



**MACQUARIE UNIVERSITY  
DIVISION OF ECONOMIC AND FINANCIAL STUDIES  
STAT822: TIME SERIES  
UNIT OUTLINE**

**Year and Semester: 2008 Semester 2**

**Unit convenor: Prof Barry Quinn**

**Prerequisites: None**

**Corequisites: STAT371 or STAT810**

Students in this unit should read this unit outline carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult Prof Quinn

**ABOUT THIS UNIT**

STAT822 Time Series is a 4 credit point unit run by the Statistics Department in the Division of Economic and Financial Studies, and is a unit within the Master of Applied Statistics program.

This unit is an introduction to the statistical theory and practice of Time Series Analysis. A Time Series is a set of data indexed by time, or by something which can be interpreted as "Time", e.g. a single spatial variable. A time series is modelled as a single "realisation" or sample of a stochastic process, i.e. a collection of (possibly) dependent random variables. The course looks at suitable models for time series, examines the estimation of parameters in these models, hypothesis testing (and alternatively estimating the number of parameters), prediction of future values of the time series (forecasting), models for multivariate time series and the estimation of periodicity. There will also be a limited look at modelling stochastic volatility.

Emphasis in this course will be on practice. The computing package Matlab will be used, and the early practical periods will be devoted to learning how to write and run Matlab programs, specifically to analyse time series.

#### **TEACHING STAFF**

Prof Barry Quinn, Room E4A 535, phone 9850 6475 email bquinn@efs.mq.edu.au

#### **CLASSES**

There are three contact hours, on Tuesday from 6pm until 9pm in room E4B 102. The three hour class is roughly divided equally into lecture and practical classes.

#### **REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS**

There is no prescribed textbook. Some reference books are

- W.A. Fuller, Introduction to statistical time series.
- C. Chatfield, The analysis of time series: an introduction.
- C. Chatfield, The analysis of time series: theory and practice.
- C. Chatfield, Time-series forecasting.
- P.J. Brockwell and R.A. Davis, Introduction to Time Series and Forecasting.
- S. Makridakis, S.C. Wheelwright and R.J. Hyndman, Forecasting, Methods and Applications.
- W.W. Wei, Time Series Analysis.
- F.X. Diebold, Elements of Forecasting.
- J.D. Cryer, Time Series Analysis.
- B.L. Bowerman and R.T. O'Connell, Forecasting and Time Series.
- H. Joseph Newton, TIMESLAB: A Time Series Analysis Laboratory.
- R.S. Tsay, Analysis of Financial Time Series.
- B.G. Quinn and E.J. Hannan, The estimation and Tracking of Frequency
- S-Plus 2000 Guide to Statistics, Volume 2, Chapters: 6. Creating and Viewing Time Series and 7. Analyzing Time Series. (available from Splus2000 Help/Online Manuals)

The lecture notes are extensive.

#### **SOFTWARE**

MATLAB version 5 will be used in the practical classes. Although this version is old, it is the last version which students are permitted to install on their own computers for the duration of the course. Students will be provided with MATLAB installation cds. Students will be prompted for a "PLP", which is included in a text file on the root of the cd. The cds also contain a STAT822 directory with the 2006 lecture notes, etc, and the latest stable version of the free Matlab clone, SCILAB, with a help file and manuals.

#### **UNIT WEB PAGE**

The web page for this unit, <http://www.stat.mq.edu.au/units/stat822/index.htm> will not be the main source of information. Instead, students should log into the Blackboard site via <http://learn.mq.edu.au>

Consult the Blackboard pages frequently. You will find administrative updates, lecture notes, tutorials and assignments posted there. As STAT822 is offered externally as well as internally, Blackboard will be used to inform external students about what has occurred in each week's classes.

### **LEARNING OUTCOMES**

The Unit is an introduction to Time Series analysis. By the end of this Unit, students will be able to model real time series using a variety of techniques, judge the adequacy of these models, and use them to forecast future values. They will also have seen many of the theoretical issues, and know the limitations of such modelling.

In addition to the discipline-based learning objectives, all academic programs at Macquarie University seek to develop students' generic skills in a range of areas. One of the aims of this unit is that students develop problem-solving skills, especially using the computer package Matlab.

### **TEACHING AND LEARNING STRATEGY**

Students enrolled internally will attend the three-hour lecture class each week. The slides shown in lectures will be available at the website before the lecture is given, but may be corrected after the lecture. A practical exercise will be set weekly and will usually be available via Blackboard before the week's practical class.

A plan of the topics to be covered is at the end of this document.

### **RELATIONSHIP BETWEEN ASSESSMENT AND LEARNING OUTCOMES**

The marks from assignments will comprise 30% of the final assessment. The remaining 70% will come from the final "take-home" examination. Satisfactory performance is required in both the assignments and the final examination in order to pass STAT822

*Assignments* Assignments are a major part of the learning process. There will be three assignments, due by the end of weeks 4, 8 and 12. Assignments may be submitted electronically, via email to Prof Quinn, but NOT via Blackboard. There is no requirement that assignments be word-processed, as the mathematical typesetting capabilities of Microsoft word are not adequate (The lecture notes have been prepared using LaTeX). On-time submission of assignment is **compulsory**. Late submission of assignments will not be accepted without a good reason.

*Final Examination* The examination will be held at a date to be agreed on, but after the end of week 13. Each student will be given a unique time series to analyse near the end of the semester, and part of the exam will be to model this time series, describing the

methods used to obtain this model. In the past, the examination has taken place on a Saturday, local time, between 9am and 5pm.

It is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period.

## **PLAGIARISM**

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the *Handbook of Undergraduate Studies* or on the web at: <http://www.student.mq.edu.au/plagiarism/>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

## **UNIVERSITY POLICY ON GRADING**

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include one of these grades plus a standardised numerical grade (SNG).

On occasion your raw mark for a unit (i.e., the total of your marks for each assessment item) may not be the same as the SNG which you receive. Under the Senate guidelines, results may be scaled to ensure that there is a degree of comparability across the university, so that units with the same past performances of their students should achieve similar results.

It is important that you realise that the policy does not require that a minimum number of students are to be failed in any unit.

The process of scaling does not change the order of marks among students. A student who receives a higher raw mark than another will also receive a higher final scaled mark.

For an explanation of the policy see

<http://www.mq.edu.au/senate/rules/Guidelines2003.doc> or

<http://www.mq.edu.au/senate/rules/detailedguidelines.doc>.

## **STUDENT SUPPORT SERVICES**

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at <http://www.student.mq.edu.au>.

**STAT822 – TIME SERIES - SECOND SEMESTER 2008**  
**UNIT SYLLABUS**

<b>TOPIC</b>	<b>MATERIAL COVERED</b>
<b>1</b>	Stationary processes, autocovariances, autocorrelations, the Wold decomposition theorem.
<b>2</b>	Autoregressive moving average (ARMA) processes, the Yule-Walker relations
<b>3</b>	Estimation of ARMA parameters. Goodness of fit. Model building. Estimating the order of ARMA models.
<b>4</b>	Prediction for ARMA processes.
<b>5</b>	Multivariate time series. The Whittle recursion.
<b>6</b>	Stochastic volatility models.
<b>7</b>	Models for periodic phenomena. The estimation of periodicity and applications