

## Course Number, Title and Credits

**ECNU 309** - Introduction to Econometrics - 3 credits

## Course Description

This course provides an introduction to applied techniques for analyzing economic and financial data. Key topics include cross-sectional and time series data, regression analysis, hypothesis testing, and selected applied topics in economics, with a strong emphasis on practical applications.

Prerequisites: ECNU 201, ECNU 202, MATU 203 and MATU 115

## Course Learning Outcomes

By the end of this course, students should be able to:

1. Apply basic probability and statistics concepts to analyze economic data.
2. Build and interpret simple and multiple linear regression models.
3. Test hypotheses and construct confidence intervals for regression parameters.
4. Use regression techniques to examine relationships between economic variables.
5. Work with different types of data including cross-sectional, time series, and panel data.

## Required Textbooks

*Introduction to Econometrics*, 3 ed., James H. Stock, Mark W. Watson. Pearson, ISBN:9780133595420

## Letter Grade/Percentage Equivalents

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| Grades are determined on a straight-scale basis using the following scales. |
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|   |             |    |            |    |               |
|---|-------------|----|------------|----|---------------|
| A | 94% to 100% | A- | 90% to 93% | B+ | 87% to 89%    |
| B | 84% to 86%  | B- | 80% to 83% | C+ | 77% to 79%    |
| C | 74% to 76%  | C- | 70% to 73% | D+ | 67% to 69%    |
| D | 64% to 66%  | D- | 60% to 63% | F  | 59% and below |

## Methods of Evaluation for Determining Grades

### Assignment Detail for Course:

| Assignments                            | Possible Points |
|----------------------------------------|-----------------|
| Quizzes                                | 200             |
| Assignments                            | 400             |
| Exams                                  | 400             |
| <b>Total Points Possible in Course</b> | <b>1000</b>     |

### Course Outline (Tentative):

| Module   | Topics&Assignments                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| Module 1 | <p><b><u>Foundations of Econometrics and Review of Statistics</u></b> (Ch. 1–3).</p> <ul style="list-style-type: none"> <li>● Introduction to causal inference</li> <li>● Review of probability spaces, random variables, and distributions</li> <li>● Properties of estimators (unbiasedness, consistency)</li> <li>● Hypothesis testing (t-tests, p-values) for the population mean</li> <li>● Confidence intervals</li> </ul> <p><b>Quiz 1</b></p> |
| Module 2 | <p><b><u>Linear Regression with One Regressor: Estimation and Inference</u></b> (Ch. 4–5)</p> <ul style="list-style-type: none"> <li>● Intuition and derivation of OLS</li> <li>● Interpretation of coefficients</li> <li>● Measures of fit (<math>R^2</math> and SER)</li> <li>● The Least Squares Assumptions</li> <li>● The Gauss-Markov Theorem and the BLUE property</li> </ul> <p><b>Quiz 2</b><br/><b>Assignment 1</b></p>                     |

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| Module 3 | <p><b><u>Multiple Regression: Basics, Inference, and Hypothesis Testing</u></b> (Ch. 6–7)</p> <ul style="list-style-type: none"> <li>● Causes and consequences of Omitted Variable Bias (OVB)</li> <li>● OLS estimation of the multiple regression model; Adjusted R<sup>2</sup></li> <li>● Hypothesis testing for single coefficients</li> <li>● Joint hypothesis testing (the F-statistic)</li> <li>● Perfect and imperfect multicollinearity</li> </ul> <p><b>Quiz 3</b><br/><b>Assignment 2</b></p> |
| Module 4 | <p><b><u>Nonlinear Regression Functions</u></b> (Ch. 8)</p> <p>Polynomial models</p> <p>Logarithmic transformations (Log-Log, Log-Level, Level-Log)</p> <p>Models with interaction terms (Continuous-Binary, Binary-Binary)</p> <p><b>Quiz 4</b><br/><b>Midterm Exam (Module 1-4)</b></p>                                                                                                                                                                                                               |
| Module 5 | <p><b><u>Assessing Studies and Regression with Panel Data</u></b> (Ch. 9–10)</p> <ul style="list-style-type: none"> <li>● Internal and external validity</li> <li>● Five major threats to internal validity (e.g., simultaneous causality, measurement error)</li> <li>● Introduction to Panel Data: Fixed effects, entity and time effects, and "before and after" comparisons</li> </ul> <p><b>Quiz 5</b><br/><b>Assignment 3</b></p>                                                                 |
| Module 6 | <p><b><u>Binary Dependent Variables</u></b> (Ch. 11)</p> <ul style="list-style-type: none"> <li>● Limitations of the Linear Probability Model (LPM)</li> <li>● Intuition and estimation of Probit and Logit models</li> <li>● Maximum Likelihood Estimation (MLE)</li> </ul> <p><b>Quiz 6</b></p>                                                                                                                                                                                                       |
| Module 7 | <p><b><u>Instrumental Variables (IV) Regression</u></b> (Ch. 12)</p> <ul style="list-style-type: none"> <li>● Endogeneity and the IV solution</li> <li>● Identification</li> <li>● Two-Stage Least Squares (TSLS) estimation</li> <li>● Instrument relevance and exogeneity</li> </ul> <p><b>Quiz 7</b></p>                                                                                                                                                                                             |

