ECO 772 Advanced Econometrics

SPRING 2025 SYLLABUS

Professor:	Dr. Emir Malikov
Class Time:	Tuesday/Thursday @ 4:00—5:30pm
Class Location:	BEH 120
Office Hours:	every Wednesday @ 3—5pm, or by appt
Office Location:	BEH 509
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COURSE DESCRIPTION

This is the second course in a graduate-level econometrics sequence. Building on ECO 770, it is designed to deepen and extend the students' knowledge base in ***microeconometric methods*** for economic and business data and the associated hypothesis testing. The course begins with a review of the class of linear regression models before moving into more complex topics, including identification and estimation of models with endogeneity, nonlinear models including with limited dependent variables and sample selection, methods for panel data, and other advanced regression methods. You will also learn how to implement these techniques in *Stata*.

Throughout the course, the emphasis will be on *understanding* the methodologies, including their underlying assumptions and statistical properties. The latter is particularly important in an age where generative AI excels in complex data analytics. Your understanding of what happens under the hood of econometric models will provide a critical human context to the interpretation of data, enabling you to make sense of data and the results of analyses to draw insights more effectively. As AI handles the computational heavy lifting, your role evolves to focus on informed supervision of data modeling which requires a though understanding of these models. By the end of the semester, you will be equipped with essential techniques for the statistical analysis of microeconomic data and the working knowledge about how to operationalize them in practice.

COURSE PREREQUISITE(S)

A successful completion of ECO 770. ECO 740 is also expected.

TEXTBOOK & READINGS

Throughout the semester, I will be providing you with lecture slides. They are an amalgam of the material from multiple sources, including some of my own, and are the bare minimum reading that is expected of you. It is imperative that you supplement it with reading the textbook as well.

Required Textbook

"A Guide to Modern Econometrics," 5th Ed., by M. Verbeek, but older editions would work fine too.

Recommended Supplementary Texts

1. *"Econometrics,"* by Bruce E. Hansen
2. *"Microeconometrics: Methods and Applications,"* by A.C. Cameron and P.K. Trivedi
3. *"Microeconometrics Using Stata,"* Revised Ed., by A.C. Cameron and P.K. Trivedi
4. Undergraduate "*Introductory Econometrics: A Modern Approach*," by Jeffrey M. Wooldridge ["the Baby Wooldridge"]

PREREQUISITE KNOWLEDGE

A solid ***knowledge of algebra, calculus, essential matrix algebra, fundamentals of math statistics and the ECO 770 material is expected***. It is YOUR responsibility to brush up your math/stats skills outside the classroom, should there be such a need. At the very minimum, be comfortable with the material in Appx. A—E of the Baby Wooldridge and Ch.2—3 in Verbeek.

STATISTICAL SOFTWARE

The required statistical software for this course is *Stata*. A 6-month license for *Stata/BE* is $48 for students and can be purchased for download at the Stata website.

Also, see this website for a list of UNLV campus computer labs equipped with *Stata* as well as the information on how to access it remotely via *RebelApps*.

When it comes to learning and mastering *Stata*, practice is the key. **Learning by doing is the way** here. In fact, most *Stata*-users would argue it is the only way, which is why mastering *Stata* will be your own responsibility. I will not "teach" it in class: after all, ours is not a programming course. Having said that, there is a huge amount of tutorials, books, videos and free tutorials available online, so Google is your best friend here. In my own experience, the most effective way to learn *Stata* is by tinkering with it on one's own. Also, always remember that virtually any questions you will ever have about *Stata* had already been asked by someone else and answered on numerous online forums. Just google it or try ChatGPT or Bard or Gemini or any other AI chatbot!

To make sure everyone is on the same page when it comes to the fundamentals of using *Stata*, the first homework assignment will have you watch an introductory video and complete a few tutorials.

STUDY TIPS

To do well in the course, you MUST study outside the classroom. **This is not an easy class, so be prepared to be intellectually challenged on a continuous basis and put in hours of hard work**. First of all, read the lecture notes/materials: read them multiple times; read them with a pencil in hand. Second, look up related materials in the textbooks and work through those too. More generally, I urge you to study on a continuing basis: it will be virtually impossible for you to do well in this class by pulling a few all-nighters before the exam or before the homework due date.

