Università Commerciale
Luigi Bocconi

MSc. Finance/CLEFIN
2019/2020 Edition

Advanced Quantitative Methods for Asset Pricing and Structuring

Professors Massimo Guidolin and Manuela Pedio

COURSE OUTLINE/OBJECTIVES

This course is designed to illustrate how econometric techniques are applied to finance, with particular emphasis on the measurement and the pricing of multi-asset derivatives. Market crashes and the resulting contagion effects have emphasized the limitations of linear correlations in capturing the dependence structure among asset returns for the purposes of: 1) assessing the risk of a financial institution; 2) pricing derivatives whose value depends on the interaction in the performance of different underlyings. Hence, it is essential to learn how to model dependence beyond the correlation structure implied by multivariate normal distributions. A number of practical applications to the pricing of equity / credit derivatives, and to issues of structuring of complex derivative securities will be provided. A few sessions will be devoted to the practical implementation of models in Matlab.

Although these are not formal pre-requisites, a working knowledge of the key contents of the courses in the Quantitative Finance and Derivatives I and of Financial Econometrics II are useful.

The installation of Matlab software shall be directly requested by enrolled students by e-mailing to software.bocconi@unibocconi.it mentioning the course code.

ASSESSMENT METHODS (THE EXAM)

There are two separate exam tracks, for attending vs. non-attending students, even though all students are invited to actively attend and participate to the lectures. A student will be considered attending after documented attendance to 50% + 1 hour of the frontal lectures and turn in both projects. No exceptions, no dementia, the word exception is UNKNOWN. Attending students have to take the exam in May or June, elsethey will lose their status.

Track 1: Attending students

11 points out of 30:	35-minute multiple choice exam on selected topics (to be communicated); the exam to include 1 short open question with space provided worth 2-3 points. Exam is closed book.
14 points out of 30:	Two projects (7 points each); the project is a group one (4 members maximum) with individual discussion. Precise guidelines will be made available during the course. The first project will be due in early April 2020; the second project will be due on May 17, 2020.
6 points out of 30:	Individual presentation/discussion of the projects (3 points each).

Track 2: Non-Attending students

30 points out of 30:	2 hours multiple choice closed-book exam on entire program; the exam to include 4 open questions with space provided worth 8-10 points.

TEXTBOOKS AND OTHER SUPPORT MATERIALS

The material covered in the course is outlined in *lecture slides made available via the class website*, at

http://didattica.unibocconi.eu/mypage/map.php?IdUte=135242&idr=14063&lingua=eng

Lecture notes and class presentations of the material should be taken as a guidance for further study on selected parts of the textbooks:

Brigo, D., and F., Mercurio (2006) *Interest Rate Models Theory and Practice, with Smile, Inflation and Credit* (2006), Springer Verlag.

Guidolin, M. and M., Pedio (2018) *Essentials of Time Series for Financial Applications*, Academic Press 1st edition (henceforth "Guidolin-Pedio").

The following textbooks may also be of some use:

Il Sole 24 Ore (2009), *I certificati di investimento. Mercati, strutture finanziarie, strategie gestionali*. M. Camelia (ed.) Edizioni Il Sole 24 ORE.

Wilmott P. (2007), *Paul Wilmott Introduces Quantitative Finance*. John Wiley & Sons.

For each topic we will also provide suggestions for further reading, whose consultation is left to the students' initiative.

DETAILED SYLLABUS (required readings are indicated by a *)

1. Introduction and review of key concepts: Loss functions and decision theory; forecast evaluation. (3 hours) [M. Pedio]

*Lecture Slides.

Granger, Clive WJ, and Mark J. Machina. "Forecasting and decision theory." *Handbook of Economic Forecasting* 1 (2006): 81-98.

West, Kenneth D. "Forecast evaluation." *Handbook of Economic Forecasting* 1 (2006): 99-134.

2. Forecasting stock returns; time-varying parameter models. (5 hours) [M. Pedio]

*Lecture Slides.

Dangl, Thomas, and Michael Halling. "Predictive regressions with time-varying coefficients." *Journal of Financial Economics* 106 (2012): 157-181.

*Rapach, David E., Jack K. Strauss, and Guofu Zhou. "Out-of-sample equity premium prediction: Combination forecasts and links to the real economy." *Review of Financial Studies* 23 (2010): 821-862.

Rapach, David E., and Guofu Zhou. "Forecasting stock returns." *Handbook of Economic Forecasting* 2, no. Part A (2013): 328-383.

3. The Instability of Correlations: Multivariate GARCH and DCC Models (3 hours) [M. Guidolin]

*Lecture Slides.

*GUIDOLIN-PEDIO, chapter 6.

4. The Instability of Correlations: Multivariate Markov Switching Models (4 hours) [M. Guidolin]

*Lecture Slides.

*GUIDOLIN-PEDIO, chapter 9.

5. Copulas in Risk Management (3 hours) [M. Guidolin]

*Lecture Slides.
Christoffersen P. F. (2012) *Elements of Financial Risk Management*, Academic Press 2nd edition, chapter 9.

6. An Introduction to the Use of Realized Variance and Covariance in Risk Management (3 hours) [M. Guidolin]

*Lecture Slides.
*GUIDOLIN-PEDIO, chapter 10.

7. The Econometrics of Network Connectedness and its Applications to Risk Management (6 hours) [M. Guidolin]

*Lecture Slides.
Glasserman, P., and P. Young (2016), Contagion in Financial Networks, *Journal of Economic Literature*, 54, 779-831.

8. Introduction to structured financial instruments: equity protection structures; exotic options and barriers and their applications in structuring (4 hours) [M. Guidolin]

*Lecture Slides.
SOLE 24 ORE, chapter 2.
WILMOTT, chapters 11 and 13.

9. Correlations and structured products: basket derivatives and certificates (2 hours) [M. Guidolin]

*Lecture Slides.
WILMOTT, chapter 12.

10. Single name credit derivatives (CDS) (2 hours) [M. Guidolin]

*Lecture Slides.
BRIGO and MERCURIO, chapter 21.1, 21.3.

11. Reduced form intensity models (3 hours) [M. Guidolin]

*Lecture Slides.
BRIGO and MERCURIO, chapter 22.

12. Structural models (2 hours) [M. Guidolin]

* Lecture Slides and references therein.

13. An Introduction to Simulations and Monte Carlo Pricing (2 hours) [M. Pedio]

*Lecture Slides.
WILMOTT, chapter 29.

14. The role of structured products in dynamic asset management (6 hours) [M. Pedio]

*Lecture Slides.
*Lecture Notes.
Caloiero, E., and M., Guidolin (2017), Volatility as an Alternative Asset Class: Does It Improve Portfolio Performance? *Quantitative Finance and Economics*, 1, 334-362.
Liu, J., and J., Pan (2003), Dynamic Derivative Strategies, *Journal of Financial Economics,* 69, 401-430.