Fixed Income

Lecturer: Dr. Vladimir Sokolov

Abstract

Fixed Income is an elective course for the master level students at ICEF. The course runs in the first semester and offers a thorough understanding of the workings and pricing of the fixed income securities and derivative instruments on fixed income securities. The course consists of three parts. In the first part we cover yield curve calculations and topics in bond portfolio management. Students will learn the contingent securities pricing methods by replication of the portfolio of the synthetic claims. The last part of the course introduces applications of the no-arbitrage theory to pricing derivative securities in different segments of the bond market. We cover a broad range of fixed-income products and contract specifications. The home work material also offers a heuristic introduction to numerical methods and various numerical recipes.

Prerequisites

For part 1 a good knowledge of the basic concepts of the modern finance and investment analysis is recommended. For parts 2 and 3 a good knowledge of the binomial tree methods in quantitative finance is recommended.

Learning Objectives and Outcomes

The course is particularly useful for students that are planning to take the CFA exams and are planning to work in the field of the quantitative finance. Students learn the pricing techniques and the trading strategies for each of the derivative product introduced in this part of the course.

The student should be able to apply professional knowledge and skills acquired while studying the course in practical areas, including academic research, work in financial institutions, industry, state governance.

Methods of Instruction

The following methods and forms of study are used in the course:

- Interactive lectures
- Self-study

Grading System and Knowledge Assessment

5 % Class participation
10 % Home assignments
25 % Mid-term test
60 % Final Exam

Sample materials for knowledge assessment are available in ICEF Information system at https://icef-info.hse.ru.
Required Readings

Optional Reading

Internet resources
www.bloomberg.com
www.cbonds.ru
http://www.cmegroup.com/
www.moex.ru

Special Equipment and Software Support
Laptop, projector, Internet connection
MS Word, MS Excel

Course plan
Part I. Introduction to the Valuation of Fixed Income Securities
1. Overview of the Bond Sectors and Instruments
Terminology and conventions, Indenture and covenants, U.S. Treasury Bonds, Treasury STRIPS, Corporate debt, Mortgage Backed Securities

2. Introduction to Valuation of Fixed Income Securities
Semiannual compounding, Yield-to-Maturity, Full and clean price calculations, The arbitrage free valuation, Deriving the theoretical spot rate, Bootstrapping

3. Risks Associated with Investing in Bonds
Interest rate risk, yield curve risk, reinvestment risk, credit risk, liquidity risk, Rating agencies, EMBI+ spreads

4. Duration and Convexity Measures based on the Parallel Yield curve Shifts
One-factor measures of price sensitivity, Macualay duration, Convexity, Price-Yield relationship for bonds, The yield value of 1/32, Convexity adjustments

5. Bond Portfolio Management
Regression based duration hedging, Key rate durations, Barbell, Ladder, Bullet portfolios

Part II. The Science of Term Structure Interest Rate Models
6. The Term Structure Models of the Short Interest Rates
   Zero-coupon bond pricing equation, The dynamic replication principle, market price of risk, fundamental PDE, The Vasicek Model, The CIR model

7. The No-arbitrage Pricing Models
   Ho-Lee model, Hull-White model, BDT model, Model calibration, Continuous time limits, Applications to contingent claims valuations

8. The Heath-Jarrow-Morton Forward Rate Model
   One factor binomial tree model, Continuous time model, Trading strategies, Synthetic construction

Part III. Valuation of Interest Rate Derivatives

9. Valuing Bonds with Embedded Options
   Callable and putable bonds, Yield-to-worst, Binomial tree approach to pricing, Option adjusted spread (OAS), Effective duration and convexity, Negative convexity for callable bonds

10. Futures on the Money Market Instruments
    LIBOR, MIBOR, Eurodollar futures, 30-days Fed funds Futures, Russian Interest Rate Futures, Futures hedging, cash-and-carry trade, Predicting the Fed actions with futures

11. Futures on Bonds, Forward Rate Agreements (FRAs)
    Cost of carry, basis risk, conversion factors, forwards and futures binomial tree pricing

12. Interest Rate Swaps
    Terminology and conventions, Pricing of swaps, Swap spreads

13. Valuation of Caps and Floors, Swaptions
    Pricing and hedging caps, floors and collars, Caps and floor Greeks, Uses of caps, floors, and swaptions

14. Valuation of Mortgage Backed Securities
    Economics of securitization, Cash Flow patterns, Trenches, Classes, Prepayment models, PACS, CPR, Markets quotes and pricing

15. Valuation of Collaterized Debt Obligations (CDOs)
    Structure of CDOs, Synthetic CDOs, CDO Trenching, Role of the rating agencies