GRADING

Your course grade consists of the following components:

GRADE COMPONENTS

Component	Weight
Homework	40%
Exams	30% each

At the end of the course, your score on each of the above components will be converted to a 100-point based scale. Your final score in the class will be a weighted average of these points. I will then map your final score (also on a 100-point based scale) to the grade you will receive in the course using the following table.

GRADE SCALE

Grade	Final Score
A	≥ 94
A–	≥ 90 but < 94
B+	≥ 86 but < 90
B	≥ 80 but < 86
B–	≥ 75 but < 80
C+	≥ 71 but < 75
C	≥ 65 but < 71
C–	≥ 60 but < 65
D	≥ 50 but < 60
F	< 50

When computing the final score, I **round it up** to the nearest whole number. That is, 85.56 is rounded up to 86, and so is 85.01.

Though unlikely, depending on performance of the class, I may adjust this table which you will be notified about. No adjustment will make a student worse off.

Requests to revise grades on exams and/or assignments are accepted in WRITING only. Please compose a brief letter argumentatively explaining (point by point) why you think your grade should be changed, then turn in this letter along with the original assignment back to me. You may contest your grade within one week from the date your graded assignments was returned to you.

All grades will be recorded and continually updated in the *Canvas* gradebook. If you think that one of your grades is missing, you must bring it to my attention within a week of the assignment's due date. I will not chase your missing grades if the assignment was past due more than a week. Therefore, I suggest you check on your grades on a regular basis.

How to Understand the "Total" score in the Canvas Gradebook

You can monitor your performance in the course throughout the semester by looking at your "Total" score in the *Canvas* gradebook. Although, it is crucial that you understand how it is being computed and why and how it changes over the course of the semester. Here are its key features.

The "Total" score in the *Canvas* gradebook is your "as-of-now" course grade that the platform continually computes for you. This as-of-now grade is "dynamic" and it constantly gets updated as more graded deliverables are assigned and completed with time.

This tentative course grade might go up or down every time you complete an assignment or take a test because, when computing the "Total" score, the *Canvas* gradebook assumes that all incomplete and/or un-attempted assignments/exams do not exist and effectively reassigns their weights to the past assignments/exams you have already completed. This means that your past assignments/exams will always be given a larger weight than they will be eventually when your truly final total score is computed at the end of the semester.

Every time you complete a new deliverable, by construction, your updated "Total" score will be higher than it was previously *only if* your score on the latest assignment is greater than the weighted average of your scores on previous assignments. For concreteness, consider the following example. There is a total of three assignments in the course: test A, test B and test C with the corresponding weights being 25%, 35% and 40%, respectively. Say, you have only taken the first two tests so far and scored 62/100 on test A and 80/100 on test B. The *Canvas* gradebook will compute your as-of-now "Total" score to be $62\left(\frac{25}{25+35}\right)+80\left(\frac{35}{25+35}\right)=72.5$. If you score exactly 72.5 on test C, then your final "Total" score will remain what it had been before: $62\left(\frac{25}{25+35+40}\right)+80\left(\frac{35}{25+35+40}\right)+72.5\left(\frac{40}{25+35+40}\right)=72.5$. If you score more/less than 72.5 on test C, then your new "Total" score will also become greater/less than 72.5. For example, if you get 75 on test C, then $62\left(\frac{25}{25+35+40}\right)+80\left(\frac{35}{25+35+40}\right)+75\left(\frac{40}{25+35+40}\right)=73.5>72.5$; or if you get 70 on test C, then $62\left(\frac{25}{25+35+40}\right)+80\left(\frac{35}{25+35+40}\right)+70\left(\frac{40}{25+35+40}\right)=71.5<72.5$.

DELIVERABLES

Homework/Problem Sets

You should expect about 5-7 homework assignments this semester. The exact due dates will be determined by the flow of the course. Problem sets will include analytical material and empirical applications of the methods. **They will take a substantial amount of time, so plan ahead!** Each question (or a sub-question within a problem) will be graded on a scale of 4 (all correct), 3 (mostly correct), 2 (mostly incorrect), 1 (all incorrect) and 0 (left unattempted).

