Wayne State University - Department of Economics
ECO 5100 (001) 20994 - Introductory Statistics and Econometrics (Winter 2019)

Instructor: Vitor Kamada
Class: MW, 2:30 - 04:10 pm in Room 10 at Meyer & Anna Prentis Bldg
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Office hours: MW, 4:10 – 5:40 pm, or by appointment.

1) Course Description

This course introduces several statistical and econometric methods that are frequently used in economic consulting, big corporations, and academic sector. An important emphasis is put on practical application and on the use of Python Computer Language to analyze real-world datasets. The first part of this course covers Probability and Statistics, the conceptual framework and building blocks for any advance statistical tools. The second part focus on Regression Analysis, a balance between causal inference and forecasting. In the third part, Students will present case studies from a Bayesian Statistician. In the fourth part, Students will write an empirical report using the skills and expertise developed in the previous parts of this course.

2) Learning Outcomes

The main goal of this course is to develop statistical and econometric reasoning. Econometric reasoning involves understanding the logic behind the econometric procedures and being able to fully interpret the results. Furthermore, after this course students will become proficient in using Python to perform a variety of statistical and econometric analysis, specially forecasting economic variables.

3) Required Textbook

All textbooks below are open source or available online for free via Wayne Library website. Check the links:

Diez, D. M., Barr, C. D., Çetinkaya-Rundel, M. (2014). Introductory Statistics with Randomization and Simulation. https://www.openintro.org/stat/textbook.php?stat_book=isrs

Fabozzi, F. J., Focardi, S. M., Rachev, S. T., & Arshanapalli, B. G. (2014). The Basics of Financial Econometrics: Tools, Concepts, and Asset Management Applications. John Wiley & Sons. https://ebookcentral.proquest.com/lib/wayne/detail.action?docID=1645271

Gelman, A. (2009). Red State, Blue State, Rich State, Poor State: Why Americans Vote the Way They Do. Princeton University Press. https://ebookcentral.proquest.com/lib/wayne/detail.action?docID=483546

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. (2016). Impact evaluation in practice. Second Edition. The World Bank. http://www.worldbank.org/en/programs/sief-trust-fund/publication/impact-evaluation-in-practice

Quantopian (2018). Lectures available for free at: https://www.quantopian.com

Sargent, T. J. and Stachurski, J. (2018). Lectures in Quantitative Economic. https://lectures.quantecon.org/py/

Sheppard, K. (2018). Introduction to Python for Econometrics, Statistics and Data Analysis. https://www.kevinsheppard.com/Python_for_Econometrics

4) Software

4.1) Jupyter Notebook

It is an open-source web application that runs Python code online. You can also install a desktop version via Anaconda Distribution. The advantages are more functionalities and integration with different data science packages. Unless we work with proprietary dataset from Quantopian, we will run Python code at https://jupyter.org/.

4.2) Quantopian

We can also run Python code online at Quantopian website (https://www.quantopian.com). However, we cannot load external data or packages, that's why you must also use Jupyter Notebook or Spyder. The advantage of Quantopian is that we can perform econometric analysis in expensive proprietary data for free, but we cannot download the data. In Quantopian, for example, we can access Corporate Fundamental Data from Morningstar, and clean Twitter Trader Mood data from PsychSignal. Just few years ago, PhD students and business analysts used to dream with the possibility to access this type of data for free. Please, create a personal account at Quantopian, it is free.

4.3) Anaconda Distribution

If you want to install the Python compiler in your desktop/laptop, the best way is via Anaconda. Then, you will have a complete professional data ecosystem. Anaconda is a free Python distribution that includes 1,000+ data science packages. Installing Anaconda is straightforward, download it at: https://www.anaconda.com/download/ . Inside Anaconda, you can use the Spyder, an integrated development environment (IDE) for data analysis. Jupyter Notebook is also inside Anaconda.

5) Course Schedule

Part I –Probability and Statistics, based on Diez et al. (2014)

Date	Topics/Key Concepts	Chapters
Week 1 **Jan 7**	**1) Probability** Law of Large Numbers, Mutually Exclusive Outcomes, Probability Distributions, Independence, Conditional Probability, Marginal and Joint Probabilities.	A.1 A.2
Week 1 **Jan 9**	**2) Random Variables** Expectation, Variance, Standard Deviation, and Linear Combinations.	A.3
Week 2 **Jan 14**	**3) Experiment** Association vs Causation, Treatment and Control Group, Population and Sample, Random Sample, Bias, and Randomized Experiment.	1
Week 2 **Jan 16**	**4) Introduction to Data** Mean, Variance, Standard Deviation, Scatterplots, Histograms, Box Plots, Quartiles, Median, Outliers, Contingency Tables, Bar Plots and Pie Chart.	1
Week 3 **Jan 21**	Holiday - University Closed Martin Luther King Jr. Day	
Week 3 **Jan 23**	**5) Statistical Test** Null Hypothesis, Alternative Hypothesis, p-value, Statistical Significance, Test Statistic, Type 1 Error, and Type 2 Error.	2 and 3.1
Week 4 **Jan 28**	**6) Normal Distribution** Central Limit Theorem, Z score, Normal Probability, Standard Error (SE), Confidence Interval, and Margin of Error.	2
Week 4 **Jan 30**	**7) t-distribution** t-confidence Interval for the Mean, One Sample t-test, Paired t-test, Difference of Two Means.	4
Week 5 **Feb 4**	**8) Analysis of Variance (ANOVA)** F-test, Mean Square Between Groups (MSG), and Mean Square Error (MSE).	4

