

**ECO 307: Introduction to Econometrics, Forecasting, and Time Series
Spring 2019**

Instructor Information

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Meeting Time / Location

Mondays, 5:30 - 8:15 PM, Centennial Hall, Room 2212

Course Description

An introduction to regression analysis and its application to economic and business research. Topics include using secondary data sources, simple and multiple regression, forecasting, time series analysis, and interpretation and communication of results. The course develops various empirical techniques and culminates with a final research report.

Course Learning Outcomes

1. Construct, estimate and interpret simple and multiple regression models that describe relationships between discrete and continuous variables.
 2. Translate the estimates from regression models into forecasts.
 3. Apply and compare alternative functional forms for the outcome and explanatory variables in the context of linear regression models, including logarithmic transformations, quadratic functions and interaction terms.
 4. Identify common problems encountered in econometric modeling, including omitted variable bias, simultaneity bias, selection bias, serial correlation, heteroskedasticity and measurement error.
 5. Estimate and interpret extensions of the multiple regression model that are designed to account for common sources of estimation bias.
 6. Construct, estimate and interpret the estimates from linear probability, logit and probit models, and choose the appropriate estimator for a given context.
 7. Create new or extend existing econometric analyses to study a relationship of interest, and communicate the results of this analysis in both written and oral form.
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Economics Major Learning Outcomes

As econometrics is an important element of the economics major, the course-specific learning objectives listed above contribute to the following learning objectives for the economics major:

1. Students will use economic models in domestic and global contexts to analyze individual decision making, how prices and quantities are determined in product and factor markets, and macroeconomic outcomes.
2. Students will analyze the performance and functioning of government, markets and institutions in the context of social and economic problems.
3. Students will think critically about economic models, evaluating their assumptions and implications.
4. Students will use data to describe the relationships among variables in order to analyze economic issues.
5. Students will communicate economic thought and analysis in both written and oral contexts to varied audiences.

Writing Emphasis Course

This fulfills the UWL General Education writing emphasis requirement for one writing emphasis course at the 300 level or above, and for those who have declared an economics major, a writing emphasis course within your major. The course includes several informal writing assignments and one formal writing assignment that is part of a final research project. The informal writing assignments are spread throughout the course and are intended to help you build your own understanding of your research project.

Course Resources

Textbook: Stock, James H. and Watson, Mark W., (2015), *Introduction to Econometrics*, Third Edition (Updated).

This textbook is available in UWL Textbook Rental. This is a standard text for undergraduate econometrics. The course outline is similar to the outline of the textbook. The textbook is a difficult read and it goes beyond the scope of the course concerning the mathematical foundations for the statistical tools that we apply in the class. When reading the textbook, focus on understanding the intuition. For students that are considering graduate school in economics, it is useful to learn all the details in the chapters of the textbook.

Online textbook: Heiss, Florian, (2018), *Using R for Introductory Econometrics*.

<http://www.urfie.net/read/mobile/index.html>

This is a free online textbook for learning both the theory and the applications of econometrics using R.

Online textbook: Wickham, Hadley, and Golemund, Garrett (2017), *R For Data Science*

<https://r4ds.had.co.nz/> This is a free guide for getting started with programming in R.

Online textbook: Hyndman, Rob J. and Athanasopoulos, George (2018), *Forecasting: Principals and Practice*

<https://otexts.org/fpp2/> This is a great textbook for forecasting in R. It is available for free. We will cover this topic toward the end of the semesters.

Software: **Rstudio.cloud**: R is an open source (free to download and install) programming language for statistical analysis, data analysis, and data visualization. It is widely used throughout many industries and in academia. **Rstudio.cloud** is a free online platform for using R that doesn't require installing any software and makes collaborating with other users easy.

Please join the ECO 307 instructor RStudio workspace using the link below. With this workspace, you can see what we do in class and copy files relevant for your project.

<https://tinyurl.com/ECO307rstudio>

DataCamp tutorials: Datacamp (<https://www.datacamp.com>) is a commercial service that provides automated interactive online "courses" in data science and coding. You will be assigned several of these courses that cover introductory statistical programming using the R programming language. Please follow the link below to join the ECO 307 Datacamp class.

