

ECON 251-100 WINTER 2018 SYLLABUS
INTRODUCTION TO STATISTICS AND ECONOMETRICS II

Course Times: Mon & Wed, 4:00 PM – 5:30 PM
Course Location: 140, Lorch Hall

Lecturer:

Asenka (Asja) Asenova

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E-mail: asenovaa@umich.edu

Office hours:

Monday & Tuesday

1:45 PM – 3:15 PM in my office

(You don't need an appointment during my office hours. After class is also a good time to talk to me.)

Graduate Student Instructors:

Bernardo Modenesi

Office: Lorch Hall, 125

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Office hours: Thursday, 10 AM – 12 PM

Thomas Brosy

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Office hours: Thursday, 1:30 – 3:30 PM

COURSE OBJECTIVES

This course is designed to introduce you to the fundamentals of econometric analysis. After the course you will be able to answer important policy questions such as:

- *Is there evidence of discrimination against black workers, women and immigrants on the labour market, and if so, what is the extent of this discrimination?*
- *What is the effect of class size on student performance?*
- *What is the effect of compulsory seat belt law introduction on traffic safety?*

We are also going to cover some fun topics, such as:

- *What is the effect of hours of study on college GPA?*
- *What is the effect of skipping classes on college GPA?*
- *Is there any monetary return to beauty?.*

We are going to start our analyses by revising and applying the fundamentals of statistics you learnt in STATS250, namely – by looking at sample averages, and then proceed to testing hypotheses about the population. We will then sophisticate the analyses starting from the fundamentals of econometrics – the simple linear regression model and ordinary least squares estimation, then gradually include more complex tools such as the multiple linear regression model, random and natural experiments, and instrumental variable estimation.

The single **most important implication of this course** is that applying not-so-advanced tools often leads to an incorrect conclusion, and that we need advanced econometric tools in order to provide compelling evidence in answering a research question. This is also my ultimate **goal in the course** – to help you develop

the tools to critically analyse economics research; to be able to recognize spurious relationships (i.e. wrong conclusions), and to be able to make strong arguments when devising research of your own.

This course will put a heavy emphasis on empirical applications; econometric theory will be discussed where necessary but will not be the central focus. If you have a strong mathematical background and seek a more advanced treatment of the material, you may wish to consider ECON 452 instead. The knowledge attained in the course will be valuable for everyone who considers a career in economics, business, marketing, finance, and other related fields.

COURSE WEBSITE

The course website is available via the Canvas Course Management System. After logging on to CANVAS at <https://umich.instructure.com/courses>, simply activate the course link. I will be posting all course materials in the folders under the “Files” tab.

MindTap is available through the Canvas management system by clicking on the link that states “Click here to access MindTap”. MindTap includes study resources, practice tests, a mobile app, interactive e-book an automatic feedback, which would be helpful in your course preparation. In order to access the MindTap practice tests go to Canvas/Modules tab.

TEXTBOOK

The textbook for the course is:

Introductory Econometrics: A Modern Approach, 6th edition, author: *Jeffrey M. Wooldridge*; publisher: *Cengage Learning*, ISBN: 978-1-305-27010-7. You can purchase a hardcover, an electronic edition, or a loose-leaf version with MindTap (which includes e-book) from here: www.cengagebrain.com/course/2689858.

Most of the datasets we will be using in the course are part of this textbook. We are only going to cover parts of the textbook as it is considerably more advanced than the purposes of this course.

Another very good textbook you may wish to use is:

Introduction to Econometrics, 3rd edition, authors: *James H. Stock* and *Mark W. Watson*; publisher: *Pearson*, ISBN: 978-0133486872.

Some of the datasets we will be using in the course are part of this textbook.

COURSE PREREQUISITES

A minimum grade of C in an introductory course in statistics (STATS 250), as well as in MATH 115 (or 116, 121, 156, 185, 186, 215, 255, 256, 285) are required.

ASSESSMENT AND GRADING

1) Homework assignments

There will be **eight homework assignments** counting towards a total of **10% of your final grade** (see homework schedule on Canvas). They will involve both theoretical and practical (i.e. working with data) exercises, with an emphasis on the latter. You are encouraged to work together with a classmate on these assignments but you should turn in your own copy of the solutions.

Your weakest homework assignment will be dropped from your final grade. Homework will be due in the course mailbox (on the 1st floor in Lorch Hall). No late submissions will be accepted unless in special circumstances.

You may wish to consult the tentative homework schedule uploaded on Canvas, such that you have an idea when to expect a homework assignment.

