

Time Series Analysis

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About this course

Time Series (Wikipedia):

“In mathematics, a time series is a series of data points indexed (or listed or graphed) in time order. Most commonly, a time series is a sequence taken at successive equally spaced points in time.

Thus it is a sequence of discrete-time data.”

Time Series Analysis: Methods for analyzing time series data, taking into consideration their key characteristic – *serial dependence*.

Example

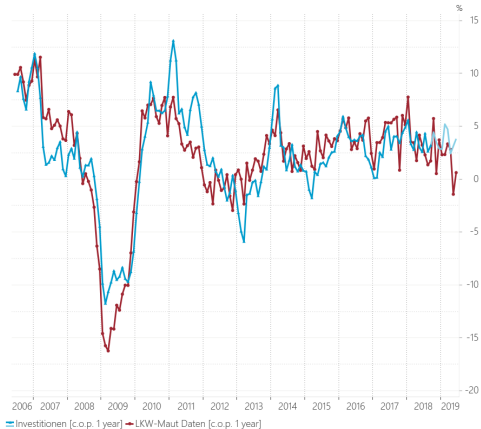


Figure: Number of kilometers travelled by trucks and German investment. Year-on-year percentage change. Source: Statistisches Bundesamt, own calculations.

About this course

Aims of time series analysis

- Description of a time series and its components
- Modelling – fitting stochastic models describing the dependence of a time series on e.g. its own past values
- Forecasting future values
- Dynamic regressions – uncovering the dependencies of a time series on explanatory variables
- Multivariate models – uncovering the dynamic relationships between multiple time series
- Monitoring and control

Topics (tentative outline)

- Descriptive time series analysis
 - Decomposition in and extraction of trend and cyclical components
 - Naive forecasting methods (e.g. exponential smoothing)
- Theory of linear filters
- Models for stationary time series (AR, MA, ARMA)
- Models for non-stationary time series (ARIMA)
- Volatility modelling (ARCH, GARCH)
- Forecasting

Organization

Lectures by JProf. Dr. Antonia Arsova

Office hours: Tuesdays 1-2pm, CDI Building, Office 6 (ground floor)
or by appointment at arsova@statistik.tu-dortmund.de

Exercises by MSc. Sven Pappert

Office hours: Tuesdays 2-3pm, CDI Building, Office 122 (first floor, left side) or by appointment at pappert@statistik.tu-dortmund.de

Organization

Lectures

Tuesdays 10:15 – 11:45 am, Maschinenbau HS 1

Thursdays 12:15 – 1:45 pm, BCI ZE / 02

Exercises

tba

Exam

- Oral exam: for MSc Statistics students (only!)
- Written 2-hour exam for everyone else:
Exam: Monday, July 22
Re-take: Monday, September 2

Organization exercise sessions

- Weekly exercise sheets will be uploaded on Moodle, solutions to be handed in
- Only selected problems will be graded and corrections returned
- A minimum of 40% of the points **for the selected problems** required to be eligible for the final exam
- Group work (up to 3 people per group) is possible and encouraged. Only one submission per group is required.
- Nevertheless, individual submissions are also possible.

Literature

The slides, in conjunction with the lectures, are aimed to be self-contained. This is a non-exhaustive list of relevant textbooks:

- Hamilton, J. D. (1994). *Time Series Analysis*. Princeton University Press.
- Wei, W. (2006). *Time Series Analysis: Univariate and Multivariate Methods*. 2nd Edition. Pearson.
- Brockwell, J.P. & Davis, R.A. (2016). *Introduction to Time Series and Forecasting*. Springer, New York.
- Brockwell, J.P. & Davis, R.A. (1991). *Time Series: Theory and Methods*. 2nd Edition. Springer.
- Shumway, R.H. & Stoffer, D.S. (2016). *Time Series Analysis and its Applications*. Springer.
- Cryer, J.D. & Chan, K. (2008). *Time Series Analysis With Applications in R*. Springer.