

# Unit Root and Cointegration Analysis

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## About this course

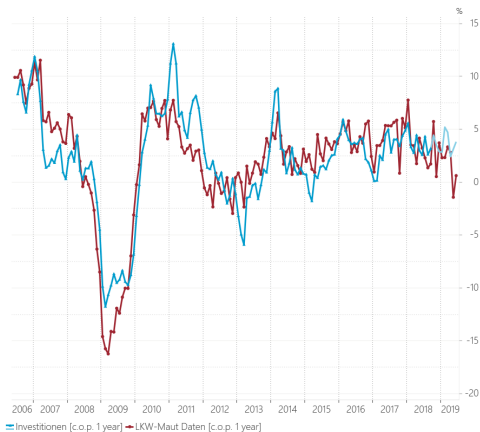
This course is about the econometric analysis of non-stationary data.

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

Topics to be covered include:

- Asymptotic methods for non-stationary processes including functional limit theory and stochastic integration
- Unit root tests and tests of stationarity
- Spurious regression
- Cointegrated systems
- Cointegration tests
- Reduced rank regression and estimation of error-correction models

# 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
  - Estimation of cointegrated regression models
  - Cointegration tests
  - Cointegrated VAR models
- ❸ Additional topics (optional, based on student's interests):  
Structural breaks, panel unit root and cointegration tests, time-varying cointegration, ... )

# Organization

**Format:** block course after the lecture period

Thursday, Feb 9 – Tuesday, Feb 28,

9am - 4:30pm, CDI 120

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.

# Literature

The slides, in conjunction with the lectures, are aimed to be self-contained. Links to original research papers will be provided.

Relevant textbooks include:

- Lütkepohl, L. 2005. *New Introduction to Multiple Time Series Analysis*. Springer 2005.
- 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.