Interest Rate and Credit Risk Models

MASTER IN MATHEMATICAL FINANCE
2019/2020

Jorge Barros Luís
(jbluis@iseg.ulisboa.pt)

PROGRAM

Part I. FIXED INCOME MARKETS AND INTEREST RATE RISK

1. Introduction
    - 1.1. Interest Rate Risk
    - 1.2. From bonds to interest rates
    - 1.3. Yield-to-maturity
2. Term Structures
    - 2.1. Introduction
    - 2.2. Stylized Facts
    - 2.3. Theories of the Term Structure
3. Hedging interest rate risk
    - 3.1. Duration
    - 3.2. Convexity
4. Interest Rate Derivatives

Part II. INTEREST RATE MODELS

1. Static Interest Rate Models
    - 1.1. Introduction
    - 1.2. Fitting the Term Structure of Interest Rates
        - 1.2.1. Direct Methods
        - 1.2.2. Spline Methods
        - 1.2.3. Deterministic Methods

2. Stochastic Interest Rate Models
    - 2.1. Continuous Time Finance Recap
    - 2.2. Short-rate models
        - 2.2.1 Interest Rate Trees
        - 2.2.2 Continuous-time Single-factor models
        - 2.2.3 Continuous-time Multi-factor models
    - 2.3. Affine Models of the Term Structure
    - 2.4. HJM model

Part III. CREDIT RISK MODELS

1. Introduction
2. Structural Models of Credit Risk
3. Reduced-form Models of Credit Risk
4. Credit Rating Models
5. Default Correlation Models
6. Recovery Issues

Part IV. RISK-NEUTRAL DENSITY FUNCTIONS

STRUCTURE

Lectures will have a significant theoretical component, even though with practical examples whenever appropriate. Students are expected to have a strong background in financial maths and some background in finance, namely financial instruments.

LANGUAGE

The course will be taught in English. All materials are also in English and made available in Aquila platform.

ASSESSMENT

The assessment is based on an open book exam. Each student must have a minimum of 8 points (out of 20) in the Final Exam to pass.

Additionally, students can improve their final exam grades (FE) by submitting 2 practical exercises, whose grades (E1 and E2) weight 15% each of the final grade (if the exercise grade is above the exam one).

Furthermore, class attendance may also improve the final grade.

Therefore, the final grade (FG) will be obtained as follows:

FG = 0,7FE + 0.15[Max(E1;FE)] + 0.15[Max(E2;FE)]

The continuous evaluation grades may only be used during the 2019-2020 exam periods, and only once.

REFERENCES

Background literature

- Fabozzi, Frank J., (2015), "Bond Markets, Analysis and Strategies", 15th Ed., Prentice-Hall International Ed., Englewood Cliffs, New Jersey.
- Fabozzi, Frank J., (2012), "The Handbook of Fixed Income Securities", 8th Edition, McGraw-Hill Education.

Main References

- Björk, Tomas (2004), "Arbitrage Theory in Continuous Time", second edition, Oxford University Press.
- Schönbucher, Phillip J. (2003), Credit Derivatives Pricing Models, Wiley Finance.

Other References

- Anderson, Nicola, Francis Breedon, Mark Deacon, Andrew Derry, Gareth Murphy (1996), "Estimating and Interpreting the Yield Curve", Wiley.
- Campbell, John Y and Andrew W. Lo (1997), "The Econometrics of Financial Markets", Princeton University Press.
- Cassola, Nuno and Jorge Barros Luís (1996), "The term structure of interest rates: a comparison of alternative estimation methods with an application to Portugal", Banco de Portugal, WP 17-96, Oct..
- Cassola, Nuno and Jorge Barros Luís (2003), "A two-factor model of the German term structure of interest rates", with Nuno Cassola, Applied Financial Economics, Vol. 13, No. 11 and ECB WP Nº.46.
- Cassola, Nuno and Jorge Barros Luís (2203), "Modelling the term structure of interest rates: an application of Gaussian affine models to the German yield curve", in Applied Quantitative Methods for Trading and Investment, edited by Christian Dunis, Jason Laws and Patrick Naim, Wiley.
- Cochrane, John H. (2005), "Asset Pricing", Revised Edition, Princeton University Press.
- Cont, R. and P.Tankov (2004), "Financial Modelling with jump processes", Chapman & Hall Financial Mathematical Series
- Duffie, Darrell and Kenneth J. Singleton (2003), "Credit Risk – pricing, measurement and management", Princeton Series in Finance
- Hull, John (2017), "Options, Futures and Other Derivatives", 10^{h} Edition, Prenctice-Hall.
- Lando, David (2004), "Credit Risk Modelling – theory and applications", Princeton Series in Finance.