Part II – Regression Analysis

Date	Topics/Reference
Week 5 **Feb 6**	**9) Linear Regression** Fabozzi et al. (2014): Chapter 2 Quantopian (2018): Lecture 12
Week 6 **Feb 11**	**10) Beta Hedging** Quantopian (2018): Lecture 31
Week 6 **Feb 13**	**11) Multiple Linear Regression** Fabozzi et al. (2014): Chapter 3 Quantopian (2018): Lecture 15
Week 7 **Feb 18**	**12) Sharp Regression Discontinuity Design** Gertler et al. (2016): Chapter 6

Week 7 Feb 20	**13) Difference-in-Difference (DiD)** Gertler et al. (2016): Chapter 7
Week 8 Feb 25	**14) Sentiment Analysis** Quantopian (2018): Tutorial 1, 2, 3, and 4
Week 8 Feb 27	**15) Estimation of Capital Asset Pricing Model** Quantopian (2018): Lecture 30
Week 9 Mar 4	**16) Integration, Cointegration, and Stationarity** Fabozzi et al. (2014): Chapter 10 Quantopian (2018): Lecture 43
Week 9 Mar 6	**17) Cointegrated Pairs Trading** Quantopian (2018): Lecture 44
Week 10 Mar 11	**Holiday - No Classes** **(Spring Break)**
Week 10 Mar 13	**Holiday - No Classes** **(Spring Break)**
Week 11 Mar 18	**18) Futures Contracts** Quantopian (2018): Lecture 51
Week 11 Mar 20	**19) Mean Reversion on Futures** Quantopian (2018): Lecture 53
Week 12 Mar 25	**20) Logit and Probit I** Wooldridge (2015): Chapter 17
Week 12 Mar 27	**21) Logit and Probit II** Seabold & Perktold (2010). Statsmodels: Econometric and Statistical modeling with Python.
Week 13 Apr 1	**22) Poisson Regression** Sargent and Stachurski (2018): Ch 4.4

Part III – Student Presentations based on Gelman (2009)

Week 13 Apr 3	**23) Group I** Chapter 1 - Introduction Chapter 2 - Rich State, Poor State Chapter 3 - How the Talking Heads Can Be So Confused
Week 14 Apr 8	**24) Group II** Chapter 4 - Income and Voting over Time Chapter 5 - Inequality and Voting Chapter 6 - Religious Reds and Secular Blues
Week 14 Apr 10	**25) Group III** Chapter 7 - The United States in Comparative Perspective Chapter 8 - Polarized Parties
Week 15 Apr 15	**26) Group IV** Chapter 9 - Competing to Build a Majority Coalition Chapter 10 - Putting It All Together

Part IV - Final Exam

Week 15 Apr 17	27) Draft Empirical Report
Week 16 Apr 22	Study Day
Week 16 Apr 24	Final Exam is the Empirical Report

6) Grading

6.1) Your final grade will be assessed as follows:

Assignment*	Composition**	Weight	Date
Surveys	Individual	1%	Wednesday, Feb 6 (at 4:00 pm)
Homework	Individual	30%	Check on Canvas
Quizzes	Individual	10%	Check on Canvas
Lab	Group	25%	Check on Canvas
Presentation	Group	10%	See above in the Course Schedule
Empirical Report	Group	24%	Wednesday, Apr 24 (at 4:00 pm)
Total		100%	

* Guidelines and detailed instructions for Assignment are on Canvas
** For Group Assignment, you must learn how to work in team, communicate properly, and negotiate with others. If you work alone, I will not accept the assignment and your grade will be automatically 0.

Grading Scale

94+ = A	74+ = C
90+ = A-	70+ = C-
87+ = B+	67+ = D+
84+ = B	64+ = D
80+ = B-	61+ = D-
77+ = C+	Below 61 = F

6.2) Makeup Policy for any Assignment

If you miss any Assignment, I will provide a makeup activity in the case of an excused and unavoidable absence. Then it is YOUR RESPONSIBILITY to provide satisfactory written documentation of an excused and unavoidable absence as soon as possible. For example, if you are ill – the accompanying doctor's note must say that you cannot (or could not) do the Homework or Lab. If the doctor's note does not state this clearly, your score will be zero.

7. Course Expectations

7.1) Clarifying Expectations

To succeed in this course, you'll need to invest a good amount of time and energy doing exercises outside the class time. If at any time you feel you're investing the required time and energy but aren't learning the material or improving your skills, contact me and I'll do my best to help you and to suggest additional resources and options. If you have questions or concerns that you believe can be handled via e-mail, feel free to contact me that way. If I cannot adequately respond to your question via e-mail, I'll ask you to come to my regular office hours or make an appointment.

7.2) Academic Integrity

Wayne State University aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Student Code of Conduct, please see https://doso.wayne.edu/conduct/codeofconduct.pdf. Students who commit or assist in committing dishonest acts are subject to sanctions described in the Student Code of Conduct.

7.3) Special Accommodations

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.