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| Module 8  | <b><u>Time Series Regression and Forecasting</u></b> (Ch. 14–15) <ul style="list-style-type: none"> <li>● Characteristics of time series data</li> <li>● Stationarity; Autoregressive (AR) and Autoregressive Distributed Lag (ADL) models</li> <li>● Lag selection</li> </ul> <b>Quiz 8</b>      |
| Module 9  | <b><u>Advanced Topics in Time Series and Macro-Econometrics</u></b> (Ch. 16–17) <ul style="list-style-type: none"> <li>● Dynamic Causal Effects</li> <li>● Vector Autoregressions (VARs)</li> <li>● Cointegration and Non-stationarity in macro data</li> </ul> <b>Quiz 9</b>                     |
| Module 10 | <b><u>Final Assessment and Empirical Project</u></b> <ul style="list-style-type: none"> <li>● Comprehensive course review</li> <li>● Best practices in empirical research</li> <li>● Interpreting complex regression tables</li> </ul> <b>Quiz 10</b><br><b>Assignment 4</b><br><b>Final Exam</b> |

## Academic Integrity

The University of Massachusetts Global is an academic community based on the principles of honesty, trust, fairness, respect and responsibility. Academic integrity is a core University value, which ensures respect for the academic reputation of the University, its students, faculty and staff, and the degrees it confers. The University expects that students will conduct themselves in an honest and ethical manner and respect the intellectual work of others.

Submitting to faculty work completed by the use of any artificial intelligence tool without permission and/or when prohibited by class policy. When faculty require the use of technology, including artificial intelligence, as a part of an assignment for the course, there is no violation. Students are reminded to consult syllabi, assignment sheets/rubrics, program documents and their faculty. Use of artificial intelligence, when permitted, must be correctly cited in the assignment.

The UMass Global online library provides resources to support research, proper citation styles, and the safe and responsible use of generative artificial intelligence or Gen AI.

- The [Academic Integrity and Plagiarism Avoidance](#) page provides guidance to help students better understand academic integrity and includes tips on how to avoid plagiarism.
- The [Citing Sources](#) page offers guidance on how to properly cite using APA, MLA, and Chicago styles.
- The [Artificial Intelligence Resource Guide for Students](#) provides advice for understanding and

appropriately using generative artificial intelligence tools such as ChatGPT and Bard.

## UMass Global's Office of Accessible Education

Students who require disability-related services or accommodations to access their educational experience can register with the Office of Accessible Education (OAE). The Office of Accessible Education (OAE) is committed to ensuring equal educational access and opportunity for all members of our academic community. Students will be provided equitable and reasonable accommodations and services that are in compliance with Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 (ADA)/Americans with Disabilities Act Amendments Act of 2008 (ADAA). Registration with OAE is on a voluntary, self-identifying basis. Please visit the Office of Accessible Education (OAE) website for more information about how to register for services, eligibility requirements, and information about potential academic accommodations and services.

Our university is committed to ensuring equal access for all students. Let us know about any accessibility barriers you encounter using any of our online systems or websites by submitting a [Feedback or Accessibility Concern Submission Form](#). We'll do our best to improve things and get you the information you need.

## UMass Global's CARES Team

The CARES team is a campus-wide team of appointed staff and faculty responsible for identifying, assessing, and responding to concerns and/or disruptive behaviors by students, faculty/staff, and community members who struggle academically, emotionally, or psychologically, or who present a risk to the health or safety of the university or its members.

Individuals may refer themselves or other community members of concern by emailing [cares@umassglobal.edu](mailto:cares@umassglobal.edu) or by filling out a referral form [here](#). The CARES Team provides short term assessment, intervention, support, and recommendations of resources to those referred and engaged in the process.

## UMass Global's Title IX Statement

The University of Massachusetts Global strives to maintain and foster a climate that promotes respect and human dignity. Sexual misconduct and relationship violence in any form is antithetical to the university's mission and core values, violates university policies, and may also violate federal and state law. The office of Title IX is primarily concerned for students' safety and well-being and is tasked with investigating all reports of sexual misconduct experienced by our community members. Title IX prohibits sex-based and gender-based discrimination and harassment, which includes discrimination based on pregnancy and/or pregnancy-related complications, parental status, and marital status. Students expecting or experiencing pregnancy-related complications, that may require educational

accommodations, should contact the University's Title IX Coordinator and/or the Office of Accessible Education.

The University and Title IX's prohibition of sex discrimination also covers sexual harassment, sexual violence, and any other form of sexual misconduct. We offer options and resources to all students affected by these issues and are committed to providing a fair, thorough, and prompt investigation and adjudication process. If you or someone you know has been impacted by sexual assault, dating, and domestic violence, stalking, or sexual exploitation, please visit the [University's Title IX Resource Page](#) to access additional resources and information.

UMass Global's staff and faculty are tasked with reporting any possible sex or gender-based discrimination or Title IX violations to the University's Title IX Coordinator at [civilrightscomplaints@umassglobal.edu](mailto:civilrightscomplaints@umassglobal.edu).

[Click on this Link to our University Title IX Policy](#)