<https://tinyurl.com/ECO307datacamp>

Class website: <http://www.murraylax.org/eco307/spring2019>. All material handed out in class will be posted on the class website.

Canvas: Canvas will be used on a limited basis for information where wide dissemination is inappropriate. Canvas will be used to post grades, any reading assignments where dissemination is protected by copyright, and possibly short quizzes or exercises. Most of the class material will be posted on the class website above.

Tutors: There will be a tutor available for this course that is trained in R. All tutor sessions are in Wimberly 327. To book a seat please use this calendar, <http://uw1-eco-lab.youcanbook.me>.

Office Hours

I am available for office hours **by appointment with a minimum of only one hour notice**. You may schedule a 15 minute appointment by visiting <https://murraylax.youcanbook.me>. The blocks of time that I am available each week vary and are kept up to the minute on the YouCanBook.Me online scheduler. Additional walk-in office hours will be added as necessary, especially during exam weeks and weeks with significant homework deadlines. My typical weekly availability is given below.

Scan code or visit

<https://murraylax.youcanbook.me>

to make an office hours appointment.



Office hours are not a substitute for attending class. Except when missing class for very extreme circumstances that were promptly discussed with me, it is not acceptable to use office hours to ask questions about material you missed while not in attendance.

Assessment

Learning will be assessed through weekly quizzes, homework, and exams. The grading breakdown will be:

- Quizzes / In-class Exercises / Homework: 10%
- Informal writing assignments: 10%
- DataCamp courses: 15%
- Research paper: 15%
- Research presentation: 10%
- Midterm Exam: 20%
- Cumulative Final Exam: 20%

Grade Breakdown

94-100	A	77-81	BC
89-93	AB	70-76	C
82-88	B	0-69	F

I reserve the right to scale every person's grade up by the same amount on any graded item in the event that much of the class falls short of the scale above. However, even if the grades are significantly low, there is no guarantee that I will ever do this.

Graded Coursework Response Time

I will return all graded work to you within two weeks of the due date, or before the next exam date if the work is relevant practice for the exam. Work that is turned in late may not be accepted, but if so, I may not be able to grade the work within the two-week time frame. Grades will be posted on the D2L gradebook on or before the date I return the graded work to the class. I will return graded coursework in compliance with FERPA regulations, such as in class or during my office hours. I will bring your graded coursework to class only once. If you are not in attendance when coursework is returned, it is your responsibility to make arrangements to pick your work.

In-class Exercises and Quizzes

There will be many announced and unannounced in-class exercises and quizzes given throughout the semester. These are based on class lecture, prerequisite knowledge, assigned reading, or other suggested work, and are designed to communicate learning expectations and give you quick feedback on how well you are achieving these. Classes will begin with your questions so that you can resolve any problems with assigned work before the quiz begins.

Homework Assignments

There may be some homework graded assignments assigned throughout the semester which are weighted equally to in-class exercises and quizzes.

Informal Writing Assignments

There will be several informal writing assignments that are designed to help you think about your research project and the process for using econometric techniques for answering a research question. All these assignments are weighted equally. You have no formal audience for these assignments. They are designed to use the writing process to help you learn. Still, you should re-read any writing assignment before submitting it and fix any grammar or spelling errors. In grading these assignments, I will consider your overall understanding of the content that you are writing about in addition to grammar, spelling, and organization.

Datacamp Courses

Datacamp (<https://www.datacamp.com>) is a commercial service that provides automated interactive online “courses” in data science and coding. You will be assigned several of these courses that cover introductory statistical programming using the R programming language. The service is provided for free to students in higher education.

Please join the Datacamp class site specific to this offering of ECO 307. Once logged in, you will see several courses assigned with due dates. Courses take approximately 4 hours to complete and you will be given one week to complete the courses when assigned. You do not need to complete the course all at once. You may log in and out and complete small amounts throughout the week. Your work is saved automatically.

