Fakultät für Wirtschaftswissenschaften
Facoltà di Economia
Faculty of Economics and Management

Syllabus
Course description

Course title	Advanced Quantitative Methods - Module 1: Uncertainty and optimization
Course code	**29054**
Scientific sector	SECS/S-06
Degree	PhD in Economics and Finance
Semester and academic year	1/2
Year	1st
Credits	6
Modular	yes

Total lecturing hours	18
Total office hours	Not foreseen
Total exercise hours	Not foreseen
Attendance	required
Prerequisites	**-**
Course page	**-**
Specific educational objectives	The first part of the course is focused on the price or value of claims to uncertain payments. We introduce the concept of a stochastic discount factor (or alternatively a equivalent martingale measure) in a simple Lucas economy. He model framework provides an economic intuition risk-neutral pricing. The second part of the course refers to typical educational activities and belongs to the scientific area of financial risk management and regulation.

Lecturer	Prof. Dr. rer. nat. habil. Andreas Hamel, Email: Andreas.Hamel@unibz.it, Phone: 0474 013651 Campus, Bruneck- Brunico, Office 1.11 Prof. Dr. Alex Weissensteiner, Email: alex.weissensteiner@unibz.it, Phone: 0471 013496, Campus Bozen - Bolzano, Office E2.06
Scientific sector of the lecturer	SECS/S-06
Teaching language	English
Office hours	Not foreseen
Lecturing assistant	
List of topics covered	• Lucas Economy (one-period model) • Stochastic discount factor (SDF) • Risk-neutral pricing • General equilibrium models (multi-period models) • Risk as a subjective concept, attitude towards risk,

	decisions under risk, • Axiomatic approach to risk quantification, risk measures and acceptance sets • Dual representation of convex risk measure • Applications: from value-at-risk to average value-at risk and the Basel accord
Teaching format	Frontal lectures

Learning outcomes	**Knowledge and Understanding:** SDF, risk-neutral pricing, getting basic knowledge on modern risk quantification; developing an understanding of axiomatic approaches to risk management. **Applying Knowledge and Understanding:** pricing uncertain claims, taking optimal inter-temporal consumption and investment decision, applying concepts from probability theory to risk management and financial regulation in practice (Basel accord). **Making Judgements:** ability to understand decision making processes under risk. **Communication skills:** develop basic abilities for communication on quantitative risk management. **Learning skills**: learn how to design and formulate an appropriate axiomatic approach for decision making problems.

Assessment	Quiz at the end of each of the two parts.
Assessment language	English
Evaluation criteria and criteria for awarding marks	Active course participation and successful completion of the quizzes result in a pass grade.

Required readings	• Cochrane, John H. *Asset pricing: Revised edition*. Princeton university press, 2009. • Dumas, Bernard, and Andrew Lyasoff. "Incomplete-Market Equilibria Solved Recursively on an Event Tree." *The Journal of Finance* 67.5 (2012): 1897-1941. • Artzner, Delbaen, Eber, Heath, "Coherent Measures of Risk", Mathematical Finance 9(3), 1999
Supplementary readings	Will be announced during the course.

List of topics covered	• High-dimensional regression models: ridge, LASSO and generalizations • Model selection: bias and variance trade-off, model complexity, resampling methods, cross-validation • Methods for estimating sparse matrices with a brief introduction on graphical models • Dimensionality reduction techniques: principal component analysis, factor analysis • Instrumental variables in high-dimensional settings • Inference and hypothesis testing with high-dimensional data
Teaching format	Frontal lectures, exercises and computer labs.
Learning outcomes	• Knowledge and ability to practically apply high-dimensional econometric and statistical tools in a variety of situations. • Knowledge and understanding of fundamental notions related to model selection and ability to practically apply them in different settings. • Knowledge and ability to apply inferential tools and hypothesis testing methods when dealing with high-dimensional data.

Assessment	2 Homework assignments (50% of the final grade in the course). Individual data analysis project (50% of the final grade in the course).
Assessment language	English
Evaluation criteria and criteria for awarding marks	The homework assignments consists of several exercises and review questions. The data analysis project involves statistical analyses on real data related to the contents of the course using the statistical software R. To receive a passing grade in the course, students must obtain a positive evaluation in both homework assignments and data analysis project.

