

Unit Root and Cointegration Analysis

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Summer 2023

About this course

This course is about the econometric analysis of non-stationary data.

Aim: prepare the students for empirical research in macroeconomics and finance by laying sound theoretical foundations.

Main concepts:

- **Unit root:** root of the autoregressive polynomial of a stochastic process, lying on the unit circle.
→ Unit roots imply non-stationarity.
- **Cointegration:** a long-run equilibrium relationship between unit-root processes.
→ Cointegrated processes evolve “together”.

Cointegrated time series

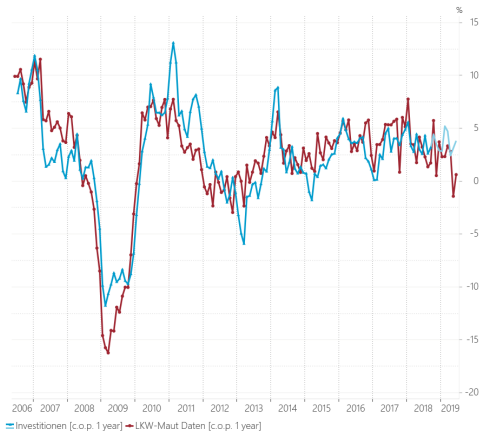


Figure: Number of kilometers travelled by trucks and German investment. Year-on-year percentage change. Source: Statistisches Bundesamt, own calculations.

Topics (tentative outline)

- ❶ Part I: Unit roots
 - (Review of) Stationary stochastic processes
 - Integrated processes and the functional central limit theorem
 - Unit root and stationarity tests
- ❷ Part II: Cointegration
 - Spurious regression
 - Multivariate integrated processes and cointegration
 - Cointegration tests
 - Estimation of cointegrated regression models
 - Cointegrated VAR models
- ❸ Additional topics (optional, based on students' interests):
Structural breaks, panel unit root and cointegration tests, time-varying cointegration, ...)

Organization

Format: semi-block course

Fridays, May 5 – July 14,
9am - 3:30pm, M/E 27

We'll switch between lectures, pen-and-paper exercises and practical computer sessions.

Exam

TBA during the first lecture

Prerequisites

Successful completion of the courses in Asymptotic Theory and Time Series Analysis is highly recommended, although parallel completion of the latter is possible.

Registration

Per e-mail at arsova@statistik.tu-dortmund.de

Literature

The class notes, in conjunction with the lectures, are aimed to be self-contained. Links to original research papers will be provided. Relevant textbooks include:

- Choi, I. (2015). *Almost All About Unit Roots*. Cambridge University Press.
- Pfaff, B. (2008). *Analysis of Integrated and Cointegrated Time Series with R*. Springer.
- Lütkepohl, L. (2005). *New Introduction to Multiple Time Series Analysis*. Springer.
- Johansen, S. (1995). *Likelihood Based Inference in Cointegrated Vector Autoregressive Models*. Oxford University Press.
- Davidson, J. (1994). *Stochastic Limit Theory: An Introduction for Econometricians*. Oxford University Press.