Approach, 5th edition*. ISBN 9781111531041. Note: The 4th edition will work, too.

These great supplemental references are free.

- Online Statistics: An Interactive Multimedia Course of Study. <http://onlinestatbook.com/index.html>.
- StatSoft. The Electronic Statistics Textbook. <http://www.statsoft.com/textbook/stathome.html>.
- UCLA Institute for Digital Research and Education (IDRE). Resources to help you learn and use Stata. <http://www.ats.ucla.edu/STAT/stata/>.

## 2.2 Software

As I mentioned during orientation, we will use Stata in PUBP 602, PUBP 603, and in your other courses such as the Policy Research Seminar. I *strongly* urge you to buy the program.

Fortunately it is available at a discounted rate via the Stata GradPlan. Here's how to purchase it:

- Surf to <http://www.stata.com/order/new/edu/gradplans/gp-campus.html>.
- On that page, I would recommend purchasing Stata/IC 13 with perpetual license (\$189.00) or Stata/SE 13 with perpetual license (\$395.00).
- Do NOT buy Small Stata 13. It has very limited capabilities.
- If not purchasing as a download, you can pick up your order at the Information Technology office in Jones Hall, next to Morton.

## 3. Assignments and grading

### 3.1 Grading

I will calculate course grades based on the following items. You need to complete all items to receive course credit. Students not completing all items will receive an Incomplete.

Percent	Item
20	Homework assignments
30	Exam 1
30	Exam 2
20	Final paper

In general, I will base grades on the following percentage scale with partial-percents typically rounded to the nearest full percent: A=93-100; A-=90-92; B+=88-89; B=83-87; B-=80-82; C+=78-79; C=73-77; C-=70-72; D+=68-69; D=63-67; D-=60-62; F<60.

In a graduate class such as this, any grade below a "B" on any assignment, exam, or paper suggests that a student is having trouble grasping basic course ideas, which are essential building blocks for future courses and the work world. Please talk with me or Mackenzie (or both) if you find yourself having difficulty.

Finally, because errors sometimes creep into grade calculations (and on rare occasions assignments are misplaced after they have been handed in) please keep a copy of all work submitted for this course until final grades have been processed.

### 3.2 Homework assignments

These assignments will focus on real life policy questions. It is crucial that you complete these assignments on time. Grading will stress two things: (1) the degree to which you have made a strong effort to complete all parts of each assignment; and (2) the extent to which your work, especially the statistical computing component and the writing component, is polished and professionally done.

### 3.3 Exams

We will have two take-home exams. Both will ask you to perform calculations and will emphasize interpreting results. The exams will be open-book and open-note.

### ***3.4 Final Paper***

The course's capstone paper will provide you an opportunity to use your quantitative skills in an area that you choose. I will make some data sets available but you may also use data from another source. More details about the paper will be forthcoming.

## **4. Other important notes**

### ***4.1 Daily class operation***

You will develop professional habits of mind and get the most out of class by doing these things.

#### The night before class:

- Do the readings. Even skimming the relevant pages for 15 minutes will be worth it. Do not expect to understand the material after only one read.
- Check Blackboard for files to download for class. Download handouts, data sets, and Stata .do files and save to your personal H:\ drive. *I strongly encourage you to print out the .pdf handouts that I post to Blackboard, or have the ability to annotate them electronically.*
- Charge your laptop battery. Unfortunately, outlet power is not always conveniently located in our classroom, so don't rely on plugging in your machine during class.

#### At the beginning of each class before lecture begins:

- Arrive on time and quietly take your seat if you are late.
- Have Stata running on your laptop computer or be sitting next to someone who does.
- Close your email and Internet entertainment and disable all other electronic distractions.

#### During class:

- Ask questions when you do not understand something.
- Do not attend to email, the Internet, or other electronic distractions, including phones.