Required readings	• Hastie, T., Tibshirani, R., Friedman, J. H., & Friedman, J. H. (2009). *The elements of statistical learning: data mining, inference, and prediction*. New York: Springer. • Hastie, T., Tibshirani, R., & Wainwright, M. (2015). *Statistical Learning with Sparsity: The Lasso and Generalizations* (1st ed.). Chapman and Hall/CRC. • Additional lecture notes with references will be provided during the lectures
Supplementary readings	Bühlmann, P., & Van De Geer, S. (2011). *Statistics for high-dimensional data: methods, theory and applications*. Springer

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	Science & Business Media
Course title	Advanced Quantitative Methods, Module 2: Time series analysis
Course code	29054
Scientific sector	SECS-P/05
Degree	PhD
Semester	2st semester
Year	2022-23
Credits	2
Modular	3

Total lecturing hours	10
Total lab hours	Not foreseen
Total exercise hours	Not foreseen
Attendance	Strongly suggested, but not required
Prerequisites	
Course page	

Specific educational objectives	The course introduces econometric modelling of time series prices and volatility. Then, it extends to tools for nonlinear models. Strong emphasis is placed on the application of the models to real financial and economic data.

Lecturer	Francesco Ravazzolo Office E207 Francesco.ravazzolo@unibz.it
Scientific sector of the lecturer	SECS-P/05
Teaching language	English

Office hours	please refer to the lecturer's timetable
Lecturing assistant	None
Teaching assistant	None
List of topics covered	Review of different estimation methods (OLS, NLS, ML, GMM, Bayesian). Time-Series Analysis models and methods for predicting future variables: specification, inference and forecasting. (Monte Carlo) Simulation Methods.
Teaching format	The course will combine in-class explanation of the background material, problem-solving and case discussions. Students will be expected to participate actively in class work, which will give them the opportunity to apply theoretical concepts to realistic situations. In order to benefit from this approach, it is important that all students come to class fully prepared.

Learning outcomes	**Knowledge and understanding** The aim of the course is to equip students with a working knowledge of important econometric techniques used in econometrics and complete the course Quantitative Research Methods on time-series analysis. Students correctly specify, estimate and test the econometric models discussed during the lectures and possess the ability to properly interpret the results provided by these procedures. Ability to perform all the mentioned econometric techniques by using appropriate softwares (MATLAB, R).

Assessment	Solution of case studies: Case studies will be assigned during the course to be completed in writing and sometimes presented in class.
Assessment language	English
Evaluation criteria and criteria for awarding marks	Assignments.

Required readings	Selection of papers provided by the teacher
Supplementary material	

Syllabus
Course description

Course title	Advanced Quantitative Methods - module 3: High-Dimensional Econometric Methods for Big Data
Course code	29054
Scientific sector	Secs-S/01
Degree	PhD in Economics and Finance
Semester and academic year	2st Semester
Year	2022/23
Credits	2
Modular	3

Total lecturing hours	10
Total office hours	Not foreseen
Total exercise hours	Not foreseen
Attendance	required
Prerequisites	N/A
Course page	-
Specific educational objectives	The course refers to the typical educational activities and belongs to the scientific area of statistics. This course introduces advanced statistical and econometric tools to perform predictions and to handle high-dimensional and complex data. The course will focus particularly on regression and supervised methods. All the methods covered in class are illustrated using real data sets commonly found in business and finance, within the R statistical computing environment. At the end of the course, the students will be able to implement and apply statistical learning and forecasting tools that are appropriate for high-dimensional data. They will be also able to draw conclusions from their analyses in the context of real data.

Lecturer	Alessandro Casa Office I3.01 e-mail: alessandro.casa@unibz.it Davide Ferrari Office E205 e-mail: Davide.Ferrari2@unibz.it
Scientific sector of the lecturer	SECS-S/01
Teaching language	English
Office hours	TBA

Lecturing assistant	N/A