University of Waterloo
Department of Economics
Economics 405

Course Outline

(Fall 2014)

Instructor: Dinghai Xu

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Lecture Time: M. & Th. 10:00 to 11:20 **Lecture Location**: DWE 3522A
Office Hours: Fri. 1:30 to 3:00 or by appointment
TA: TBA
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Course Description

The main goal of this course is to provide students with an econometric (statistical) foundation for pursuing applied and theoretical research in economics and finance. The topics for this class are listed below.

Recommended References:

Statistics and Finance: An Introduction (SF) by David Ruppert
Time Series Analysis (TSA), by J. D. Hamilton, Princeton University Press
The Econometrics of Financial Markets (EFM), J. Y. Campbell, A. W. Lo, A. C. Mackinlay, Princeton University Press.
Asset Price Dynamics, Volatility and Prediction (AVP), by S. J. Taylor, Princeton University Press.
Econometrics Analysis (EA), by W. H. Greene, Fifth Edition, NY, Macmillan.

Journals:

Econometrica, Journal of Econometrics, Journal of Business and Economic Statistics, Journal of Finance, Journal of Empirical Finance, Journal of Financial Econometrics, Journal of Applied Econometrics and etc.

Topics to be covered

Probability and Statistics Foundation [SF: Chp. 2]
(random variable, probability functions, independence, moments, multivariate concepts, some common continuous distribution)

Concepts of Prices, Returns and Volatility [SF: Chp. 3, TSA: Chp. 2, Chp. 3]
(definitions and conventions of prices, returns and volatility, basic financial modelling via distributions, some stylized facts / empirical phenomena)

Linear Time Series Models and Estimation [SF: Chp.4, TSA:Chp.3; EA: Chp.18]
(White Noise (WN) process, Autoregressive (AR) process, Moving Average (MA) process, ARMA process, stationarity conditions, Forecasting, MLE, GMM)

Time-Varying Volatility Processes [SF: Chp. 12, TSA: Chp. 21; EA: Chp. 18.5]
(Autoregressive Conditional Heteroskedasticity (ARCH) model, Generalized ARCH (GARCH) model, Stochastic Volatility (SV) model, Stochastic Conditional Duration (SCD) model, statistical properties of the modelling structures, estimation procedures, empirical applications)

Multivariate Time Series [TSA: Chp. 10, Chp. 11]
(Vector Autoregrssions (VAR), Vector Moving Average (VMA), Granger Causality)

Non-Stationary Models for Time Series and Co-integration [TSA: Chp. 15, Chp. 16, Chp. 17, Chp 18, Chp. 19; EA: Chp. 22]
(Random Walk, Unit Roots, ARIMA, Dickey-Fuller Tests, Co-integration System and error correction)

Risk Management [Time Permitted]
(Value-at-Risk(VaR) , Conditional Value-at-Risk, Expected Short-fall, Portfolio theory, Efficient Frontier)

Continuous Time Stochastic Process [Time Permitted]
(Brownian Motion, Poisson process, Wiener process, Gaussian process, Stochastic Differential Equations (SDE), empirical applications) + High Frequency Data Analysis

Some related papers (empirical / theoretical) for each topic might be discussed in the class. If necessary, some introductions of Matlab may be illustrated for applications.

Computing SoftWare

There might be several problem sets which require using statistical software for computation. Feel free to use any computing package you prefer. But I would suggest Stata or Matlab. Some popular computing software packages have been installed in the computers in the computer Lab or in Arts' public computing labs. For more information, please consult the Information Systems and Technology (IST) office.

Course Requirements

- Homework (20%)
- Midterm Exam (30%)
- Presentation (10%)
- Research Project (40%)

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Economics Department Deferred Final Exam Policy

Deferred Final Exam Policy found at https://uwaterloo.ca/economics/current-undergraduates/policies-and-resources/deferred-final-exam-policy.

Cross-listed course

Please note that a cross-listed course will count in all respective averages no matter under which rubric it has been taken. For example, a PHIL/PSCI cross-list will count in a Philosophy major average, even if the course was taken under the Political Science rubric.

Academic Integrity

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and responsibility. See the UWaterloo Academic Integritity Webpage (https://uwaterloo.ca/academic-integrity/) and the Arts Academic Integrity Office Webpage (http://arts.uwaterloo.ca/current-undergraduates/academic-responsibility) for more information.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, **including writing exams in a section that you are not registered in,**

disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline. For typical penalties check Guidelines for the Assessment of Penalties found at http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4. In addition, read the Student Grievance Process for the Faculty of Arts found at https://uwaterloo.ca/arts/current-undergraduates/student-support/student-grievances-faculty-arts-processes.

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals.

Other sources of information for students

Academic integrity (Arts) Academic Integrity Office (uWaterloo)

Accommodation for Students with Disabilities

Note for students with disabilities: The AccessAbility Services office, located in Needles Hall Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AS office at the beginning of each academic term.