

Fixed Income Securities and Debt Markets

Professor Philippe Mueller

Spring Term 2025

Session: Spring Term 2025.

Prerequisites: Basic mathematics and statistics.

Objectives and Content: The market for fixed income products is huge and ever growing. Throughout the 2007-2009 financial crisis, the 2008-2009 recession and the crisis in the Eurozone, debt markets have been in the spot light. Central banks have been trying to fight the crisis with aggressive expansionary monetary policy and by greatly expanding their balance sheets. