Time-Series Econometrics

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Sample Syllabus

Course Description

This course introduces students to the most popular econometric techniques applied to time series data. Lectures will cover methods for both stationary and non-stationary time series, in the univariate and multivariate cases. Furthermore, the course will also cover forecasting, dealing with heteroskedastic time series data, and structural change models. Finally, theoretical lectures will be followed by applications in the open-source statistical/programming language R.

Course Objectives

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

- Perform quantitative analyses on macroeconomic data;
- Proficiently use R to conduct time series studies;
- Better understand macroeconomic phenomena through applied exercises and real-world examples.

Prerequisites

Intermediate Macroeconomics and Principles of Econometrics.

References

Required Textbooks:

- W. Enders (2015). *Applied Econometric Time Series*, 4th edition. Wiley.
- P. Cowpertwait, and A. Metcalfe (2009). *Introductory Time Series with* R. Springer.

Additional References:

- J. M. Wooldridge (2013). *Introductory Econometrics: A modern approach*, 5th edition. Cengage Learning.
- B. Pfaff (2008). *Analysis of Integrated and Cointegrated Time Series with* R. Springer.

- R. Shumway, and D. Stoffer (2017). *Time Series Analysis and its Applications with* R *examples*, 4th edition. Springer.

Required Software

- Download R: http://www.r-project.org
- Download RStudio: http://www.rstudio.com

Grading

Assignments (30%) + Exams (40%) + Class Participation (10%) + Research Paper (20%)

Assignments

Students will be asked to solve several problem sets, covering each class topic. These will include both theoretical and R applied exercises. Group work is strongly encouraged; however, students must turn in individual submissions.

Exams

Students will have one Midterm and a Final exam. Exams will be strongly based off of problem sets, and will also cover both theoretical and applied parts of the content. The Final exam is comprehensive.

Class Participation

Class attendance is required, and class participation is a crucial part of class dynamics.

Research paper

Students will also be asked to write a short research paper, due the last day of class. Its purpose is to have students ask a research question, review the relevant bibliography, collect the data, and perform the adequate estimation procedures to answer that question. In summary, this assignment proposes a *hands-on* experience with time-series data. Papers should have no more than 10 pages, double-spaced. A template and several databases will be made available in the beginning of the semester.

Letter Grade Distribution

- Excellent, superior performance: A (93-100%), A- (90-92.9%)
- Good performance: B+ (87-89.9%), B (83-86.9%), B- (80-82.9%)
- Standard performance: C+ (77-79.9%), C (73-76.9%), C- (70-72.9%)
- Substandard performance: D+ (67-69.9%), D (63-66.9%), D- (60-62.9%)
- Unsatisfactory performance: E (0-59.9%)

Class Policies

You can expect me to:

- Grade and provide feedback on assignments and exams within one week from the due date;
- Reply to emails/messages within 24 hours during the week and within 48 hours on weekends and holidays;
- Hold weekly in person/virtual office hours, where students can join and ask every question and talk about any issues/concerns relative to our class. For virtual cases, links for each meeting will be provided every week.

I expect students to:

- Come to class prepared, by checking out announcements, new content updates, and studying the assigned readings;
- Take the exams on the scheduled dates. No make-up exams will be allowed, except in cases of documented medical emergencies or religious circumstances;
- Respectfully participate in in-class discussions and activities;
- Immediately notify me in the event of an emergency that prevents you from doing an exam or completing the course;
- Ask questions if any expectations or assignments are unclear.

Tentative Course Outline

The course will follow 8 sections, whose readings are detailed below:

1. **Course introduction; why do we need specific time series models?**

- *Required Readings*:
  - Enders (2015), ch. 1.
  - Cowpertwait & Metcalfe (2009), ch. 1.
- *Recommended Readings*:
  - Wooldridge (2013), ch. 10.

2. **Visualizing and decomposing time series data: trend, seasonality, and noise**

- *Required Readings*:
  - Cowpertwait & Metcalfe (2009), ch. 2 and 4.

3. **Stationary time series: ARMA modeling**

- *Required Readings*:
  - Enders (2015), ch. 2.
- *Recommended Readings*:
  - Cowpertwait & Metcalfe (2009), ch. 6.

4. **Nonstationary time series: ARIMA modeling**

- *Required Readings*:
  - Enders (2015), ch. 4.
- *Recommended Readings*:
  - Cowpertwait & Metcalfe (2009), ch. 7.

5. **Multivariate time series models: VAR, SVAR, and VEC approaches**

- *Required Readings*:
  - Enders (2015), ch. 5, 6.
- *Recommended Readings*:
  - Pfaff (2008), ch. 4 and 8.

6. **Heteroskedasticity in time series: (G)ARCH models**

- *Required Readings*:
  - Enders (2015), ch. 3.
  - Wooldridge (2013), ch. 12.
- *Recommended Readings*:
  - Shumway & Stoffer (2017), ch. 5.

7. **Structural change in time series models**

- *Required Readings*:
  - Enders (2015), ch. 7.

8. **Time series forecasting**

- *Required Readings*:
  - Cowpertwait & Metcalfe (2009), ch. 3.

Space for University Policies and Procedures