University of Waterloo
Department of Economics
Economics 423

Course Outline

(Winter 2020)

Instructor: Dinghai Xu

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Lecture Time: T. & Th. 10:00 to 11:20 **Lecture Location**: DWE 3516
Office Hours: Th. 14:00 to 15:00 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 (Optional)

Statistics and Finance: An Introduction (SF) by David Ruppert
Time Series Analysis (TSA), by J. D. Hamilton, 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)

Linear Regression Models [EA: Chp. 4, 6]
(OLS, MLE, model mis-specification, asymptotic properties)

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, Estimation and Forecasting [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)

Note:
1. The topics may not be covered in the exact order as shown above.
2. Some related papers (empirical / theoretical) for each topic might be discussed in the class.
3. If necessary, some introductions of Matlab or R 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 or R.

Course Requirements

- Homework (30%)
- Midterm Exam (30%)
- Final Exam (40%)

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Economics Department 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 and the Arts Academic Integrity webpage for more information.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offences, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (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, 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.

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. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Appeals: A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 - Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 - Student Appeals.

Accommodation for Students with Disabilities

Note for students with disabilities: The AccessAbility Services office, located on the first floor of the Needles Hall extension (1401), 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.

If you are using Turnitin® in your course

Turnitin.com: Text matching software (Turnitin®) will be used to screen assignments in this course. This is being done to verify that use of all material and sources in assignments is documented. Students will be given an option if they do not want to have their assignment screened by Turnitin®. In the first week of the term, details will be provided about arrangements and alternatives for the use of Turnitin® in this course.

Note: students must be given a reasonable option if they do not want to have their assignment screened by Turnitin®. See guidelines for instructors for more information.