ECON 4870: Introduction to Econometrics (Section 001)

Instructor Contact

Name: Dr. Myungsup Kim
Pronouns: He, him, his
Office Hours: (**In person at Wooten Hall 345**) 12:50 p.m. – 1:50 p.m. on Monday, 10:30 a.m. – 11:30 a.m. on Tuesday, and by appointment.
Email: myungsup.kim@unt.edu
Communication Expectations: The primary form of communication will be email through the email address above. You may send a message to me through Canvas as well. I will respond to you within 48 hours excluding the weekend or as early as I can. If you do not hear from me in that time frame, please send me a reminder email. CLEAR has a webpage for online communication tips, https://digitalstrategy.unt.edu/clear/online-communication-tips.html

Course Description

This course introduces the basic statistical methods used by economists for analyzing economic data and for testing economic theories. The course is intended to provide a sound theoretical foundation of introductory-level econometrics while using real-world examples to illustrate theoretical concepts. Particular attention will be given to linear regression analysis and the extensions that are important in the fields of economics and finance.

Course Structure

This course is taught face-to-face at Wooten Hall 115 from 2:00 p.m. to 3:20 p.m., Monday and Wednesday.

Course Prerequisites or Other Restrictions

There are **two** prerequisites:

- (1) either MATH1190 (Bus Cal) or MATH1710 (Cal I),
- AND (2) One of the following courses: ECON4630 (Data Analysis), DSCI3710 (Bus Stats II), MATH3680 (Applied Stats) or MATH4650 (Stats).
- Otherwise, you are **not** allowed to take this course.

By having completed the prerequisites satisfactorily, you must be familiar with topics in introductory statistics, college algebra and calculus I. For example, you must have a good understanding of probability theory (population vs. sample, random variable, probability density function, etc.), algebra, statistical inference, normal distribution and *t*-distribution, hypothesis testing and calculus concepts (slopes, derivatives, minimization, etc.). Summation notation and derivatives are essential in understanding the theoretical foundation of econometrics. In addition, some knowledge of matrix algebra will be useful for this course and other econometrics courses.

Materials

Textbook (required): *Introductory Econometrics* by Wooldridge (8th edition).

- You may use an older edition of the textbook (7th or 6th edition).
- Reading the textbook or other books on econometrics can strengthen your understanding of class topics. There are other good textbooks such as *Introduction to Econometrics* by Dougherty*, Introduction to Econometrics* by Stock and Watson (either brief or full edition).

Statistical software:

- We use R for data analysis.
- After the 1st midterm exam, there will be a lab session on how to use R within RStudio. With RStudio, it is much easier to use R.
- Go to http://www.urfie.net for *Using R for Introductory Econometrics*. You can read the full text online for free or buy a hard copy: the 2nd edition book is available. For additional resources, go to
  - https://www.econometrics-with-r.org/index.html
  - https://swirlstats.com/
  - https://r4ds.hadley.nz/ This is for *R for Data Science* (2e).
- Unlike Stata, SAS or EViews which you may learn in other courses, one advantage of R (and RStudio) is its price: it is free! Getting started with R can be a bit challenging, but with proper installation and careful coding, R will be a useful tool.

Course Requirements

	Percentage of Final Grade
Problem sets	**16%**
Midterm 1	**26%**
Midterm 2	**26%**
Final exam (cumulative)	**32%**

Problem sets:

- **Upload a PDF file of your answers to Canvas**. **Do not turn in a paper copy of your work.**
  - How to make a PDF file of your answers? We may use a photo-to-PDF converter app on our smartphone. I will list some recommended apps on our Canvas course page.
- You must upload your work by the due date and time which will be indicated on Canvas.
  - Late submission policy: a **late submission penalty of 5% per hour** will be imposed. If your work is submitted 5 minutes late, the raw score of 40 will be adjusted to 38 with 5% penalty. If 65 minutes (or 1.08 hours) late, the penalty will be 10% as hours late will be rounded up to the next whole number (this is how Canvas treats a fractional hour). If more than 19 hours late, the adjusted score will be zero.
  - To avoid the late submission penalty, please upload your work before the due time.
- The lowest problem score will be dropped in determining your course grade. However, if you do all the problem sets and need a fraction of one point for the next higher grade, the dropped score may be considered in bumping your grade up to a higher grade. Also, doing all the problem sets will get you ready for the exams.