Homework submissions **must be properly scanned as high-resolution PDF** and turned in through *Canvas*. If handwritten, it is imperative that it is legible for, otherwise, I reserve the right to require that it be typeset, including all equations. Albeit handwritten solutions are allowed on default, you are encouraged to typeset them using *Overleaf/LaTex*.

All your answers must be written as complete thoughts in well-written sentences. "Yes" or "no" are not acceptable answers and will be given a grade of zero. Needless to say, all equations must be mathematically sound.

Exams

Expect 2 in-class paper-and-pencil exams (a midterm and a final). The exact date of a midterm exam is to be determined depending on the flow of the class; I will announce it at least a week in advance. For the final exam date, see the Registrar's website or MyUNLV.

CLASS PARTICIPATION

Participation is important for this class and, in fact, is graded, so ***you should attend class*** *unless you are ill, in which case please stay home.* The success of the course depends heavily upon the contributions of each student: it is you who makes the class more fun! I expect you to come to class prepared and willing to contribute to the class discussion. ***If you must miss class, please get notes from another student.*** If any questions remain, please attend office hours.

EXTRA CREDIT

I do NOT allow individual students to do any additional work for extra credit. All students are advised to consult with me throughout the semester to avoid end-of-the-semester "surprises."

OFFICE HOURS

I will hold weekly office hours on Wednesdays between 3 and 5pm (except for the school breaks and observed holidays). If you cannot make it to see me during my regular office hours, please email me for an appointment.

Since access to upper floors of BEH is still restricted, you will need to let me know beforehand via email of your intention to come see me so that I plan to come down (or send someone) to the first floor to get you.

EMAILS

If you cannot see me during my office, feel free to email me with any questions: I will be happy to help. I should be able to reply within one business day. Having said that, please keep in mind that it is nearly impossible to meaningfully answer conceptual or debugging questions via email. In such instances, instead I will ask you to set an appointment with me or see me during my next office hours in order to get your question answered/explained.

CLASSROOM ETIQUETTE

We are all adults, so please be considerate to myself and your fellow classmates:

- Please do not be late for class.
- Please no chatter amongst yourselves. It is distracting, and I will call you out on it.
- Put your cell phones on silent and put them away before the class starts. This also implies no texting, being on social media or surfing web for unrelated stuff on your laptops/tablets during the lecture. If I see an inappropriate use of technology during class, I will call you out publicly.
- The use of laptops/tablets is permitted for course-related purposes only.
- Please wait until the class ends before gathering your belongings.
- If you need to leave early, please sit near the door.

The bottom line is, if you do not want to participate and pay attention in class, then do not come to class.

ANNOUNCEMENTS

All announcements (including those about assignments), supplementary course materials and other relevant information will be posted on the *Canvas* course page. ***It is your responsibility to check for announcements daily.*** Your scores for homework assignments and exams will also be posted on *Canvas*.

UNLV ACADEMIC POLICIES

Please refer to Academic Policies for Students.

COURSE OUTLINE

This course outline is *tentative* and subject to change as the semester progresses.

PRELIMINARIES
- Two paradigms of econometrics: causal/structural vs. descriptive/predictive analyses
- Conditional expectation function
- Best linear predictor
- Review of fundamental stuff on inference, sampling, identification

OLS
- OLS as a linear projection estimator
- OLS vs. Classical Linear Regression Model

(Q)MLE
- Different estimation approaches: method of moments, maximum likelihoods, least squares, m-estimation
- Maximum likelihood estimation
- Normal regression
- Quasi maximum likelihood estimation

ASYMPTOTIC INFERENCE
- Finite-sample vs. asymptotic inference
- Delta method
- Wald test, LR test, LM test

NLLS

LIMITED DEPENDENT VARIABLE MODELS
- Binary choice
- Multiple choice: categorial and ordered
- Fractional response
- Count and non-negative outcomes

MODELS WITH ENDOGENEITY
- Instrumental variables
- IV and 2SLS estimators and related tests
- Sample selection models

PANEL DATA MODELS
- POLS, FE, LSDV, FD estimators of linear models
- Nonlinear models, CRE estimators

QUANTILE MODELS
- Conditional and unconditional quantile regressions

RESAMPLING-BASED INFERENCE