Please follow this link to join the ECO 307 Datacamp course: <https://tinyurl.com/ECO307DataCamp>

Tutors

There will be a tutor available for this course that is trained in R. All tutor sessions are in Wimberly 327. To book a seat please use this calendar, <http://uwl-eco-lab.youcanbook.me>.

Note that you only have access to that room when seeing a tutor. The class does not have open access. The slots are in 1 hour increments on the hour so to book for the 7:30 to 8:30 tutor session, please book 7:00 to 8:00.

The role of the tutors is to assist you in fixing R coding errors and attempt to help you implement ideas you have for a table or graph or to run a test. You should go with your questions or problems already identified. **Go with your questions already written down, and be ready to login to Rstudio.cloud and show them your code.**

The tutor is not intended to help you content decisions for your projects or writing assignments. The tutor is also not intended to help you study for your exams.

Finally, please be mindful that the tutor for this class is a very highly capable and skilled undergraduate student, the student is still an undergraduate student like yourself and very low paid. The student tutor does not do this for a living, does not have a decade of experience programming in R, has not taken dozens of statistics classes, and does not make many tens of thousands of dollars teaching statistics. (Your professor is lucky to have all that.) It is possible that the student tutor may not be able to solve your problem. Put yourself in their shoes and be forgiving and still forgiving when this happens, then come see your professor.

Attendance

Attendance is required to receive credit for quizzes, in-class exercises, and exams. However, if you need to miss a class day or exam day because of illness, emergency, or other exceptional circumstances discussed with me, you can be excused and arrangements can be made for you to make up missed work. Attendance to your group meetings is always required, unless your group excuses you for illness or emergency according to the terms of your group’s contract.

Exams

There is one midterm exam and one cumulative final exam. While we apply econometric techniques to data using the R programming language, the exam will only involve paper and pencil. The exam will include R code and output, some of which (but not all!), is useful for answering the questions. The exam dates are as follows:

- Midterm Exam: Monday, March 11, 5:30 - 8:15 PM, Room 2212 Centennial
- Final Exam: Monday, May 13, 7:00 - 9:00 PM, Room 2212 Centennial
The UWL final exam schedule can be found here:
<http://www.uwlax.edu/Records/Final-Exam-Schedule/>

I will provide a practice exam one week before the exam. For each exam, I will write two versions with questions similar in style, content, and expectations, and choose with a coin flip which becomes the real exam and which becomes the practice exam. I will not provide answer keys to the practice exams, but I am happy to help you with questions in class or during office hours.

Exams do not require a calculator, computer, mobile phone, nor any other electronic device. No electronic devices are allowed during exams. If English is not your first language, you are permitted to bring a paperback English translator/dictionary.

Grade Change or Extra Credit Requests

I evaluate and assign grades for a lot of work from a lot of students in multiple courses, so it possible or even likely I may make mistakes. It is appropriate and helpful to me if you keep track of your grades that I post to D2L and notify me if I have made a mistake. **It is not appropriate to ask for grade changes or special extra credit opportunities after performing poorly on assignments or exams**, or not achieving a grade that you hoped to earn. These requests will not be granted. Know also that such requests to me and most any instructor reflect poorly on your professionalism, attitude, and priorities.

In the event that scores are low for an assignment or exam across most or all students I do reserve the right to increase every students' grade by the same amount or give an extra credit opportunity to all students. Please understand that such events are rare and will probably not happen in a typical semester. Please do not make requests for such grade changes or extra credit opportunities. I do see the full distribution of all the students' grades and I have over a decade of knowledge and experience of the historical performances of students on similar assignments and exams in my classes and with other instructors. I use this full range of information to determine when such changes are appropriate.