Exams:

- **The midterm exams and the final exam date, time and location will be indicated on page 5.**
- The final exam is **cumulative**.
- The exams will be given in class, and it is a closed-book and closed-note test. However, a formula sheet will be made available before and during the exams.
- Except for those with a valid University-approved reason (https://policy.unt.edu/policy/06-039), everyone is required to take the exam at the scheduled time.
- There will be no makeup midterm. If you miss a midterm exam with a valid, documented University-approved excuse, the weight will be redistributed to the remaining exam(s). If you miss any exam without a valid University-approved excuse, a score of zero will be given.

Grading

Letter grade will be assigned based on a student's total percentage score (x):

Total percentage score (x)	Letter grade
$90 \leq x$	A
$80 \leq x < 90$	B
$70 \leq x < 80$	C
$55 \leq x < 70$	D
$x < 55$	F

Course Policies

ADA accommodation statement

The University of North Texas makes reasonable accommodations for students with disabilities. To request accommodations, you must first register with the Office of Disability Access (ODA) by completing an application for services and providing documentation to verify your eligibility each semester. Once your eligibility is confirmed, you may request your letter of accommodation. ODA will then email your faculty a letter of reasonable accommodation, initiating a private discussion about your specific needs in the course.

You can request accommodations at any time, but it's important to provide ODA notice to your faculty as early as possible in the semester to avoid delays in implementation. Keep in mind that you must obtain a new letter of accommodation for each semester and meet with each faculty member before accommodations can be implemented in each class. You are strongly encouraged to meet with faculty regarding your accommodations during office hours or by appointment. Faculty have the authority to ask you to discuss your letter during their designated office hours to protect your privacy. For more information and to access resources that can support your needs, refer to the Office of Disability Access website (https://studentaffairs.unt.edu/office-disability-access).

Campus closing

You will be notified by Eagle Alert if there is a campus closing that will impact a class: the Campus Closures Policy (https://policy.unt.edu/policy/15-006). In such case, the class schedule is subject to change.

Attendance policy

I expect that everyone will come to every class. Attendance at every class meeting is essential to understanding course materials. In case of absence, you are responsible for class materials and announcements. You should visit the Canvas course page and check with classmates regarding what has been covered or announced. Also, you may miss in-class activities if you do not attend class, and there will be no make-up credit for missed activities.

Syllabus change policy

If necessary, changes may be needed for the contents in syllabus. I will announce such changes through Canvas or in class.

Use of AI for problem sets in this class

Students in this course are encouraged to use AI tools (such as ChatGPT, Claude, Copilot, Gemini) as a collaborative tool when answering questions in problem sets, with only one requirement: all AI usage must be stated, following the "**Instructions on AI Disclosure Statement**" below which includes examples of AI usages.

Use of AI without proper Disclosure Statement will be considered "cheating". Based on the Student Academic Integrity Policy (UNT Policy 6.003), note that *any form of "unauthorized assistance" constitutes cheating. If the use of artificial intelligence is not authorized for the assignment, the violation is "cheating".*

Therefore, what I require you to do is to properly acknowledge your use of AI by following the instructions in the next section when you turn in your work on a problem set. If I believe a student violated the Disclosure Statement policy, I will contact the student via university assigned email for a meeting, and if the student does not respond nor schedule a meeting within a reasonable amount of time, an Academic Integrity Violation Report may be filed.

Please note that AI results can be inaccurate. It is your responsibility to ensure that the information you use from AI is accurate. Additionally, pay attention to the privacy of your data. Many AI tools will incorporate and use any content you share, so be careful not to unintentionally share copyrighted materials, original work, or personal information.

My encouragement of the use of AI is to strengthen your learning so that you are better prepared for your career with Econometrics. If you have any questions about what constitutes academic integrity in this course, please contact me.