### ***4.2 Appropriate use of computers in class***

As section 4.1 suggests, your laptops will be powerful educational tools for this class. However, do not let them or other electronic devices distract you, your fellow classmates, or me from our in-class work. Students who use electronic devices in class inappropriately suggest that they possess neither the intellectual focus nor the respect for others needed to do real professional work. Those students end up developing reputations that make it difficult for faculty members to give them strong recommendations to other professors and future employers.

### ***4.3 Academic misconduct***

I begin each semester by assuming that academic misconduct will not be an issue, but as a policy matter I mention this on every syllabus. For any questions about policies regarding cheating, plagiarism, or other types of misconduct, please refer to the web site of the William & Mary Honor Council and the relevant pages about the Honor Code from the Student Handbook. If I discover a student violating the Honor Code I will initiate an Honor Council proceeding and, at a minimum, recommend to the Council that the student receive an "F" for the course. I take this issue extremely seriously, and hope you do, too.

### ***4.4 What you can expect from me***

So far I have said a lot about what I expect from you. A fair question, though, is: What can you expect from me? First, and above all, I will not ask you to do things that waste your time. In

fact, *everything I will teach or require of you is based on the best practices of professional policy analysts and academic researchers.* In my own work I try to live up to the standards I will be teaching you. Second, Mackenzie and I will offer lots of honest feedback in office hours, via email exchanges, and on your written work. If our comments seem confusing, harsh, or unclear then let's talk it over. Finally, I promise to treat you and your ideas with fairness and respect.

## 5. Schedule

We will adjust this schedule as needed. Any changes to assignment or exam due dates will provide you with more time, not less time, to complete the work. You'll notice that the reading assignments repeat for some days. That is intentional because re-reading certain pages in a new context will help to deepen your understanding of prior concepts while establishing new ones.

### 5.1 Introduction

W 8/28	Course and Stata overview
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### 5.2 Data Description

M 9/2	Measurement <ul style="list-style-type: none"> <li>StatSoft. Read the brief section on this page called "Measurement Scales": <a href="http://www.statsoft.com/textbook/elementary-statistics-concepts/">http://www.statsoft.com/textbook/elementary-statistics-concepts/</a>. As you read, try to think of some policy-relevant variables that would be examples of each variable type.</li> </ul>
W 9/4	Describing one variable: Summarizing central tendency and spread, and Stata basics <ul style="list-style-type: none"> <li>Wooldridge, A.1. The Summation Operator (pp. 703-705). Focus on his discussion of "average" and "median."</li> <li>UCLA IDRE site. "Descriptive information and statistics," <a href="http://www.ats.ucla.edu/stat/stata/modules/descript.htm">http://www.ats.ucla.edu/stat/stata/modules/descript.htm</a> .</li> <li>UCLA IDRE site. "Labeling data," <a href="http://www.ats.ucla.edu/stat/stata/modules/labels.htm">http://www.ats.ucla.edu/stat/stata/modules/labels.htm</a>.</li> <li>UCLA IDRE site. "Creating and recoding variables," <a href="http://www.ats.ucla.edu/stat/stata/modules/vars.htm">http://www.ats.ucla.edu/stat/stata/modules/vars.htm</a>.</li> </ul>
M 9/9	Describing one variable: Probability distributions <ul style="list-style-type: none"> <li>Wooldridge, B.1 Random Variables and Their Probability Distributions (pp. 722-727) and B.3 Features of Probability Distributions (pp. 730-737).</li> <li>Online Statistics, "Basic concepts," <a href="http://onlinestatbook.com/chapter5/basic.html">http://onlinestatbook.com/chapter5/basic.html</a>.</li> </ul>
W 9/11	Describing one variable: Probability distributions (cont.) <ul style="list-style-type: none"> <li>Re-read Wooldridge, B.1 Random Variables and Their Probability Distributions (pp. 722-727) and B.3 Features of Probability Distributions (pp. 730-737).</li> <li>National Institutes of Standards and Technology, "Gallery of distributions" at <a href="http://www.itl.nist.gov/div898/handbook/eda/section3/eda366.htm">http://www.itl.nist.gov/div898/handbook/eda/section3/eda366.htm</a>. Do two things here: (1) Focus on the visuals (but try puzzling through the formulas) for these distributions: normal, t, F, chi-square, and Poisson. How would you describe them? (2) Try to understand the distinction between these terms used to describe each distribution: "Probability Density Function" and "Cumulative Distribution Function."</li> </ul>

