# COURSE: <u>High-dimensional time series analysis</u>

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**COURSE DESCRIPTION**

Introduction to multivariate time series analysis.

The course covers the basic aspects of multivariate time series analysis, with the focus on modeling and forecasting a large set of variables. The topic in the course will be: Vector autoregressions; Estimation of Large VAR models using Bayesian VAR and Compressed VAR; Estimation of High-dimensional covariance matrices with applications in finance; Shrinkage estimators; Factor models and their applications. Empirical applications will be illustrated using updated software tools.

**LEARNING OUTCOMES**

- To study the basic theory of multivariate processes.
- To learn Vector Auto-Regressive (VAR) models and their dimensionality reduction and data compression
- To learn large volatility models, Factor Models, and their Applications.

**METHODOLOGY**
Theoretical lessons and classes

**ASSESSMENT**
Written exam 1 hour.

**OUTLINE**

1. Multivariate Time Series
2. Vector autoregressive model and their shrinkage
3. High dimensional covariance matrices
4. Factor models

**READINGS**

Ruey S. Tsay (2014), *Multivariate Time Series Analysis with R and Financial Applications*, Wiley, ISBN: 978-1118617908.
Web page for the textbook: http://faculty.chicagobooth.edu/ruey.tsay/teaching/mtsbk/
Mohsen Pourahmadi (2013), *High-Dimensional Covariance Estimation,* Wiley
Stock, J.H., and M.W. Watson (2011), Dynamic Factor Models, in Clements, M.P., and D.F. Hendry (eds.) *Oxford Handbook of Economic Forecasting*, Oxford University Press.
Fan J., Liao Y, and Liu, H. (2016) An overview of the estimation of large covariance and precision matrices, *The Econometrics Journal*, Vol. 19, p C1-C32.

Bauwens, L. , Laurent, S. and Rombouts, J. V. (2006), Multivariate GARCH models: a survey. J. Appl. Econ., 21: 79-109. doi:10.1002/jae.842

Koop, G., Korobilis, D. and Pettenuzzo, D. (2018). "Bayesian Compressed Vector Autoregressions" Journal of Econometrics.

Further reading will be given during the lectures.