

ECON 452 : Applied Time Series Analysis

Pier-André Bouchard St-Amant

1 General Information

This course is intended for persons willing to perform meaningful time series analysis after they graduate. The semester will be divided in two periods. In the first one, there will be classes about the theory of time series as well as applied examples. Tutorials will cover an introduction to a statistical software. In the second period, Students will have to apply theory to a project of their own (and there will thus be no formal classes). At the end of this course, students are expected to be able to write a coherent report and forecasts about a time series on which they have performed econometric analysis.

1.1 Course

- Class periods : tuesdays, 10h00 & thursdays, 8h30.
- TA classes : wednesdays, 10h00.
- Course webpage : <http://www.pabsta.qc.ca/en/courses/ECON452>
- The statistical software used for this class is Stata. Some details about it can be found in the section 5 below.

1.2 Books

- There is no mandatory book for this class. I however give some reference books as different sources might be useful to deepen some topics covered. In the description of topics covered each week, I give specific references in each book.
- *Time Series Analysis : Forecasting and Control* by [G. Box](#), [G. Jenkins](#) and [G. Reinsel](#) (**BJ**) is probably the closest book to this class. It however relies on mathematics used mostly by electrical engineers (signal analysis) and the “big picture” might be hard to get.
- *Econometric Analysis* by [Thomas H. Greene](#) (**G**) is a great companion for econometrics. It covers both theory as well as some applied examples. However, it covers much more topics than what we will see in this class.
- *Econometric Theory and Methods* by [Davidson & McKinnon](#) (**DM**) is also a good general book for econometrics.

- The book *Time Series Analysis* by [James D. Hamilton](#) (**H**) is a complete *theoretical* book about time series. Students willing to understand deeply the theory we cover might want to have a look at this book. It however requires a great understanding of mathematics.

1.3 Instructor

- Instructor : Pier-André Bouchard St-Amant, DUN 332.
- Office Hours : thursdays, 10h00.
- Email : pabsta@econ.queensu.ca

1.4 Teaching Assistant

- TA : Vincent Chandler, DUN 333.
- Office Hours : TBA.
- Email : chandlev@econ.queensu.ca

1.5 Evaluation

- 30% based on one intermediary report, due March 2nd.
- 50% based on one final report, due April 5th.
- 10% based on class attendance.
- 10% based on one surprise quiz in class or a homework.
- There will be no exams.
- Details about the intermediary and final reports can be found below in section [3](#).

2 Courseplan

2.1 Week 1

- Class : Courseplan, review of ordinary and generalized least squares.
G : ch. 4-5, **DM** : ch. 2-3, **H** : ch. 8.
- Labs : No lab.

2.2 Week 2

- Class : introduction to AR(p), MA(q), ARMA(p,q), Wald and Likelihood Ratio tests.
For the ARMA section : **G** : ch. 19.2, 20.2.1, **DM** : ch. 13.1.-13.4, **H** : ch. 3, **BJ** : ch. 1.2.
For the tests : **G** : ch. 6.3, 17.5, **DM** : ch. 4.3.-4.4, 10.6.

- Labs : Introduction to Stata : workspace, variables, importing data, help files, ways to access various data sources.

2.3 Week 3

- Class : MLE estimation and applications.
G : ch. 17, **DM** : ch. 10.1.-10.2, **H** : ch. 5.1-5.6, **BJ** : 7.1.
- Labs : Introduction to do-files, log-files and an example of GLS application.

2.4 Week 4 & 5

- Class : stationary, non-stationary processes and associated diagnostic tools.
G : ch. 20.2-20.3, **DM** : ch. 13.1-13.4, 14.1-14.4 **H** : ch. 3, 17, **BJ** : ch. 4.
- Labs : Basic commands for descriptive analysis : sum, tab, desc, graph, multiple graphs, etc.
- Labs : Time operator framework (tset), lags, leads, correlograms, autocorrelation functions and partial autocorrelation functions.

2.5 Week 6

- Class : Numerical estimations, non-stationary processes.
For Numerical Methods : **G** : Appendix E.6, **DM** : ch. 6.4-6.5 (although it is not on time series), **H** : ch. 5.7, **BJ** : 7.2.
For non-stationary processes : **G** : ch. 20.2-20.3, **DM** : ch. 10.1.-10.2, **H** : ch. 5.1-5.6, **BJ** : ch. 4.
- Labs : Applied examples and some diagnostics for stationarity.

2.6 Week 7

- Class : seasonality, some estimation problems and forecasting.
H : ch. 4, **BJ** : ch. 5.
- Labs : Applied examples and some diagnostics for stationarity.

2.7 Week 8

- Class : Model building, paper structure and first paper review.
- Labs : Forecasts.

3 Intermediary and Final Reports

Evaluation will be done mostly based on the reports students will submit during the course. Reports should reflect the analysis done on a variable chosen by group of students, reflect critical thinking and explain modeling choices. Working in pair is allowed and equal grades will be given to both authors. The class aims to give students a specific research framework in which they should perform their analysis. In broad terms, there might not be a unique “right report”, but students should explain why they think their econometric modeling reflects the best model choice based on what they have learned in class.

In short, the first paper will try to answer to the question “what does the variable look like?” while the second will answer “what is the best way to forecast the variable?”

