APPLIED ECONOMETRICS

Econometric Methods Applied to Cross-Section and Panel Data Sets

Christopher Ferrall

Queen's University

Version 1.0
Printed: 2017-01-06

CODE: _____

452

I. Introduction & Overview

This section of Econ 452 concerns the practice of MICROeconometrics. Applied econometrics is both a science and an art. This course builds on the foundation of Econ 250 and Econ 351 to develop both aspects. Classes will consist of a mix of lectures, demonstrations and individual and group exercises. The meetings will take advantage of the active learning classroom, Ellis 319.

The primary determinant of the course grade is the Course Project. The Course Project requires students to find data to apply microeconometric techniques in order to address a question of interest. Students can find look for data in several repositories of research data sets covering Canada, the U.S. and other countries. They can also look for other sources of data.

Several take-home and in-class tasks are assigned before the project. There are three types of tasks:
- Individual in-class quizzes
- Partner take-home assignments
- Group in-class activities

These tasks are assessed (graded) for demonstrating a minimum standard. That is, they are all Pass/Fail. Your base grade before the Course Project is determined by how many of these tasks you pass, as explained below.

These notes are divided into five parts:
- This first introductory section
- An overview of statistics and econometrics ("what to do" in the Course Project)
- Explanation of Stata and microeconometric data sets("how to do" the Course Project)
- Description of some of the take-home and in-class tasks
- Econometric research reports and the Course Project

The notes are still in progress. Not everything covered in class or needed to do well on the Course Project is contained in this version.

A. Outline

I. Review & Reenforcement of Econ 250/351
- A. Probability, Random Variables, Distributions, Expectations, Hypothesis Testing
- B. Normal and Related Distributions
- C. Two Univariate Probability Models: Bernoulli and one-variable normal linear "regression".
- D. Likelihood and Maximum Likelihood
- E. Bivariate Normal Linear Regression and Bivariate Probit (and Logit)
- F. Implementation in Stata

Milestone A

At this point a successful student will be able to use Stata to manipulate and explore data sets and to interpret the some of the output of the regress and probit commands. They will be somewhat familiar with how Stata deals with missing data, weighted sampling and categorical variables. Student understanding of background material will be refreshed and augmented by the concept of likelihood and some technical aspects of probability not emphasized earlier.

II. Multivariate Econometric Models
Concepts
- A. Conditional Distributions, Expectations
- B. Matrix Notation and Random Vectors
- C. Multivariate Linear Regression and Probit/Logit

D. MLE and/or OLS

E. Likelihood Ratio and Other Tests

F. Functional Form and Specification of Econometric Models

G. Implementation in Stata

Milestone B

At this point a successful student will be able to choose among common specifications of multivariate regressions and probits. They will be able to interpret all the output of related Stata commands and use the results and other commands to test hypotheses, form predictions with confidence intervals and identify potential problems with the model.

III. Advanced Techniques for more complex data

A. Panel Data Methods (fixed and random effects)

B. Instrumental Variables

C. Tobit, Ordered Probit, Multinomial Logit (probit)

D. Implementation in Stata

Milestone C

Successful students will have a basic understanding of how to relax limitations of standard (ideal) assumptions of econometric models to handle complex data sets and deeper questions of interest. They will understand the basic use of Stata commands to carry out the estimation.

IV. The Research Process

A. Steps in an Applied Econometric Project

B. Format and Content of a Report

C. Reading and Assessing Applied Econometrics

Milestone D

Successful students will be able to read an applied econometrics article using techniques covered in the Econ 250-351-452 sequence to find the key aspects and possible weaknesses of the analysis. Given a topic and estimation results, students will understand how to write a report to communicate their results in a way expected by trained economists.

B. Resources

onQ

onQ/Econ452 will be used for submitting Course Projects, Peer-Review Reports and other tasks.

Stata

Students are expected to purchase a copy of Stata/IC for use in this course. (Details provided later in the notes.) Stata is also installed on the computers in Dunning 350 for your use, but that room has limited opening times and *should not be solely relied on for completing the projects*.