Research Paper

A major goal of this class is to be able to apply econometric tools to current data to answer an original research question in economics. The course will involve a semester-long research project. Early in the semester we will work on identifying a topic and dataset. You will apply new econometric tools that we learn in the class to your dataset as we cover them. As the semester proceeds, you will be expected to focus your research question and closely tie to it your decisions for what type of analysis to conduct. By the end of the semester, your work will culminate in a formal research paper and an oral presentation. Below are some additional guidelines and expectations for the project:

1. Your project results in an *empirical* economics paper, which means it answers a question of interest in economics based on applying statistical methods to data, and letting the results from the data analysis support your conclusion.
2. Your project should involve publicly available data available from one of the sources below. These datasets are exhaustive enough to include variables relevant to research questions in many economics fields.
 - IPUMS International: Collection of census data from around the world, measured at the household and individual level. <https://international.ipums.org/international/>
 - IPUMS USA: Collection of household and individual data from the U.S. Census and American Community Survey. It includes data on educational attainment, income, language proficiency, migration, disability, employment, and housing. <https://usa.ipums.org/usa/>

- IPUMS CPS: Collection of household and individual data from the U.S. Current Population Survey. It includes but is not limited to data on educational attainment, income, health insurance, migration, disability, employment, housing, poverty, and welfare. <https://cps.ipums.org/cps/>
 - Integrated Health Interview Series: Collection of household and individual data on health outcomes, health behaviors, and personal and socio-economic demographics. <https://www.ihis.us/ihis/>
 - Federal Reserve Economic Database (FRED): Collection of U.S national, state, and international macroeconomic and finance data from multiple sources. <https://research.stlouisfed.org/fred2/>
3. A good paper should be interesting to read. To make your paper interesting, introduce the question quickly and motivate it. Why is your question interesting? Why do we not have an adequate answer to it yet? What will the readers learn that is not already known if they decide to continue reading the paper? Imagine your paper was optional to read (because in the real world, your written work is optional to read). Convince your reader that your paper is worth reading.
 4. Your paper should include a short literature review (either as part of the introduction or a separate section) that describes sufficient background for the audience to understand the purpose and context of your work and be used to help motivate your research question. You should cite primarily peer-reviewed academic articles from economics journals.
 5. Usually, research papers make *marginal* contributions. Your paper will not solve a big problem, but will instead make an incremental step toward better a understanding of some specific aspect of the literature you are citing.
 6. Make your literature review, methodology, and results interesting to read. These sections should tell a story and proceed with a clear purpose. Avoid making these sound like a letter to your parents from summer camp, “Then we did this... then we did this... then we did this...”
 7. A good paper should be easy to read. Make the organization of the paper clear and your text concise. Avoid repeating the same ideas in multiple sentences when a single sentence will do. Avoid repeating ideas in multiple areas of your paper unless it is necessary; this hurts both organization and conciseness.
 8. The paper should be approximately 8-12 pages in length. The page length requirement will not be strictly enforced, but serves as a guide to you for how long a paper you should expect to write to adequately meet all other expectations for the paper.
 9. Plagiarism will not be tolerated. This constitutes academic misconduct and will be handled accordingly.
 10. Below are tentative research paper milestones. I may adjust the assignments depending on the needs of the class, and the timing of other course assignments and content.
 - **Informal writing assignments:** There will be several informal writing assignments where you will respond to short prompts that will encourage you to think deeper about your project and make plans for how to proceed.
 - **Research proposal:** You will write a short research proposal that will include, (1) a one-sentence thesis statement or research question; (2) A short description of relevant background information including at least two citations of peer-reviewed articles from economics journals; (3) A description of your dataset including the source and some of the variables that you are likely to use; and (4) A very brief and broad explanation for the relationships you expect to look for among the variables.
 - **Annotated bibliography:** This includes bibliographic information, summary, and purpose for **eight** sources that you are likely to cite in your paper. At least **six** of these must be published papers in academic, peer-reviewed journals.
 - **Rough draft of introduction and literature review:** There is no requirement on the exact organization of these sections. You may have these as two separate sections, as a combined section, or another organization that you find appropriate for your project.
 - **Rough draft of your methodology and results:** There is no requirement on the exact organization of these sections. You may have these as two separate sections, as a combined section, or as multiple sections organized by the type of question you answer or the type analysis you conduct.
 - **Rough draft of your conclusion section:** This is more than just repeating what you already stated. Discuss the implications and importance of your findings and connect it to the purpose of your paper. Be sure to properly qualify your conclusions (do not be overly general or presumptuous about its significance), discuss any weaknesses or areas for further research, but close on its strengths and the take-away thought you want to leave your reader with.