Instructions on AI disclosure statement

When working on a problem set, you may use AI as a collaborative tool: this means that AI can help you to answer problem set questions. However, AI should not replace your own reasoning and understanding. You may ask AI to

- explain a concept in a problem set question,
- generate a different example for practice,
- or, check whether or not your answers are correct.

When you turn in your work, you must state one of the following two disclosure statements at the end of your work. There is no penalty for using AI, but statement is required.

1. **Disclosure statement if AI is used:**
   - Template statement: I acknowledge the use ***of [insert AI system(s)]*** to ***[specific use, e.g., concept explanation, assist in finding a critical value, refine language].*** The generated content was ***[accepted/rejected/modified]*** and integrated into ***[answering certain question(s)].***
   - Example statement: *I used Claude to practice how to invert a matrix with examples in the context of answering Q1. The content generated by Claude was accepted for learning a matrix inversion, but I did the matrix inversion in Q1 on my own.*
   - Another example statement: *I used ChatGPT to check my answers in the matrix multiplication and computing an inverse of a matrix in Q1. The content generated by ChatGPT was accepted as it showed my answer was not correct. After learning my mistake in computing an inverse, I redid the matrix inversion in Q1.*
2. **Disclosure statement if AI is NOT used:**
   - Example statement*: I did not use AI technologies in answering questions in this problem set.*

Course Objectives

How do we quantify relationship among variables? By the end of this course, you will be able to:

- Set up a linear regression model for estimating relationships using scalar variables or matrices,
- Learn mathematical and statistical tools necessary to understand the regression model,
- Interpret the estimated linear regression model, including various statistics produced after estimation,
- Understand the assumptions made in the estimation process,
- Understand what happens to the linear regression model results when an important variable is omitted,
- Learn how to know if the estimated relationship is statistically significant,
- Understand the consequences of the violation of an assumption, how to detect such violation and how to fix it,
- Learn how to use qualitative information in estimating relationships,
- Learn different models using time series variables,
- And carry out the above analysis using R, a statistical software.

Course outline (subject to change)

Date	Topic
1/12, 1/14	1. Data, summation, matrix algebra, statistical concept review including PDF, CDF, expectation, variance, and correlation coefficient (Ch. 1; App. A, B, D)
1/19	No class – MLK day
1/21, 1/26	2. Comparing estimators with unbiasedness, efficiency, MSE, and consistency; Normal, chi-squared, t, and F distributions; and intro to simple linear regression with E(Y|X) (App. B, C; Ch. 2)
1/28, 2/2	3. OLS estimator derivation in the simple linear regression model, interpretation with log, R-squared, and dummy variable with ATE (Ch. 2; App. A)
2/4, 2/9	4. Omitted variable bias, linear regression model in matrix form, GM assumptions 1, 2, 3. (Ch. 2-5, 3, 5-1; App. E-1)
2/11	**Midterm Exam 1 (Wednesday in class)**
2/16, 2/18	5. GM assumptions 4, 5, GM theorem, goodness of fit (Ch. 3), hypothesis testing with t test, and confidence interval for \beta_j (Ch. 4; App. C-5 ~ C-7)
2/23, 2/25	6. R session with RStudio **at GAB 550A**.
3/2, 3/4	7. Hypothesis testing with multiple parameters and restrictions: t test, p value, and F test (Ch. 4; App. C-5 ~ C-7)
	No class – spring break
3/16, 3/18	8. Data scaling, using log, quadratic regressor, interaction term, RESET, and confidence interval for prediction (Ch. 6-1 ~ 6-3; Ch. 9-1)
3/23	**Midterm Exam 2 (Monday in class)**
3/25, 3/30	9. Binary qualitative variable, LPM (Ch. 7) and probit (Ch. 17-1; App. C-4)
4/1, 4/6	10. Heteroskedasticity: consequences, detection, and fix (Ch. 8) and the DID estimator (Ch. 13-1, 13-2)
4/8, 4/13	11. Regression with time series data: models including AR(1), deterministic trend, stochastic trend, a random walk process, and Dickey-Fuller test (Ch. 10-1 ~ 10-3, 10-5, 11-1 ~ 11-3, 18-1 ~ 18-3)
4/15, 4/20	12. Serial correlation: consequences, detection, and fix; ARCH(1) (Ch. 12)
4/22	13. Intro to panel data analysis: fixed-effects and first-differencing estimators (Ch. 13-3; Ch. 14-1)
4/27	**Review**
4/29	**No class - office hour**
5/4	**Final Exam (at our classroom, 12:30 p.m. - 2:30 p.m. Monday)**