CF452 Stata

Stata data sets and programs that supplement our study of econometrics are provided at the CF452 site accessed directly in Stata. This Stata material is hosted here: `http://edith.econ.queensu.ca/CF/452`. Explanation for accessing this information is given in the *Starta* section (I.D).

Hardware

Students are expected to have access to a laptop with Stata installed on it during class and extra Stata tutorials. Two students can sit together and use one laptop, and this will count as access. In this case both students are encouraged to spend time doing the work and not have one student always looking on. But you may find having access to Stata in any lecture useful. Students may also find it helpful to access other material online during class.

Lecture notes & Textbook

These notes supplement prerequisite material. Some material may be presented in class that is not in these notes. It is the student's responsibility to obtain material present in class from other students.

No other text is required for this course. The references below cover much of the material and are readily available if you wish to supplement the notes.

Supplementary texts

- Your textbooks and lecture notes from the prerequisite courses
- *Introductory Econometrics: A Modern Approach*, Jeff Wooldridge, South-Western.
- *Using Stata For Principles of Econometrics*, Lee C. Adkins And R. Carter Hill, Wiley.
- *Basic Econometrics*, Damodar N. Gujarati, McGraw Hill.
- Wikipedia entries on the statistics topics is typically accurate, although some entries may follow different notation and conventions.

TurnItIn.Com

You will submit the report of the Course Project as a PDF to the DropBox for the project onQ. Every submitted report will be uploaded by us to turnitin.com which will confirm that your text does not contain plagiarized material. Turnitin is very sophisticated. It is not fooled by changing a few selected words from a paragraph.

3

A snip of the summary of turnitin analysis

TITLE	SIMILARITY ▼
❗ FP23_assignsubmission_file_Final.2.pdf	100% ■
FP23_assignsubmission_file_Final.pdf	97% ■
FP23_assignsubmission_file_FinalProject....	93% ■
❗ FP23_assignsubmission_file_Final.3.pdf	81% ■
❗ FP26_assignsubmission_file_Link to Data ...	66% ■
late	36% ■
FP6_assignsubmission_file▮▮▮	16% ■
FP27_assignsubmission_file▮▮▮	14% ■
❗ FP17_assignsubmission_file_452ProjectLog...	14% ■
FP26_assignsubmission_file▮▮▮	12% ■
FP22_assignsubmission_file_HM 452project...	12% ■
FP1_assignsubmission_file▮▮▮	12% ■
FP9_assignsubmission_file_Final 452 Proj...	11% ■

Turnitin produces a similarity score for your report.

These are duplicate files ... so their scores are very high and are marked red. because they match other submissions (not shown). But it is easy for me to see this so these scores are ignored.

This student had trouble ... and thought they could lift much of their report from an obscure working paper. Turnitin.com found it. The student failed Econ 452.

These scores are marked green because their scores are low. The instructor can see what sources are similar and why ... often because the report cites papers which use the same data, variable names, etc. NO Problem!

This screenshot is part of the summary of the report that turnitin produced for Econ 452 F2015. I can see a line-by-line comparison of each report and external sources. Almost all reports were honest. The matches were due to discussing reference papers and using data sets that other papers use. One student thought they could fool the system.

Example Articles and Past Projects

Several articles are used as models for students learning to carry out and report an econometric analysis. Links to these items are onQ.

C. Assessment
Assignments & Grades

PRELIMINARY TASKS/QUIZZES/ACTIVITIES

These items are all marked as Pass/Fail with corresponding scores 0/1.

Quizzes (Individual)

There will be two individual in-class, paper-only quizzes to test basic understanding of Stata. These quizzes will be short and time limited. They will each be followed immediately in the same class by a group tournament.

Take Home Tasks (Partners)

- Billy Joel Sociology
- Homer Simpson Econometrics
- Prop Joe Prospectus

Students can work on these tasks alone or with a partner. Partnerships can be different for each task but partners are "pre-committed" before the task is due. Once committed both partners get the same score on the task.

