Econometrics IV
Econ 722
Spring 2019

Course Instructor: Francis DiTraglia
Office: PCPSE 630
Office Hours: M 3–4pm, R 4–5pm

Lecture Time and Location: TR 1:30–3PM PCPSE 203

Website and Courseware: Lecture slides and notes, as well as problem sets and a copy of this syllabus are available at `http://ditraglia.com/econ722`. Course announcements will be posted on Canvas: `http://canvas.upenn.edu`. Please submit all assignments electronically via Canvas rather than handing in paper copies. Course readings will be shared via Dropbox.

Course Description: This course covers statistical decision theory, model selection, moment selection and averaging, high-dimensional regression, factor models, and selective inference. See the semester calendar at the end of this document for more details. Topics may vary depending on time constraints and the interests of the students registered for the course. We will also discuss effective writing and presentation for economics and econometrics.

Prerequisites: Econ 705 and 706 or equivalent graduate level econometrics.

Readings: The readings for this course include my lecture slides and notes, available on the course website, along with references that I will share through a password protected Dropbox folder. A recommended text for the machine learning material in the course is *Machine Learning: A Probabilistic Perspective* by Kevin Murphy (2012).

Assignments and Grading

As this course comes at the very end of your second year, I see no point in wasting your time with endless problem sets. Thus, while I will require you to complete some problems related to the course material, the bulk of the course assignments are intended to help you begin work on your third year paper, whether you plan to specialize in econometrics or another field.

$$\text{Grade} = (10\% \text{ Participation}) + (10\% \text{ Problem Presentation}) + (20\% \text{ Problem Set})$$
$$+ (10\% \text{ Paper Idea}) + (20\% \text{ Referee Report}) + (30\% \text{ Final Presentation})$$

Participation: I expect you to attend each class meeting and participate actively. This means arriving on time, paying attention, and taking part in class discussions. In some cases I will ask you to complete a reading assignment before class and come prepared to discuss. I expect you to take such assignments seriously: they are just as much a part of the course as the homework and other assignments. If you follow these guidelines in good faith, you will receive full credit for participation. If you do not, I will deduct points as the situation warrants.

Problem Set: Your homework grade will have two components, each of which depends on a set of fourteen homework problems that I have posted on the course website. The first component is a problem set worth 20% of your course grade, and due at 11:59pm on May 1st, 2019. For your problem set you must submit solutions to six of the fourteen posted problems: four from the section marked "Theoretical" and two from the section marked "Computational." Subject to this constraint, you may choose any problems that you like. Your full set of solutions must be

type-written, and submitted in pdf form to canvas. Along with your pdf write-up, make sure to submit all the source code required to replicate your solutions to the computational exercises. This code must be written in an open-source language. R, Python, Julia, and Octave are permitted; Matlab is not. While your problem set grade will depend on the completeness and correctness of your answers, clarity of writing and exposition are equally important.

Problem Presentation: The second component of your homework grade is a problem presentation worth 10% of your course grade. Each student will present a solution to one homework problem during the semester. This presentation will take place during class time and should last between 5 and 7 minutes. Afterwards, we will discuss both the substance and style of your presentation. You may use chalk, slides, or a combination of both. The appropriate choice will depend on the question. The problem you present, along with the date of your presentation, must be agreed in advance with the instructor.

Paper Idea: Each student must submit an idea for a third-year paper topic to canvas by 11:59pm on Sunday, March 31st. Your submission should be in pdf form, and no more than two pages in length. The key word is *idea*: I do not expect a fully fleshed-out research proposal or a detailed literature review. Take this as an opportunity to think about the questions and topics that most excite you and convey this excitement in your writing.

Referee Report: Each student must submit a referee report to canvas in pdf form by 11:59pm on May 1st. Your report should be 3–5 pages in length and discuss a recent working paper agreed in advance with the instructor. I will provide guidelines for referee reports in class.

Final Presentation: Each student will give an in-class presentation, with slides, of approximately 20 minutes in length. Presentations will take place during the final two class meetings of the semester, and the topic must be agreed with the instructor in advance. You have three options for your presentation: (1) a literature review and research proposal, (2) a summary of an important paper, or (3) an overview of an econometric method that we did not cover in Econ 722. If you elect to present a paper, it must be different from the one you selected for your referee report. Whichever option you choose, the content of your presentation should relate in some way to your third-year paper idea.

Semester Calendar

Tuesday	Thursday
Mar 12th **No Class**	14th **1** Decision Theory I
19th **2** Decision Theory II, Writing Workshop	21st **3** Model Selection I: AIC, TIC, AIC_c, Mallow's C_p Problem #1 (Di)
26th **4** Model Selection II: BIC, Cross-validation Problem # 3 (Zijun)	28th **5** Model Selection III: Asymptotic Properties, <u>Consistent vs. Efficient</u> Model Selection Problem #10 (Ryan)
Apr 2nd **6** <u>Moment Selection I: Consistent Moment Selection</u> Problem #5 (Collum)	4th **7** Presentation Workshop – **(2pm Start time!)**
9th **8** Moment Selection II: Focused Moment Selection and Averaging, Inference Problem #2 (Hongye)	11th **9** High-Dimensional Regression I: QR and SV Decompositions, PCA, Ridge Regression Problem #11 (Agustin)
16th **10** High-Dimensional Regression II: LASSO, PCR	18th **11** High-Dimensional Regression III Problem # 12 (Boyuan)
23rd **12** Problem #9 (Xiaoliang) Selective Inference	25th **13** Presentations: Boyuan, Agustin, Ryan, Hongye
30th **14** Presentations: Zijun, Di, Xiaoliang, Collum	May 2nd **No Class**