

**Carleton University
Department of Economics**

**ECON 5713 W
Time-Series Econometrics**

Professor: Ba Chu

Winter 2024

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Class hours: Mondays, 6:05 - 8:55 p.m.

Log into Carleton Central or Brightspace to view location information.

Office hours: TBC

Nature of the Course:

This course is designed as an introduction to time series analysis and its applications in economics. Main econometric methods to analyze time-series and panel data will be covered, though the focus will be on stationary and non-stationary time series. The exposition will be formal in some parts. Students are expected to have taken or be taking concurrently ECON 5027 or an equivalent course in econometrics/statistics.

Note: Students are advised to check [Brightspace](#) regularly [every day] for course material and latest announcements. All lectures will be delivered in person.

Plagiarism:

Please be aware that plagiarism is a serious offence at Carleton and should be recognized and avoided. For further information on how to do so, please see “Academic Integrity and Offenses of Conduct” at <https://carleton.ca/economics/courses/writing-preliminaries/academic-integrity-and-offenses-of-conduct/>.

Requests for Academic Accommodations:

For Religious Obligations	To be worked out on individual basis with instructor. Consult Equity Services Website or an Equity Advisor (ext. 5622) for Policy and list of Holy Days (www.carleton.ca/equity)
For Pregnancy	Contact Equity Services (ext. 5622) to obtain <i>letters of accommodations</i>

For Students with Disabilities:

Students with disabilities needing academic accommodations are required to contact a

coordinator at the Paul Menton Centre to complete the necessary *letters of accommodation*. Students are required to check with the PMC center for accommodations regarding formally scheduled final examinations.

Texts and References:

W. Enders, *Applied Econometric Time Series*, 2nd edition, New York: Wiley, 2004. (Supplementary text). HB139.E55 2004

P. Kennedy, *A Guide to Econometrics*, 5th edition, Cambridge: The MIT Press, 2003. (Supplementary text). HB139 .K45 2003

J. Hamilton, *Time Series Analysis*, Princeton, NJ: Princeton University, 1994. (a pretty good introductory text for somebody who is curious about how a time series method works). QA280 .H345

M. Hashem Pesaran, [Time Series and Panel Data Econometrics](#), Oxford: Oxford University Press, 2015. (Please click the blue text to access the e-book.)

There are several good books and references that you may wish to consult.

M. Verbeek, *A Guide to Modern Econometrics*, 2nd edition, New York: Wiley, 2004. HB139.V465

G.E.P. Box, G.M. Jenkins, and G.C. Reinsel, *Time Series Analysis*, 3rd ed., Englewood Cliffs, NJ: Prentice-Hall, 1994. QA280.B67 1994

P. J. Brockwell and R. A. Davis, *Introduction to Time Series and Forecasting*, New York: Springer-Verlag, 1996. QA280 .B757 2002.

R.F. Engle and D.L. McFadden (eds.), *Handbook of Econometrics*, V. 4, Amsterdam: North- Holland, 1994 - referred to as *HE* below. HB139.H36 v.4

W. Fuller, *Introduction to Statistical Time Series*, 2nd ed., New York: John Wiley & Sons, 1996. QA280 .F84 1996

G.S. Maddala and I.M. Kim, *Unit Roots, Cointegration and Structural Change*, Cambridge: Cambridge University Press, 1998. HB139 .M3555

Hamilton is a thorough and advanced treatment of time series analysis in econometrics and the Box-Jenkins-Reinsel volume is the latest revision of a classic in time-series analysis by Box and Jenkins. The Maddala-Kim volume provides a comprehensive review of developments in unit roots, co-integration, and related issues. The Kennedy book provides a good introduction of the econometric tools used for time series analysis.

Notes on Course Assessment:

1. There will be one final exam weighted at 50% (to be held on the last day of this course), and two big assignments weighted at 24% after the 4th lecture. The rest 26% weight is awarded for in-class presentations. (Please ignore the weights automatically assigned by Brightspace.) Note that the final exam is cumulative and it covers the entirety of the course material.
2. For your assignments, you may use EViews or Stata on the computer network, R or Python (if you wish to). First, you will need to download Stata/SE 14.0 for Windows/Mac from the following link:

<http://carleton.ca/ccs/all-services/computers/site-licensed-software/>

Another GPL package, GRETLL, can also be used. You can download it to your personal computer from

<http://gretl.sourceforge.net/win32/>

3. It is very important to keep in mind that assignments will be due approximately TWO WEEKS after they are made available online. An assignment must be submitted within 15 minutes of the beginning of the class on the due date. No late or deferred assignment will be accepted. If you fail to submit your assignment on time, a zero weight (out of '12%') will be assigned to your final grade.

4. 24-Hour Window Policy: If you have any question regarding the material, please ask early so that you are well prepared for success! The Instructor or TA will not be available for 24 hours before exam times and assignment due deadlines, or 24 hours after assignments/midterms are returned. Do not raise questions in these windows.

Please follow the above policies, and you will be able to achieve an easy 2% grade on Communication.