- **Oral Presentation - May 6, 2019, 5:30 PM** You will present your final project on the last day of class.
- **Final paper is due May 17, 5:00 PM (last day of finals)**

Double Counting Work with Other Courses

You may be allowed to use an assignment from this course to also satisfy a requirement for another course if you adhere to the following requirements:

1. Notify both me and the instructor of your other course of your intention in writing in a single email that is addressed to us both.
2. Explain how your idea satisfies the assignment requirements for both courses. You should review the assignment guidelines and rubrics from both courses, if applicable.
3. Clearly articulate how the one assignment will result in something more valuable and more sophisticated than if you completed the two assignments separately. You need to establish here that by completing a single assignment to satisfy both courses' requirements results in *higher quality work and not less total work*.
4. Both instructors give written permission (an email will suffice) which includes a notification to the other instructor.

Submitting the same work in multiple courses without obtaining permission from both instructors is considered self-plagiarism. Self-plagiarism is a type of plagiarism; it is considered academic dishonesty and it will be treated as such.

Submitting Late Work

Attendance is required to receive credit for graded work completed in class, including quizzes, in-class exercises, and exams. Late work will be penalized by 8 percentage points per calendar day after the deadline, except for extraordinary circumstances (illness, emergency, etc) that are discussed with me. If there is an extraordinary circumstance, you should notify me before a missed class or assignment deadline that you will not be able to complete the assigned work at the given deadline and we may agree on an appropriate accommodation. In the event of missing class or an assignment deadline due to illness or emergency, you should notify me as soon as possible afterwards so that we can make arrangements for you to make up missed work. **Late work cannot be accepted under any circumstances after I have returned graded work to the class or after answer keys have been circulated.** It is for this reason that is important to notify me as soon as possible any circumstance that makes it appropriate to submit work late.

Eagle Alert System

This class will be participating in the UWL Eagle Alert system through WINGS. The Early Alert system is designed to promote student success. If I notice that you are experiencing difficulties early in the semester (e.g., low assignment scores, poor attendance, minimal engagement in the classroom), I may enter feedback into the program and you will receive an email indicating that feedback has been left. I may also enter positive feedback encouraging you to think about additional opportunities. You will be able to access the feedback through your student center in WINGS. I encourage you to meet with me and use one or more of several helpful campus resources listed here <http://www.uwlax.edu/studentsuccess/>.

Online Student Evaluation of Instruction (SEI)

The university conducts student evaluations electronically. Approximately 2 weeks prior to the conclusion of a course, you will receive an email at your UWL email address directing you to complete an evaluation for each of your courses. In-class time will be provided for students to complete the evaluation in class. Electronic reminders will be sent if you do not complete the evaluation. The evaluation will include numerical ratings and, depending on the department, may provide options for comments. The university takes student feedback very seriously and the information gathered from student evaluations is more valuable when a larger percentage of students complete the evaluation. Please be especially mindful to complete the surveys.

Veterans and Active Military Personnel

Veterans and active military personnel with special circumstances (e.g., upcoming deployments, drill requirements, disabilities) are welcome and encouraged to communicate these, in advance if possible, to me. For additional information and assistance, contact the Veterans Services Office (<http://www.uwlax.edu/veteran-services/>). Students who need to withdraw from class or from the university due to military orders should be aware of the military duty withdrawal policy (<http://catalog.uwlax.edu/undergraduate/academicpolicies/withdrawal/#military-duty-withdrawal-university>).

Mandatory reporter statement

As a faculty member of the University of Wisconsin-La Crosse, I am a mandated reporter of sexual harassment (including sexual violence). This means that faculty are obligated to disclose any detailed or specific information we receive about such incidents involving a member of this campus while that person is a member of this campus, regardless of whether the incident takes place on campus or off. If you believe you or another member on campus may be a victim or witness of sexual harassment, you should know your options under the Title IX guidelines. There are confidential reporters for UWL students where you can have this discussion. The contact in Student Life is Ingrid Peterson, Violence Prevention Specialist, at (608) 785-8062 or ipeterson@uwlax.edu. I am also happy to help you find counseling and support services. Simply ask me to assist you in locating a confidential reporter and I will do so.

