Fixed Income Analysis

Course Syllabus

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1. Course Objective and Format

Fixed income analysis is an optional 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. In particular different measures of bond price sensitivity are introduced such as duration and convexity. This part of the course is particularly useful for students that are planning to take the CFA exams. The second part of the course introduces the arbitrage-free and equilibrium term structure models. Students will learn the contingent securities pricing methods by replication of the portfolio of the synthetic claims. This part of the course is particularly useful for students that are planning to work in the field of the quantitative finance. 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. Students learn the pricing techniques and the trading strategies for each of the derivative product introduced in this part of the course. The home work material also offers a heuristic introduction to numerical methods and various numerical recipes.

1.1 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.

1.2 Methods of Learning

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

- Interactive lectures
- Self-study
1.3 Grade determination

5 % Class participation
35 % Home assignments
35 % Mid-term exam
50 % Final Exam

2. Literature

2.1 Main Readings


2.2 Supplementary Readings


2.3 Internet resources

www.bloomberg.com
www.cbonds.ru
http://www.cmegroup.com/
www.moex.ru
3. Course Outline

Part I. Introduction to the Valuation of Fixed Income Securities

- **Week 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

  *Readings: T ch. 1, F ch. 7-11, J ch. 1, MR ch. 9*

- **Week 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

  *Readings: T ch. 2-3, D ch. 4*

- **Week 3. Risks Associated with Investing in Bonds**

  Interest rate risk, yield curve risk, reinvestment risk, credit risk, liquidity risk, Rating agencies, EMBI+ spreads

  *Journal Readings:*


- **Week 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

  *Readings: T ch. 5-6, J ch. 2, H ch. 4, D ch. 5*
• **Week 5. Bond Portfolio Management**

Regression based duration hedging, Key rate durations, Barbell, Ladder, Bullet portfolios
*Readings: T ch. 7-8, H ch. 6*

**Part II. The Science of Term Structure Interest Rate Models**

• **Week 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

*Readings: T ch. 10-12, H ch. 28, J ch. 17, MR ch. 10*

*Journal Readings:*


• **Week 7. The No-arbitrage Pricing Models**

Ho-Lee model, Hull-White model, BDT model, Model calibration, Continuous time limits, Applications to contingent claims valuations

*Readings: T ch. 11, H ch. 28, MR ch. 11*

*Journal Readings:*


- **Week 8. The Heath-Jarrow-Morton Forward Rate Model**

One factor binomial tree model, Continuous time model, Trading strategies, Synthetic construction

Readings: J ch. 3-9, H ch. 29, MR ch. 11

Journal Readings:


**Part III. Valuation of Interest Rate Derivatives**

- **Week 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

Readings: J ch. 11, T ch. 19

Journal Readings:

• **Week 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

*Readings:* J ch. 12, T ch. 17, H ch. 2-6, D ch. 10

*Journal Readings:*


• **Week 11. Futures on Bonds, Forward Rate Agreements (FRAs)**

Cost of carry, basis risk, conversion factors, forwards and futures binomial tree pricing

*Readings:* J ch. 12, T ch. 20, H ch. 2-6, D ch. 9, F ch. 29

• **Week 12. Interest Rate Swaps**

Terminology and conventions, Pricing of swaps, Swap spreads

*Readings:* J ch. 13, T ch. 18, H ch. 7, 30 D ch. 8, F ch. 29

*Journal Readings:*


• **Week 13. Valuation of Caps and Floors, Swaptions**

Pricing and hedging caps, floors and collars, Caps and floor Greeks, Uses of caps, floors, and swaptions

*Readings:* J ch. 13, T ch. 19, H ch. 26, F ch. 29
Journal Readings:


- **Week 14. Valuation of Mortgage Backed Securities**

Economics of securitization, Cash Flow patterns, Trenches, Classes, Prepayment models, PACS, CPR, Markets quotes and pricing

**Readings:** T ch. 21, F ch. 14-17

Journal Readings:


- **Week 15. Valuation of Collaterized Debt Obligations (CDOs)**

Structure of CDOs, Synthetic CDOs, CDO Trenching, Role of the rating agencies

**Readings:** T ch. 21, F ch. 14-17

Journal Readings: