STOCKHOLM UNIVERSITY
Department of Statistics
Fall 2024

Pär Stockhammar
2024-11-20

Course Description for Time Series Analysis, 7.5 ECTS Credits, Code: ST2301

COURSE CONTENT

In this course we will deal with time series data, i.e. observations obtained sequentially over time. In particular, we cover concepts such as time series data, transformations, stationarity, serial correlation, heteroscedasticity, forecasting and models such as exponential smoothing, ARIMA, ARCH/GARCH, VAR, local projections, state-space and non-linear models.

COURSE LITERATURE (ALL AVAILABLE ON ATHENA)

- Cowpertwait and Metcalfe (CM), "Introductory Time Series with R", Springer. https://michaela-kratofil.com/files/2009_Book_IntroductoryTimeSeriesWithR.pdf)
- Stockhammar (S1), “Supplementary material for the course in time series analysis”.
- Stockhammar (S2), “Icke-linjära tidsseriemodeller”.
- Stock and Watson (SW), ”Vector Autoregressions”, *Journal of Economic Perspectives*, 2001. Vector Autoregressions (harvard.edu).
- “Exercises in Time Series Analysis” (ETSA).

TEACHING AND EXAMINATION

The full course consists of 11 lectures (F1-F11), 4 problem-solving sessions (Ö1-Ö4) and 4 computer labs (D1-D4). Details of the content at each teaching occasion can be found at the end of this document. There are also 4 jour sessions (scheduled time for potential questions).

The examination consists of one exam and one compulsory hand-in assignment:

- Exam, 5 ECTS Credits (Examination code 11ST)
- Assignment, 2.5 ECTS Credits (Examination code 12ST)

Allowed tools for the exam: Pocket calculator, formula sheet (will be handed out with the exam, also available on Athena).

The topics of the hand-in assignments will be announced through Athena. The assignments are done as a group project (a group consists of 2-3 students) and are presented as a written report. We encourage discussions among students between groups during the work on the assignment, but each group must finally be able to answer for their own handed-in written report.

Use of AI tools

The use of AI tools is permitted as assistance for knowledge acquisition and study, but not for producing materials or code for any form of examination.

- All types of plagiarism are prohibited. This includes text generated by AI tools.
- The use of AI tools to improve an originally self-written text is not allowed.
- The department uses text-matching software and detectors for AI-generated text.

Dates for exams

Exam: January 16, 2025, 8:00-12:00

Remember to sign up for the exam at least 10 days before the examination. If you do not register, you cannot take the exam. The registration opens 30 days before the exam.

Assignment: Deadline January 12, 2025.

GRADING CRITERIA FOR THE EXAM

A (Excellent): The student can excellently use concepts and theorems within time series analysis that are not necessarily directly addressed in the course part. Requires at least 90% of the points on the written examination.

B (Very good): The student can very well use concepts and theorems within time series analysis that are addressed in the course part. Given for 80-89% of the points on the written examination.

C (Good): The student can well use concepts and theorems within time series analysis that are addressed in the course part. Given for 70-79% of the points on the written examination.

D (Satisfactory): The student can satisfactorily use concepts and theorems within time series analysis that are addressed in the course part. Given for 60-69% of the points on the written examination.

E (Adequate): The student can adequately use concepts and theorems within time series analysis that are addressed in the course part. Given for 50-59% of the points on the written examination.

Fx (Fail, some more work required): The student's performance is insufficient with respect to the course contents. Given for 40-49% of the points on the written examination.

F (Fail, much more work required): The student's performance shows clear deficiencies with respect to the course contents. Given for 0-39% of the points on the written examination.

To pass the exam a minimum grade of E is required. Failing grades are F and Fx. When obtaining a failing grade F or Fx in the written examination, we will not give extra exercises or extra assignments to obtaining a passing grade.

Hand-in assignment:
The compulsory hand-in assignment is graded as Pass (G) or Fail (U). If the compulsory assignment is graded as Fail (U), the student will have only one chance to re-submit the assignment and this has to be done within a week after the comments from the first hand-in are received.

Grading criteria for the hand-in assignment:

G (Pass): The student has set up appropriate time series models for the given situation, has demonstrated sufficient ability to use time series terminology and has presented the results in a well-written report in accordance with the instructions. All subtasks has been correctly solved.

U (Fail): The student's performance is insufficient with respect to at least one of the criteria for G.

TEACHERS AND COMMUNICATION DETAILS

Course coordinator, examiner, and lecturer: Pär Stockhammar
Email: par.stockhammar@stat.su.se
Reception hours: On agreement.

Teaching assistant: Yulia Ryanova
Email: yulia.ryanova@stat.su.se
Reception hours: On agreement.

TEACHING PLAN

Below a preliminary schedule over the contents, reading suggestions and exercises of the teaching occasions.

Lectures

	Contents	Reading
F1	Introduction + Time series data and transformations	CM ch 1, 2 and 6.2 + S1
F2	Time series regression. Forecasting strategies	S1. CM ch 2 and 3
F3	Exponential smoothing methods. Evaluating forecasts	S1 + CM ch. 3, 4.1-4.4
F4	Simple stochastic processes. Unit root tests, information criteria. AR, MA, ARMA, ARIMA and SARIMA models	CM ch 4, 6, 7.1-7.3 and 11.3. S1
F5	AR, MA, ARMA, ARIMA and SARIMA cont.	CM ch 4, 6 and 7.1-7.3
F6	Forecasting using autoregressive models. Non-linear models	S2. CM ch 5.8
F7	Non-linear models cont. Volatility models	S2, CM ch 5.8 and 7.4
F8	VAR models	CM ch 11, SW.
F9	VAR models, cont. Cointegration. Local projections	CM ch 11, SW, S1
F10	State space models	CM ch 12
F11	Recap and a smörgåsbord of other topics (long memory processes, spectral analysis etc.)	CM ch 8 and 9

Exercises sessions		
	Contents	**Problems**
Ö1	Random walk, Exponential smoothing	ETSA **2.10**, **1.1**, 1.2, **1.3**, 1.4, **1.5**
Ö2	ARIMA models	ETSA **2.2**, 2.6, **2.7**, 2.8, 2.11, **2.5**
Ö3	ARIMA models, forecast evaluation	TBD
Ö4	Exam problems	TBD

Computer labs	
D1	Data treatment, exponential smoothing, forecast evaluation
D2	ARIMA
D3	SARIMA, volatility models
D4	VAR models

COURSE EVALUATION

After the course is completed, an evaluation of the course is done. The course evaluation is used as a basis for the quality work with the course and as part of student influence. The evaluation is carried out by sending a survey via email to all registered course participants. The course participants' responses to the survey are compiled and placed together with the course responsible teacher's final report/course evaluation on Athena.

Further information about the department of Statistics and the course can be found at: Statistiska institutionen and Tidsserieanalys - Stockholms universitet.