Homework grading and types of homework problems

The homework will be **graded on a 100 percent basis**; grades will be assigned largely based on competition and demonstration of sufficient effort. This means that even if you got 100/100 points on the homework, your homework may contain minor mistakes or omissions. For this reason, you should **always consult the official solutions once they are uploaded**, and use them as a guideline of how the complete and correct solution should look.

There will be two **types of homework problems**:

- **compulsory**: these are the problems you definitely need to solve in order to get full credit
- **optional**: Skipping such a problem will not lower your homework grade, but solving it will allow you to make up for a potential downgrade on a compulsory problem. E.g. if you got one of the compulsory problems wrong, solving the optional problem correctly would allow you to still get a 100 percent score. However, if you solve the compulsory problems correctly and you solve the optional problem correctly, you will still get 100 percent.

2) Quizzes

There will be **four scheduled 15 minute quizzes** administered in class counting towards a total of **10% of your final grade**. There will be **no make-up quizzes under any circumstances**. To allow for absence due to any reason (such as illness, family emergency, job interview, etc.) your lowest quiz will be omitted from calculating your final grade. Answers to the quiz will be posted on Canvas after administering the quiz.

Please, check if your homework or quiz grade is uploaded, and notify your GSI if there is an issue of a missing grade within 3 days after the grades are posted.

3) Exams

There will also be an 80-minute in-class **midterm exam on Wednesday, February 21st** counting towards **30% of your final grade**. There will be no make-up exam for the midterm exam unless in special circumstances; in case you skip the midterm with a valid excuse (documented illness or a family emergency), your final exam will be weighted to 80%. If you take the midterm, then it will count with the weight announced below. Travel plans do not constitute a valid excuse for skipping the midterm exam.

There will be a **final exam on Friday, April 20th from 10:30 AM to 12:30 PM** counting towards **50% of your final grade**. **Please, plan your trips accordingly, and take the course only if you can attend the final exam at the scheduled date and time.**

The final exam will be cumulative but it will not include statistical theory questions which will only be included in the midterm.

Both exams are closed book and closed notes. This is beneficial for you as an open book exam would involve a considerably higher level of difficulty.

Course grade

Homework:	10%
Quizzes:	10%
Midterm exam:	30%
Final exam:	50%

Your **course total score** will be calculated as follows: once I have everyone's final exam score, I will drop the lowest quiz and lowest homework, and give the relevant weight to each grade component (see above). **Then I will rank-order all the students in the course and decide on the exact grading scale.** I will e-mail you the grading scale once I submit the final grades.

There will be no exceptions from the grading system announced above. This means I cannot provide any extra credit for additional work done after the final exam, or change the weight of the grading components. Also, please note that I will give you the grade that reflects your course performance and not the grade you need (e.g. I cannot provide a grade increase since you need a certain average GPA, since this is your last term before graduation, etc.).

STATISTICAL SOFTWARE

We are going to use the statistical software package STATA during this class. You may wish to purchase an annual or a permanent STATA license but this is not required as STATA is available in most computer labs on campus; you may find a list of the labs here: <http://www.itcs.umich.edu/sites>. You can also access STATA via the UM virtual sites here: <https://midesktop.umich.edu>.

Some class time (either during lectures or during sections) will be devoted to explaining common STATA commands. In addition to this, I have uploaded a document on CANVAS including detailed instruction on how to use STATA (see folder "Stata Features and Instructions").

COURSE COMMUNICATION

In addition to class communication, you will be receiving important information, including assignment and exam instructions and reminders, through email. Please make sure your University email address works properly and check it regularly.

Feel free to also contact me via e-mail (i.e. not via CANVAS) with any course-related questions or concerns. However, **please, do not e-mail me or your GSIs about administrative details which are made available and you can easily check yourself, such as: our offices, lecture halls, class time, homework due dates, etc.** I check my e-mail regularly **on weekdays before 6PM** but please allow for a 24-hour time interval to hear from me due to the large number of students I teach.

