AREC335/ECON335
Introduction to Econometrics
Spring 2020

Class Meeting:
MWF 9:00-9:50 am in Clark C 360

Instructor: Dr. Jesse Burkhardt
Office: Clark B311
Email: jesse.burkhardt@colostate.edu
Office Hours: Wed 2:00-3:00 and by appointment

Teaching Assistant:
TBD
Email: TBD
Office hours: TBD

Course Description
The purpose of this course is to provide students with an introduction to econometrics and basic competence in applying statistical methods as a scientific tool in the analysis of practical economic problems. The course will begin with a brief preview of how econometrics can be used to answer applied, real-world question. A brief review of basic statistics and data analysis will follow, before moving into the core material, which is the linear regression model. Students will learn to specify and estimate econometric models, interpret results, and uncover and correct for common statistical problems. The lectures will balance theory and mathematical derivations on the one hand and applications to real-world and simulated data sets on the other. The training received in this course can shape attractive job candidates, and the computer work will provide skills that can be taken directly into the workplace.

Specific Class objectives
1. Starting from a research question, identify data needs, the relevant economic and econometric model, estimate the model.
2. Understand and interpret ALL output from a regression in Excel
3. Use estimated model to predict outcomes and test hypotheses
4. Be aware of potential pitfalls in estimating models via OLS

Student Learning Outcomes
Technical Competence: Graduates will demonstrate technical competency including the ability to appropriately use economic theory in formulating analytical problems, identifying and gathering appropriate data, and employing appropriate economic methods to analyze those problems, utilizing appropriate available computer technology.

Problem-solving Skills: Graduates will demonstrate the ability to solve real-world problems beyond the context of the classroom. Students will be able to identify a problem and its scope, evaluate resources available to address the problem, formulate alternative solutions, and select the solution(s) most consistent with a stated objective.

Course Readings:

Stock, James H., and Mark W. Watson. "Introduction to econometrics." (2007). I don't care what addition you purchase. You can get a cheap used version on Amazon or the new version at the bookstore.

- Class notes, posted on Canvas

Course Prerequisites: ECON 204; MATH 141 or MATH 155 or MATH 160; STAT 201 or STAT 204 or STAT 301 or STAT 307

Computer Software: We will use Microsoft Excel for data analysis and econometric estimation. You can find the instructions on how to do it here: https://support.office.com/en-us/article/Load-the-Analysis-ToolPak-6a63e598-cd6d-42e3-9317-6b40ba1a66b4. It is assumed that you either have working knowledge of Excel or that you are capable of learning it on your own or with basic guidance. There is a very useful tutorial available from the book website (Excel 2007), which I have uploaded in the class website. If you are already proficient using a specialized econometrics software, it is acceptable to use it for your homework. You will also be required to use word-processing software homework assignments and the final project.

Warning for the Unwary: This is an upper-division course that *assumes* a mature understanding of basic mathematics and calculus, statistics, and economics, as well as good study habits. If you do not keep up with the material you will suffer and possibly fail the course. However, if you work diligently, you are very likely to do well, come away with highly useful skills and most importantly enjoy this course.

Course Evaluation

As a default, the grades are as assigned as follows: A = ≥ 90%; B = 80-89%; C = 70-79%; D = 60- 69%; F = < 60%. Individual student course grade will be automatically determined by the highest score yielded by the following two weighting methods:

Method A:

Homework Exercises	15%
Group Project	10%
Midterm Exam 1	20%
Midterm Exam 2	20%
Final Exam (comprehensive)	30%
Attendance	5%

Method B:

Homework Exercises	15%
Group Project	10%
Final Exam (comprehensive)	70%
Attendance	5%

Important Notes:

1. The **midterm exams** and the **final exam** are in-class, closed-book. You may use a calculator and a back-to-back 8 ½ by 11-inch *cheat-sheet*. In each exam, there will be an extra credit question with variable score (based on the performance of the class).

2. **Method A** means that if you have done well along the way, you will not be unduly penalized for a sub-par performance on the final exam. **Method B** means that if you do well on the final, you will not be penalized for relatively poor performance on the midterm exams. **Missed midterm exams** are assigned a zero, implying that you course score will be determined by method B. No excuse is needed as to why a midterm exam is missed. Please contact the instructor for university-sanctioned events.

3. Homework exercises will be handed one week before the due date. You can expect 7-8 of them. When **applying formulas, be always explicit** (i.e. reproduce the formula and properly label your variables; when testing hypotheses, always clearly state your null and alternative hypothesis). **Answers containing only numbers will not be graded** (and receive a zero score).

    a. **Homework exercises** are assigned throughout the semester, 1 week prior to the due date. The homework with the lowest score will be dropped from your final grade. You may work in groups but each person is responsible for their own work.
    b. There will be one **group project.** Each group is formed by 4 people. The project will be assigned after the core of the course material has been covered. This assignment will involve writing a formal, business style report from an econometric analysis. In addition to the econometric content, you will be graded for the style and presentation of your findings.

<u>Course Policies and Exceptions</u>

1. **Homework exercises** are due on the stated due date. Beyond that, no assignments will be accepted.
2. **Attendance** is not required, but highly encouraged. If you arrive late or expect to leave early, please sit near the exit to avoid disrupting the lecture. Attendance will not be considered to determine the final grade.
3. The general rule is that **make-up exams** will NOT be administered. At the instructor's discretion, however, exceptions can be made for specific CSU-sponsored activities or DIRE circumstances, provided appropriate documentation is presented.
4. You have one week after receiving a graded homework assignment or exam to provide the instructor with a written **grade appeal**. The appeal should identify which question is

believed to be incorrectly scored. Note that the instructor/teaching assistant reserves the right to re-grade the entire work, potentially resulting in a lower overall grade.