**Friday, September 13. HOMEWORK #1 DUE TO MACKENZIE BY 5PM**

M 9/16	Describing one variable: Visual display using Stata's graphics commands <ul style="list-style-type: none"> <li>UCLA IDRE site. "Introduction to graphs in Stata," <a href="http://www.ats.ucla.edu/stat/stata/modules/graph8/intro/graph8.htm">http://www.ats.ucla.edu/stat/stata/modules/graph8/intro/graph8.htm</a>. Study the first six graphs shown (2 histograms and 4 box-plots). How would you describe them?</li> </ul>
W 9/18	Describing relationships between two variables: Contingency tables <ul style="list-style-type: none"> <li>Wooldridge, B.2 Joint Distributions, Conditional Distributions, and Independence (pp. 727-730).</li> </ul>
M 9/23	Describing relationships between two variables: Scatterplots and correlation <ul style="list-style-type: none"> <li>Wooldridge, B.4 Features of Joint and Conditional Distributions (pp. 737-745).</li> <li>UCLA IDRE site, "Introduction to Graphs in Stata," <a href="http://www.ats.ucla.edu/stat/stata/modules/graph8/intro/graph8.htm">http://www.ats.ucla.edu/stat/stata/modules/graph8/intro/graph8.htm</a>. Study the last 7 graphs on the page that come after the pie chart.</li> </ul>
W 9/25	Describing relationships between two variables: Scatterplots and correlation (cont.)

**Friday, September 27. HOMEWORK #2 DUE TO MACKENZIE BY 5PM**

M 9/30	In-class simulation
W 10/2	Describing relationships between two variables: Regression <ul style="list-style-type: none"> <li>Wooldridge, A.2 Properties of Linear Functions (pp. 705-709). Then read the first two paragraphs (p. 710) of A.3 Some Special Functions and Their Properties and skim the pictures in section A.3. How do the pictures in A.2 differ from the pictures in A.3?</li> <li>Wooldridge, B.4 Features of Joint and Conditional Distributions, re-read part on "Conditional Expectation" (pp. 741-742).</li> <li>Wooldridge, Chapter 2. The Simple Regression Model, sections 2.1, 2.2 (study the figures; you can skim the text), and 2.3.</li> </ul>
M 10/7	Describing relationships between two variables: Regression (cont.) <ul style="list-style-type: none"> <li>Re-read the assignment from 10/2. Be sure you can interpret the discussion in example 2.1 (p. 23), example 2.2 (p. 24), example 2.3 (p. 32), example 2.4 (pp. 33-34), and example 2.5 (p. 34).</li> <li>Woodridge, A.3 Proportions and Percentages (pp. 707-709). Be sure you understand the discussion in example A.3 (p. 709). If you ever misuse or conflate the concepts "percentage change" and "percentage point change," later you will be placed in the pillory in Colonial Williamsburg to pay for your statistical crimes. See: <a href="http://www.flickr.com/photos/36652543@N06/6046817425/">http://www.flickr.com/photos/36652543@N06/6046817425/</a>.</li> </ul>
W 10/9	No class—Washington program trip
M 10/14	No class—fall break

**5.3 Statistical inference**

W 10/16	Population, sample, and sampling distributions <ul style="list-style-type: none"> <li>Wooldridge, C.1 Populations, Parameters, and Random Sampling (pp. 755-756) and C.2 Finite Sample Properties of Estimators (pp. 756-763). Try hard to understand the message conveyed in Figure C.1 (p. 759) and Figure C.2 (p. 761).</li> </ul>
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**Friday, October 18. TAKE-HOME EXAM #1 DUE TO MANNA BY 5PM.**