Inclass Group Tournaments

Activities (Randomly Assigned Groups of 5 or 6 students)
- Don't Look Back in Anger: Econ 250/351 Review Questions.
- Should Have Been an Engineer: data description, variable construction, summary stats
- Levittation: Choose a Y variable, X variable and Model Specification
- Dissect an Applied Econometrics Article

Notes: Activities are competitive between groups. At most half of the groups receive a 1, others receive a 0. Attendance is taken 15 minutes after class starts and only group members present from then on are eligible for the point.

Based on these items, each student will have a score between 0 and 8 (or more). This score determines the minimum course grade of the student. (See MVP below.)

```
#passed      MINIMUM Course Grade
--------------------------------
  0-2             F
  3-4             D
   5+             C
```

NB: If for some reason the number of individual/partner tasks actually assigned falls below 5, due to instructor illness or other course interruptions, then the cut-offs will be modified./dd>

COURSE PROJECT

The course project can be done alone or with a partner. As with take home tasks, partners pre-commit.

MVP (Most Valuable Partner)

Up to two students working with a partner may be given the MVP award. This requires that their contribution to the Course Project was clearly much greater than equal. It is not tied directly to the quality of the project. Instead it is a mechanism to compensate students whose partner's shirk. A project MVP award is worth 1 point added to the number of passes.

Mapping of Preliminary Tasks and Project Score to Final Course Grades

```
Project|    # of tasks passed
Score  |  0-2     3-4       4+
-------|-----------------------
   0   |   F       F        F
   1   |   D-      D+       C+
   2   |   D       C-       B-
   3   |   D+      C        B
   4   |   C-      C+       B+
   5   |   C       B-       A-
   6   |   B-      B        A
   7   |   B       B+       A+
```

Course Project Milestones

The guide below gives "milestones" that projects will pass to get different scores. But because of the wide variety of projects and the many dimensions to consider the grade will be based on the report in full. For example, someone might have something that doesn't make sense in their specification but otherwise did a really good job. So in one aspect the project might not meet the "5 points" standard but in other ways look like an "6 point" paper. In this case you can think that the project would get some "credit" towards the "6 point" milestone but not all the points toward the "5 points" milestone. However, in the end there is no arguing over "points", there is just a score that sums up the judgment of the TA and the instructor.

Milestone 0:

A score of 0 will be given if a complete report is not submitted on time; or if what was submitted did not meet a very minimum standard; or there is compelling evidence of academic dishonesty. In the latter situation students will be given a provisional score of 0 and then provided an opportunity to explain the situation in person.

Milestone 1: (Just) Meeting Standard [1 points]

The report does not contain plagiarized elements; data was acquired that meets the minimum standards; an econometric model covered in 452 was estimated on the data; the report contains proper English and gives the reader a reasonable idea of what was done and why; the log file produce the results presented in the report.

Milestone 2: Getting Beyond the Minimum [3 points]

The data are handled properly with no obvious errors; the specification makes sense; the relevant literature provides some support for the analysis; the report is complete and formatted according to the models provided; the report makes it clear what was done and why.

Milestone 3: One or More Excellent Feature [2 points]

One or more of the following apply: complicated data were accessed and handled properly; sophisticated model or set of models were estimated correctly; the topic is complex but also closely connected to its literature; the results are used in a sophisticated way with real insight; in style the report is similar in quality to a published applied econometrics article.

Milestone 4: Undergraduate(s) produced this for a course? [1 point]

The project and the report are similar in ambition, originality and clarity to the top half of the summer research essays produced by Econ Master's students every year.

D. StaRta
Getting Started with Stata

Why do we use `Stata`?

There pros and cons to any resources required in a class (textbooks, software, etc).
The pros of Stata include:
- It has been the leading statistical package in micro-econometrics (and other disciplines) for at least two decades. It is a platform and a standard that comes up with many resources.
- Because it is well-established standard many data sets you might use for this class are provided in Stata format
- It makes handling data and carrying out the estimation for the final project easy (at least as easy as possible).
- For producing verifiable results it is better than using a spreadsheet like Excel
The cons of Stata include:
- It is a commercial product so it is not free. The "Grad Plan" purchasing arrangement we use for you to purchase Stata is priced just low enough that it is justified, but high enough that you will not see it as cheap.