Additional comments

- Learning econometrics is like learning math: by mindlessly reading a textbook or listening to a lecture without paying attention, you will not fully learn econometrics. Actively working through problems in assignments (by referring to lecture notes, searching for related pages in the textbook) and creatively working with data in R assignments (asking yourself "can I use a different data set to answer the questions in this problem set?" or "can I use a different approach?" or "can I come up with a better code than what Dr. Kim wrote?") will be important steps to master the materials in our course.
- Plan ahead, complete assignments on time, and study for the exams. If you have questions while you are studying, please ask me. I will be happy to help.
- Class materials are the intellectual property of the university or instructor and are reserved for use only by students in this class and only for educational purposes. Students may not post or otherwise share the materials outside the class, or outside the Canvas Learning Management System, in any form. Failing to follow this restriction is a violation of the UNT Code of Student Conduct and could lead to disciplinary action.
    - **This means that lecture notes, handouts, assignments, and exams are not to be posted or shared outside this class in any form.**
- Important dates: Beginning **January 25**, a student can drop a course with a grade of W (see https://registrar.unt.edu/registration-guide). **April 10** is the last day for a student to drop a course or all courses with a grade of W).
- If you miss a class, you are responsible for class materials or any class announcement: you should visit the Canvas course page and check with your classmates regarding what has been covered or announced.
- **Let's treat everyone with respect in communicating online and in-person.**
- While the freedom to express yourself is a fundamental human right, any communication that utilizes cruel and derogatory language on the basis of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal, or state law will not be tolerated.
- Treat your instructor and classmates with respect in any communication online or face-to-face, even when their opinion differs from your own.
- Ask for and use the correct name and pronouns for your instructor and classmates.
- Speak from personal experiences. Use "I" statements to share thoughts and feelings. Try not to speak on behalf of groups or other individual's experiences.
- Use your critical thinking skills to challenge other people's ideas, instead of attacking individuals.
- Avoid using all caps while communicating digitally. This may be interpreted as "YELLING!"
- Be cautious when using humor or sarcasm in emails or discussion posts as tone can be difficult to interpret digitally.
- Avoid using "text-talk" unless explicitly permitted by your instructor.
- Proofread and fact-check your sources.
- Keep in mind that online posts can be permanent, so think first before you type.

Course Technology

Minimum Technology Requirements

Every student must have

- reliable internet access,
- a smart phone (or a scanner) for making a PDF file of your work,
- a computer for R and RStudio. Note that RStudio may not work or run smoothly on a Chromebook. If you have a Chromebook or an old computer, you may be able to access UNT lab computer remotely via: https://academictechnologies.unt.edu/services/computer-labs

  This page explains the remote access process. The downside is that it can take a while to install packages within R that we need. You may have to re-install packages every time you connect to a lab computer remotely.

For Canvas app and browser compatibility, go to
https://digitalstrategy.unt.edu/clear/approved_and_supported_technologies/index.html

Technical Assistance

Part of working in the online environment involves dealing with the inconveniences and frustration that can arise when technology breaks down or does not perform as expected. Here at UNT we have a Student Help Desk that you can contact for help with Canvas or other technology issues.

UNT IT Help Desk: https://aits.unt.edu/support/
Email: helpdesk@unt.edu
Phone: 940-565-2324
In Person: Sage Hall, Room 330. For hours, see the website.
Laptop Checkout: https://library.unt.edu/services/laptop-checkout/
Note that the information on room and hours may change. Please check the UNT IT's website above for up-to-date information.

For Canvas support, try the Help menu at the bottom of Global Navigation in Canvas.