COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Multivariate Time Series and Financial Econometrics	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Andrius Buteikis **Other(s):**	Faculty of Mathematics and Informatics, Vilnius University, Naugarduko 24, LT-03225 Vilnius, Lithuania

Study cycle	Type of the course unit (module)
Second	Elective

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face-to-face	Second (spring) semester	English or Lithuanian

Requirements for students	
Prerequisites: Algebra, Probability Theory, Time Series Analysis	**Additional requirements (if any):**

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	125	42	83

Purpose of the course unit (module): programme competences to be developed		
The aim of this course is to provide the basics of modern financial econometrics, introduce to the multivariate time series models and to most popular financial time series models, their interpretation and statistical inference; to train analytical and critical thinking.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
• know the construction of Vector Autoregressive (VAR) models and their properties; • know the features of modelling the univariate and multivariate financial time series; • know the main methods of estimation of the multivariate time series.	Traditional lecture, discussion lecture, problematical lecture.	Midterm, written exam.
• understand the methods of multivariate time series analysis and the areas of applications; • understand the construction of financial time series models; • understand the methods of statistical analysis for financial time series.	Discussion lecture, case studies, seminars.	Midterm, written exam, work at the seminars.
• be able to derive the properties of the models under consideration; • be able to estimate the parameters of financial time series models; • be able to apply VAR and financial time series models in practice	Discussion lecture, case studies, group discussions.	Midterm, written exam, work at the seminars.

Content: breakdown of the topics	Lectures	Tutorials	Seminars	Contact hours	Self-study hours	Assignments
1. Univaraite time series models: trend, seasonality, stationarity, unit root, SARIMAX	4		2	**6**	**8**	Lecture slides.
2. Univariate conditional heteroskedasticity models: ARCH test and GACH-type models.	4		1	**5**	**8**	Lecture slides.
3. Vector Autoregression, its properties.	4		1	**5**	**7**	[1] Sections 2.1, 2.4
4. Forecasting; Causality; impulse response analysis.	3		1	**4**	**7**	[1] Sections 2.2, 2.3.1, 2.3.2, 2.4
5. Estimation of VAR and parameter constraints.	4		1	**5**	**7**	[1] Sections 3.1, 3.2, 3.3, 5.1, 5.2, 5.3, 3.8
6. Structural change analysis.	4		1	**5**	**7**	[1] Section 4.6
7. Cointegration and VEC models.	4		1	**5**	**7**	[1] Sections 6.1-6.4, 6.8, 7
8. Multivariate financial time series models: Multivariate GARCH, BEKK, Factor GARCH, CCC and DCC.	5		2	**7**	**9**	[1] Sections 16.1-16.3, 16.8, [2], articles
9. Preparation for the midterm and exam.					**23**	
Total	**32**		**10**	**42**	**83**	

Assessment strategy	Weight, %	Deadline	Assessment criteria
General evaluation scheme. 10-point scale is used for grading. The final grade consists of 40% for seminars, 30% for midterm, 30% for final exam. To get a positive final grade, at least 5 (out of 10) points are necessary. Taking the course on an external basis is not allowed.			
Intermediate exam (written)	30	In the middle of the of semester	The midterm consists of 3-6 tasks of different complexity and includes the questions from the first half of the course. The questions can be both theoretical problems, or exercises.
Project presentation (defense)	40	The end of the semester	Students work on a chosen and agreed with the teacher subject, prepare a report and give a presentation.
Final exam (written)	30	Exam session	The exam consists of 3-6 tasks of different complexity and includes questions from the second half of the course. The questions can be both theoretical problems, or exercises.

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
[1] H. Lütkepohl	2007	New Introduction to Multiple Time Series Analysis		https://link.springer.com/book/10.1007/978-3-540-27752-1
Optional reading				
[1] C. Francq, J.-M. Zakoian.	2010	GARCH Models		Wiley, New York
[2] R. S. Tsay	2014	Multivariate Time Series Analysis		Wiley, New York