ATTENDANCE

Class attendance is encouraged but not required. **Please attend only if you plan to devote your full attention to the class.**

LAPTOP USE POLICY

If you prefer to bring a laptop, tablet, or any other device for taking notes, viewing the lecture notes and datasets or otherwise participating in class, this is fine. However, **please do not use a personal device during class for any purpose unrelated to our class that may be distracting to the other students (such as watching videos).**

EXAM RE-GRADE POLICY

Your exams are graded by your graduate student instructor. Please, first consult them about your grade. If you need further assistance, you can talk to me, and I will re-grade your exam by taking your concerns into consideration. **Note that you are not guaranteed a higher grade with re-grading; in fact, it is possible you will get a lower grade through the re-grading process.**

SPECIAL ACCOMMODATION

If you need a special accommodation for a disability, please let me know within 2 weeks from the start of term. You would need to present a valid Verified Individualized Services and Accommodations form (commonly known as “VISA”), issued by the Office of Services for Students with Disabilities (<http://www.umich.edu/sswd>). Failure to present your VISA on time, might mean that TAC will not accept the reservation request and that special accommodation cannot be provided.

In case you do take the exam at TAC, please note that TAC policy requires that students monitor their own test time and submit the exam by the designated end time. In other words, the TAC proctors will not tell you when time is up; you need to make sure you monitor your time and submit by the end of the designated end exam time. Failure to submit the exam on time will result in repercussions on your grade.

ACADEMIC INTEGRITY

The course will comply with the Economics Department policy on academic integrity listed here:

<https://lsa.umich.edu/econ/undergraduates/policies-and-procedures.html>.

COURSE OUTLINE

Week 1 – 3: INTRODUCTION AND STATISTICS REVIEW (WITH EXTENSION)

Week 1:

- Introduction. What is Econometrics? (Chapter 1, section 1.1)
- Populations, parameters and random sampling (Appendix C, sections 1.A and 2.A)
- The summation operator (Appendix A, section A.1)
- Random variables and their probability distributions. Features of probability distributions. (Appendix B, section B.1 and B.3)

Homework 1 posted on CANVAS

Week 2-3:

- Finite (small sample) properties of estimators. Unbiasedness and efficiency. (Appendix C, section C.2).
- The Normal distribution. The t-distribution. (Appendix B, section B.5).
- Asymptotic (large sample) properties of estimators. Consistency. Law of Large Numbers. Central limit theorem. (Appendix C, section C.3)
- Statistical inference: testing hypotheses (Appendix C, section C.6). Using STATA for data analysis and hypotheses testing
- Using STATA for data analysis and hypotheses testing (sections and lecture time)

Homework 2 posted on CANVAS

Homework 1 due

Week 3 – 4: THE SIMPLE LINEAR REGRESSION MODEL (SLR)

Week 3:

- Definition. Population regression function. (Chapter 2, section 2.1)
- Estimation: the method of Ordinary Least Squares. Regression line (sample regression), fitted values and residuals. (Chapter 2, section 2.2)
- Properties of OLS. Goodness of fit. (Chapter 2, section 2.3)

Homework 2 due

Homework 3 posted on CANVAS

Quiz 1 on properties of estimators (tentative)

Week 4:

- The classical linear regression model: key assumption underlying OLS (Chapter 3, section 3.2 and 3.4)
- Expected value and variance of the OLS estimators. (Chapter 2, section 2.5)
- Using STATA for regression analysis

Homework 3 due

Quiz 2 on the simple linear regression model (tentative)

Week 4 – 5: MULTIPLE REGRESSION ANALYSIS

Week 4: MULTIPLE LINEAR REGRESSION (MLR): ESTIMATION AND SIMPLE INFERENCE

- Motivation for multiple regression and interpretation. (Chapter 3, sections 3.1 – 3.3)
- Testing hypotheses about a single population parameter: the t-test. (Chapter 4, sections 4.1 and 4.2)

Homework 4 posted on CANVAS

Sample midterm exam posted on CANVAS

Week 5:

- Omitted variable bias (Chapter 3, sections 3.3.B)
- Proxy variables (Chapter 9, section 9.2)
- The classical linear regression model: properties of least-squares estimators; Gauss–Markov theorem (Chapter 2, section 2.5 and Chapter 3, section 3.5).

Homework 4 due

Homework 5 posted on CANVAS

Week 6-7: MULTIPLE REGRESSION ANALYSIS WITH QUALITATIVE INFORMATION: BINARY (DUMMY) VARIABLES

- The nature of dummy variables (Chapter 7, section 7.1)
- Models with a single dummy regressor (Chapter 7, section 7.2)
- Models with interaction terms involving dummy variables (Chapter 7, section 7.4)

Week 7: EXAM REVIEW

- Sample midterm exam solution (in class)

Week 8

MIDTERM EXAM: Wednesday, February 21st (80 minutes)

Week 9: Spring break

Week 10: MULTIPLE REGRESSION ANALYSIS WITH QUALITATIVE INFORMATION (CONTINUED). MULTIPLE LINEAR REGRESSION ANALYSIS: INFERENCE

- A binary dependent variable: the Linear Probability Model (Chapter 7, section 7.5)
- The dummy variable regression (Chapter 7, section 7.3).
- Testing a single linear restriction (Chapter 4, sections 4.1 and 4.2)
- Testing multiple linear restrictions: the F test. Algebra of testing hypotheses. (Chapter 4, sections 4.2 and 4.5)
- Using STATA for hypotheses testing

Midterm exam solutions posted on CANVAS

Homework 6 posted on CANVAS

Homework 5 due

Quiz 3 on models with qualitative data (tentative)

Week 10: MULTIPLE REGRESSION ANALYSIS: FURTHER ISSUES

- Functional form (Chapter 6, section 6.2)
- Effects of data scaling and units of measurement (Chapter 6, section 6.1)
- Other issues: Multicollinearity (Chapter 3, section 3.4)

Week 10-11: BASIC REGRESSION WITH TIME SERIES DATA

- The nature of time series data (Chapter 10, section 10.1)
- Trends and seasonality (Chapter 10, section 10.5)

Homework 7 posted on CANVAS

Homework 6 due

Week 12-13: INSTRUMENTAL VARIABLE ESTIMATION

- Random and natural experiments (Chapter 15, section 15.1 and lecture notes)
- Motivation for the IV estimator (Chapter 15, section 15.1)
- IV estimation (Chapter 15, sections 15.1, 15.2 and lecture notes)
- Two stage least squares (Chapter 15, sections 15.3)

Homework 8 posted on CANVAS

Homework 7 due

Week 14: DEVIATIONS FROM THE CLASSICAL ASSUMPTIONS

- Heteroskedasticity and serial correlation (Chapter 8, sections 8.1 and 8.2, and Chapter 12, section 12.1 and 12.2)
- The linear probability model (Chapter 7, section 7.5)

Homework 8 due

Sample final exam posted on CANVAS

Week 14: OTHER TOPICS (if time permits)

- Pooled cross-section: the difference-in-differences (DID) estimator (Chapter 13, section 13.1 and 13.2)
- Distributed-lag models (Chapter 10, section 10.2)
- Errors of measurement (Chapter 9, section 9.4)
- First difference estimator (Chapter 13, section 13.5)

Week 14-15: REVIEW

- Sample final exam solution (in class)

FINAL EXAM: Friday, April 20th from 10:30 AM to 12:30 PM in our regular classroom

Final exam solutions will be sent via e-mail once the final grades are submitted.

COURSE BIBLIOGRAPHY

This is a list of papers we will be talking about in the course (in the order in which we are going to cover them); we are also going to replicate the results of some of these papers. You may wish to consult them in case you are interested in a more detailed treatment of the material, although they will not be a required reading due to the high degree of complexity.

Blackburn, M. L., & Neumark, D. (1993). *Are OLS estimates of the return to schooling biased downward? Another look* (No. w4259). National Bureau of Economic Research.

Hamermesh, D. S., & Parker, A. (2005). Beauty in the classroom: Instructors' pulchritude and putative pedagogical productivity. *Economics of Education Review*, 24(4), 369-376.

Hamermesh, D. S., & Biddle, J. E. (1993). *Beauty and the labor market* (No. w4518). National Bureau of Economic Research.

Houston, D. J., & Richardson, L. E. (2002). Traffic safety and the switch to a primary seat belt law: the California experience. *Accident Analysis & Prevention*, 34(6), 743-751.

Bertrand, M., & Mullainathan, S. (2004). Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination. *The American Economic Review*, 94(4), 991-1013.

Krueger, A. B., & Whitmore, D. M. (2001). The effect of attending a small class in the early grades on college-test taking and middle school test results: Evidence from Project STAR. *The Economic Journal*, 111(468), 1-28.

Angrist, J. D., & Krueger, A. B. (1992). *Estimating the payoff to schooling using the Vietnam-era draft lottery* (No. w4067). National bureau of economic research.

Card, D. (1993). *Using geographic variation in college proximity to estimate the return to schooling* (No. w4483). National Bureau of Economic Research.

Stinebrickner, R., & Stinebrickner, T. R. (2008). The causal effect of studying on academic performance. *The BE Journal of Economic Analysis & Policy*, 8(1).

Angrist, J. D., & Evans, W. N. (1996). *Children and their parents' labor supply: Evidence from exogenous variation in family size* (No. w5778). National bureau of economic research.

Angrist, J. D., and A. B. Krueger (1991). "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics* 106, 979-1014.