3.1 Intermediary Report

The first report will broadly cover a descriptive analysis of the variable as well as a justification for your work. What does the data look like? Why is it interesting? Why should we need to be able to predict the variable’s behavior? What will be your approach for your modeling strategy in the next report? You should think of this report as a something in between the raw material for the beginning of your final paper and a work proposal (e.g : why should your company/employer need to know something about this particular variable and investigate further?).

3.2 Final Report

The second report will be a full sustained report mimicking the format of a journal article. In an introduction, you will briefly present why your work is important as well as your main results and perhaps its implications. In the following sections, you will present descriptive results (as in the first report), methodology, interpretation of econometric analysis as well as forecasting. In all these steps critical thinking will be needed to report the most important results as well as governing choices for models and forecasts. You will also need to provide sound arguments for your interpretation of the results and forecasts.

3.3 Some general requirements and comments for both papers

- No more than 15 pages, double spaced (with times 12), including references.
- There should be references and sources (data, other papers, related literature, etc.).
- Reports should be easy to read and understand. Some care should be taken to format the data as well as graphs. Copying and pasting output from Stata directly into your report is not a good idea. One should instead learn how to use commands like outfile, outreg and the like.

- Reports should contain your Stata Code used to generate your results with comments to accompany the reader (do file). This do file can be copied and pasted.
- References and good guidelines for writing a paper are given on the class website.

4 Class participation

Class attendance is mandatory for the first 8 weeks and is worth 10%. Five periods out of 24 (class times and TA times) will be randomly chosen to take presences for the purpose of evaluation. Each of them will be worth 2%.

5 Statistical Software

- The statistical software that will be used for this class is Stata.
- If the “help” command should be the first reference, internet can provide with a lot of help as well. There is a tremendous amount of information available on the internet about the software.
- The computer room on the third floor (DUN 350) has Stata installed on each of the computers. Class periods, TA periods as well as office hours periods have been reserved for the students taking this class. Students have at least 7.5 hours per week to perform their project in the computer room.
- As there is roughly 30 persons registered and 16 computers in the Lab, TA sessions will have to be done in groups of two. If need be, the class might be split into two groups to share reserved periods in the lab.
- Students can also purchase the statistical software with a discount through the courseplan available at [this address](#). A gradplan ID is required to benefit from a discount. Such ID will be given in class. Depending on the type of license you wish to buy (6 months, one year, perpetual), prices will vary.

6 Some Data Sources

- Queen’s Library has a nice portal for finding [statistics](#).
- [E-STAT](#) contains a lot of free time series from Statistics Canada.
- [Wharton Research Data Services](#) is the reference for business (market) data. You need to [request an account](#) in order to access the data.
- St Louis Federal Reserve [Economic data](#). It can be downloaded directly into Stata.
- [U.S. Bureau of Economic Analysis](#).
- The [Bank of Canada](#).
- [Yahoo Finance](#) is good for trade prices of stocks.
- [Institute for Health Economics](#).

- [Canadian Institute for Healthcare Information](#) contains a lot of data for provincial expenditures in in healthcare.
- The [U.S. Bureau of Labor Statistics](#).
- [OECD database](#).
- [ODESI](#) contains a lot of panel and synchronous data and might be worth exploring for time series as well.

7 FAQ

7.1 Can I submit my reports late in exchange for a penalty ?

No and there are no exceptions.

7.2 I have missed a quiz/exam because I was sick/my grandmother died. Can I get a make-up test ?

Unless you have a signed medical bill or a letter from a funeral home, no. Perhaps you should know that professors are aware of the [dead grandmother syndrome](#).

7.3 My partner has not done anything of his work and our report sucks. Can this be taken in consideration for my final grade ?

Evaluation is based on your capacity to produce a coherent report as you would be required to do in a real job. If your partner sucks, you should try to get ahead of the problem before its too late. Bad or incomplete reports will receive bad or incomplete grades, and so will their authors.

7.4 I need a letter of recommendation for a job or for a grant application, can you help me ?

You should know first that professors recommendations bear more weight than those from teaching fellows, especially if it is for a research oriented application. Hence, you should look first for recommendations from professors. Second, if you want a recommendation from me, I suggest you get involved in class and perform well. We (teachers) have very little to distinguish between good and bad students, specifically on “non-academic” features. The more you get involved, the more we get to know you.

7.5 What *exactly* is required to be in our reports ?

There is no “definite” answer to that question. You should include the usual stuff (see the section “Some Useful Readings” for some guidelines), but most of this are the

procedural requirements (data sources, definitions, regressions specifications, output, etc.). What should be in the report is what you think is interesting. Obviously, the interesting results in terms of forecasts, predictions errors and so on, but also discussions about model selection and why one model was chosen over another. What did go wrong in your research is also instructive. Creativity, originality as well as critical thinking will be rewarded.

7.6 I already have version X of Stata. Should I really buy a new version ?

You should be all right with any version greater or equal to 10. If you intend to do econometric analysis in the future, it might not be a bad idea to profit from the discount given through the class plan, though.

8 Statement of Academic Integrity & Copyright

8.1 Academic Integrity

Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see [this webpage](#)). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the [Senate Report on Principles and Priorities](#)).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see [Academic Regulation 1](#)), on the [Arts and Science website](#), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

8.2 Copyright

The material on the course page is copyrighted and is for the sole use of students registered in ECON452. The material on this course page may be downloaded for a registered student's personal use, but shall not be distributed or disseminated to anyone other than students registered in ECON452. Failure to abide by these conditions is a breach of

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