5. In-class presentations will be scheduled around the third/fourth week of February. I will provide a list of papers on various topics so that students are welcome to choose any topic that they are interested in. *Students are expected to let me know the papers to be chosen for their presentations by the end of January* - please note this deadline. If the class size is big (say, more than 20), then each group of two or three students may work on a presentation.

6. *Students can write in-person exams via Brightspace in the classroom.* Please note that the final exam will use a remote proctoring service provided by [Scheduling and Examination Services](#). You can find more information at <https://carleton.ca/ses/e-proctoring>. To know how to log into the CoMas e-Proctoring platform, please refer to this guide: <https://carleton.ca/ses/wp-content/uploads/CoMaS-Student-Instructions-v.-1.06.pdf>. Students are required to have **webcams** (and laptops/computers) to use with the e-Proctoring platform. In addition, to ensure that everyone is on the same page, *there is no option to take distance exams.*

7. Failure to write the final examination will result in a grade of **F**. To write a deferred final exam, students must contact the Registrar's Office as soon as possible after the missed exam. Note that makeups or deferrals should have the same modality as the test or exam they replace.

Reading Assignments:

Readings in theory/applied work will be assigned as the course progresses.

1. Univariate Time Series Models

- a. Stationary time series process
- b. ARMA models
- c. Integrated processes and ARIMA models

Lecture Notes, Ch. 1
Kennedy, pp. 319-324
Verbeek, pp. 255-265
Enders, pp. 48-68, 156-170
Hamilton, Ch. 3

2. Building Univariate Time Series Models

- a. Estimation
- b. Identification
- c. Diagnostic checking
- d. Unit root tests
- e. Forecasting

Lecture Notes, Chs. 1-2
Enders, pp. 69-100, 170-230
Kennedy, pp. 325-326, 358-363
Verbeek, pp. 266-293
Hamilton, Chs. 4 and 5
Hamilton, Ch. 17
J.H. Stock, "Unit roots, structural breaks and trends," Ch. 46 in *HE*
P.C.B. Phillips and Z. Xiao, "A Primer on Unit Root Testing,"
Journal of Economic Surveys, 1998, 12(5), 423-469

3. Multivariate Time Series: I

- a. Stationarity of multiple time series
- b. Autoregressive distributed lag models

Enders, pp. 239-264
Hamilton, Ch. 10

4. Multivariate Time Series: II

- a. VAR modeling
- b. Causality and exogeneity
- c. Models with nonstationary variables
- d. Cointegration
- e. A brief description of dynamic panel data models
Lecture Notes, Chs. 3-4
Enders, pp. 265-311, Ch. 6
Kennedy, pp. 326-328
Verbeek, Ch. 9
Hamilton, Chs. 11, 18, 19 and 20
Pesaran, Chs. 26-28 (providing a very good review of panel data models)
M. Watson, "Vector autoregression and cointegration," downloadable from
<http://www.eco.uc3m.es/jgonzalo/teaching/PhDTimeSeries/varmwatson.pdf>
V. A. Muscatelli and S. Hurn, "Cointegration and Dynamic Time Series Models," *Journal of Economic Surveys*, 1992, 6(1), 1-43.
K. Hubrich, H. Luetkepohl, and P. Saikkonen, "A Review of Systems Cointegration Tests," *Econometrics Reviews*, 2001, 20(3), 247-318.
Nobel Committee, "Advanced Information: Time Series Econometrics: Cointegration and Autoregressive Conditional Heteroskedasticity," **2003**.

5. ARCH Models (if time permits)

- a. ARCH models
- b. GARCH and other models

Enders, Ch. 3
Verbeek, pp. 297-303
Hamilton, Ch. 21
T. Bollerslev, R.F. Engle, and D.B. Nelson, "ARCH models," Ch. 48 in *HE*
Engle, R. (2001), "GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics," *Journal of Economic Perspectives*, 15, 157-168.
A.K. Ber and M.L. Higgins (1993), "ACH Models: Properties, Estimation and Testing," *Journal of Economic Surveys*, 1993, 7(4), 305-366.

6. Dynamic Panel Data Models (if time permits)

- a. Fixed effects and random effects models
- b. Long vs. short panels
- c. Bias corrections

J. Alvarez and M. Arellano, “The time series and cross-section asymptotics of dynamic panel data estimators,” *Econometrica*, 2003, 71(4), 1121-1159.

M. H. Pesaran, Y. Shin, and R. Smith, “Pooled mean group estimation of dynamic heterogeneous panels,” *Journal of the American Statistical Association*, 1999, 94(446), 621-634.

Chapters 27 and 28 of Pesaran’s (2015) textbook.

7. State Space Models (if time permits)
 - a. Examples of state space models in macroeconomics.
 - b. Filtering methods (e.g., bootstrap filtering and auxiliary filtering).
 - c. Particle MCMC.

E.P. Herbst and F. Schorfheide, “*Bayesian Estimation of DSGE Models.*”

P. Fearnhead and H.R. Kunsch, “Particle Filters and Data Assimilation,” *Annual Review of Statistics and Its Application*, 2018, 5, 421-449.

Notes:

Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).

Thank you! If you have any further question/concern, please feel free to ask me for help.