5. If you have a **documented disability** that requires special arrangements, please let the instructor know immediately at the beginning of the course.
6. **Academic integrity** is expected. No cheating will be accepted, period. This course will adhere to the CSU Academic Integrity Policy as found on the Student' Responsibilities page of the **CSU General Catalog** and in the **Student Conduct Code.** At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.
7. Always show appropriate **respect** for your instructor and fellow students. This means, among other things, that **cell phones** should be turned off or on mute prior to class.
8. If you are finding that you have difficulties in this course, **ask for help** as soon as possible. The instructor and teaching assistant want you to do well and meet your academic goals. The sooner you ask for help, the sooner we can get you back on track. *Your learning and well-being is of highest priority.*

Principles of Community

The Principles of Community support the Colorado State University mission and vision of access, research, teaching, service and engagement. A collaborative, and vibrant community is a foundation for learning, critical inquiry, and discovery. Therefore, each member of the CSU community has a responsibility to uphold these principles when engaging with one another and acting on behalf of the University.

- **Inclusion:** We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents, and contributions.
- **Integrity: W**e are accountable for our actions and will act ethically and honestly in all our interactions.
- **Respect**: We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.
- **Service**: We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.
- **Social Justice:** We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

Mental Health Statement: Need Help?

CSU is a community that cares for you. If you are struggling with drugs or alcohol and/or experiencing depression, anxiety, overwhelming stress or thoughts of hurting yourself or others please know there is help available. Counseling Services has trained professionals who can help. Contact 970.491.6053 or go to http://health.colostate.edu. If you are concerned about a friend or peer, tell someone at by calling 970.491.1350 to discuss your concerns with a professional who can discreetly connect the distressed individual with the proper resources (http://supportandsafety.colostate.edu/tellsomeone). Rams take care of Rams. Reach out and ask for help if you or someone you know is having a difficult time.

Sexual Assault and Violence Elimination

CSU's Student Sexual Harassment and Violence policy, following national guidance from the

Office of Civil Rights, requires that professors follow CSU policy as a "mandatory reporter" of any personal disclosure of sexual harassment, abuse, and/or violence related experiences or incidents shared with the professor in person, via email, and/or in classroom papers or homework exercises. These disclosures include but are not limited to reports of personal relational abuse, relational/domestic violence, and stalking. While professors are often able to help students locate appropriate channels of assistance on campus (e.g., see the CSU Health Network link below), disclosure by the student to the professor requires that the professor inform appropriate CSU channels to help ensure that the student's safety and welfare is being addressed, even if the student requests that the disclosure not be shared.

For counseling support and assistance, please see The CSU HEALTH NETWORK, which includes a variety of counseling services that can be accessed at: http://www.health.colostate.edu/. And, The Sexual Assault Victim Assistance Team is a confidential resource for students that does not have a reporting requirement and that can be of great help to students who have experienced sexual assault. The web address is http://www.wgac.colostate.edu/need-help-support .

Finally, if there is anything you would like me to know about you, please do not hesitate to tell me. If you are having trouble in the class, please come tell me as soon as possible so that we can work together to keep you on track.

Tentative Course Outline (Modifications are likely and at the instructor's discretion)

- Week 1: Economic Questions and Data, S&W Chapter 1.
    - Causal inference
    - Data sources and types
- Week 2: Review of Probability, S&W Chapter 2.
    - Random variables
    - Probability distributions
    - Expected Values, mean, and variance
    - Random Sampling
    - Large sample approximations
- Week 3: Review of Statistics, S&W Chapter 3.
    - Estimation of population functions (mean)
    - Hypothesis tests concerning population means
    - Confidence intervals
    - Comparing means from different populations
    - Using t-statistics when sample size is small
    - Scatterplots, covariance, correlation
- Week 4-5: Linear Regression with One Regressor, S&W Chapter 4.
    - Estimating the coefficients of a linear regression model
    - Measures of Fit
    - Least Squares Assumptions
    - Sampling distributions
- Week 6 and 7: Linear Regression with One Regressor, continued. S&W Chapter 5
    - Testing hypotheses with one regressor
    - Confidence intervals
    - Binary independent variables
    - Heteroskedasticity and Homoskedasticity

    - **MIDTERM FRIDAY OF WEEK 7**
- Week 8-10: Linear Regression with Multiple Regressors, S&W Chpt. 6.
    - Omitted Variable Bias
    - Multiple regression model
    - OLS estimators in multiple regressions
    - Measures of Fit
    - Least Squares Assumption in multiple regression
    - Distribution of OLS Estimators in multiple regression
    - Multicollinearity
- Week 9: Spring Break
- Week 11: Hypothesis Tests and Confidence Intervals (Multiple Regressors), S&W Chpt. 7
    - Hypothesis tests and confidence intervals for a single coefficient
    - Tests of joint hypotheses
    - Confidence sets for multiple hypotheses
    - Testing single restrictions involving multiple coefficients
    - Model specification for multiple regression
- Week 12: Nonlinear Regression Functions, S&W Chapter 8.
    - Strategy for modelling nonlinear regression functions
    - Nonlinear functions for single independent variable
    - Interactions between independent variables
    - **MIDTERM FRIDAY OF WEEK 12**
- Week 13-14: Assessing Econometric Studies, S&W Chapter 10. (Note that this will appear as Chapter 9 in the full edition if you purchased that one instead.)
    - Internal and external validity
    - Omitted variable bias
    - Misspecification of the functional form
    - Measurement error
    - Missing data and sample selection
    - Simultaneous causality
    - Sources or inconsistency in OLS standard errors
- Week 15: Additional topic if time allows
- Week 16: Final