M 10/21	Population, sample, and sampling distributions (cont.) <ul style="list-style-type: none"> <li>Wooldridge, C.3 Asymptotic or Larger Sample Properties of Estimators (pp. 763-767).</li> </ul>
W 10/23	Probability revisited: Working with the normal distribution <ul style="list-style-type: none"> <li>Wooldridge, B.5 The Normal and Related Distributions (pp. 745-752). Today will focus on the normal distribution, but soon we will begin using the other distributions as well.</li> </ul>
M 10/28	Confidence intervals and hypothesis testing <ul style="list-style-type: none"> <li>Wooldridge, C.5 Interval Estimation and Confidence Intervals (pp. 770-777). The paragraph on p. 771 that contains the phrase “A confidence interval is often interpreted as follows...” is very important, as is the “rule of thumb” at the bottom of p. 775.</li> </ul>
W 10/30	Confidence intervals and hypothesis testing (cont.) <ul style="list-style-type: none"> <li>Wooldridge, C.6 Hypothesis Testing (pp. 777-789). The section on “Practical Versus Statistical Significance” (p. 788) is very important.</li> </ul>

**Friday, November 1. HOMEWORK #3 DUE TO MACKENZIE BY 5PM**

M 11/4	Confidence intervals and hypothesis testing (cont.)
W 11/6	Inference for means and differences of means <ul style="list-style-type: none"> <li>Online Statistics, “Single mean,” <a href="http://onlinestatbook.com/chapter10/single_mean.html">http://onlinestatbook.com/chapter10/single_mean.html</a>.</li> <li>Online Statistics, “Difference between two means,” <a href="http://onlinestatbook.com/chapter10/difference_means.html">http://onlinestatbook.com/chapter10/difference_means.html</a>.</li> </ul>
M 11/11	Inference for means and differences of means (cont.)
W 11/13	Inference for regression <ul style="list-style-type: none"> <li>Online Statistics, “Inferential statistics for b and r,” <a href="http://onlinestatbook.com/chapter12/inferential.html">http://onlinestatbook.com/chapter12/inferential.html</a>. You can focus on the discussion of the slope rather than the correlation coefficient.</li> </ul>

**Friday, November 15. HOMEWORK #4 DUE TO MACKENZIE BY 5PM**

M 11/18	Inference for regression (cont.)
W 11/20	Inference for contingency tables <ul style="list-style-type: none"> <li>Online Statistics, “Contingency tables,” <a href="http://onlinestatbook.com/chapter14/contingency.html">http://onlinestatbook.com/chapter14/contingency.html</a>.</li> </ul>
M 11/25	In-class simulation
W 11/27	No class—Thanksgiving break
M 12/2	Error in hypothesis testing <ul style="list-style-type: none"> <li>Online Statistics, “Significance testing,” <a href="http://onlinestatbook.com/chapter9/significance.html">http://onlinestatbook.com/chapter9/significance.html</a>.</li> <li>Online Statistics, “Type I and Type II errors,” <a href="http://onlinestatbook.com/chapter9/errors.html">http://onlinestatbook.com/chapter9/errors.html</a>.</li> </ul>
W 12/4	Multiple regression warmup <ul style="list-style-type: none"> <li>Wooldridge, re-read Chapter 2. The Simple Regression Model, sections 2.1, 2.2, and 2.3.</li> <li>Wooldridge, Chapter 3. Multiple Regression Analysis: Estimation, section 3.1.</li> </ul>

**Tuesday, December 10. TAKE-HOME EXAM #2 DUE TO MANNA BY 5PM.**

**Wednesday, December 18. FINAL PAPER DUE (VIA EMAIL) TO MANNA BY 5PM**