E-mail Guidelines

I insist on the following e-mail etiquette rules (many of these are also recommended by the College of Business Administration). Failure to adhere to these guidelines will result in a reply with a friendly reminder to follow these e-mail guidelines.

- Allow one business day to elapse before expecting a reply.
 - Questions sent by e-mail should be able to be answered with only a few words, such as 'yes' or 'no' questions. Questions whose answers involve explaining class material are not appropriate over e-mail. For answers to these questions you should come to office hours.
 - Always include a subject that is brief but still has sufficient detail, *including the class you are in (ECO 301)*.
 - Look at your class notes and syllabus before sending an e-mail. Do not ask a question whose answer is on the syllabus or announced in class (unless you missed class for a legitimate reason).
 - Always spell check, grammar check, and re-read your e-mail before sending it.
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Students with Disabilities

Any student with a documented disability (e.g. ADHD, Autism Spectrum Disorder, Acquired Brain Injury, PTSD, Physical, Sensory, Psychological, or Learning Disability) who needs to arrange academic accommodations should contact The ACCESS Center (165 Murphy Library, 608-785-6900, ACCESSCenter@uwlax.edu) and meet with an adviser to register and develop an accommodation plan. In addition to registering with The ACCESS Center, it is the student's responsibility to discuss their academic needs with their instructors. You can find out more about services available to students with disabilities at The ACCESS Center website: <http://www.uwlax.edu/access-center>.

Academic Misconduct

Academic misconduct is a violation of the UWL Student Honor Code and is unacceptable. I expect you to submit your own original work and participate in the course with integrity and high standards of academic honesty. The UWL Student Honor Code can be found online at <http://catalog.uwlax.edu/undergraduate/academicpolicies/studentconduct/>. In the event a student is caught committing academic misconduct, I will pursue the harshest penalties allowed according to the UWS 14 Student Academic Disciplinary Procedures, which can be found here <http://www.uwlax.edu/Student-Life/Student-handbook/#14>.

Preliminary Topics Schedule

Below is a list of topics and readings for this class. This is a preliminary schedule. Depending on time constraints and the topics the class finds most interesting, we may choose to not cover some of the items below, cover items that are not shown below, or re-arrange the schedule.

1. Introduction / R overview
 - (a) Review of hypothesis testing for single and two variables, interpretation
 - (b) Review of confidence intervals for single and two variables, interpretation
 - (c) Using R: Conducting simple statistical analyses
2. Simple Regression
 - (a) Estimating the simple model
 - (b) Interpretations of the results
 - (c) Variance decomposition
 - (d) Assumptions and properties
 - (e) Functional form
3. Multiple Regression
 - (a) Estimating the model, interpreting results
 - (b) Variance decomposition
 - (c) Assumptions and issues using multiple explanatory variables
 - i. Multicollinearity
 - ii. Omitted variable bias
 - iii. Over-specification (including irrelevant variables)
4. Hypothesis testing in Regression Analysis
 - (a) T-tests and confidence intervals on regression coefficients
 - (b) F-test for overall model fit
 - (c) F-test for multiple exclusions
 - (d) Testing general linear restrictions
5. Regression Model Specification
 - (a) Standardized regression
 - (b) Functional forms: logs and quadratics
 - (c) Interaction terms and marginal effects
6. Binary (Dummy) Variables
 - (a) Single dummy variable
 - (b) Dummy variables for multiple categories
 - (c) Interact with dummies
 - (d) Dependent dummy: linear probability model
7. Regression with Time Series Data
 - (a) Autoregressive models
 - (b) Distributed lag models
 - (c) Autoregressive distributed lag models
 - (d) Assumptions for OLS with time series data

- (e) Regression with time trends
 - (f) Seasonal dummies
8. Advanced Issues in Time Series (time permitting)
- (a) Highly persistent time series, unit root tests
 - (b) Serial correlation
 - (c) Heteroskedasticity
 - (d) Autoregressive conditional heteroskedasticity models
 - (e) Cointegration and error correction model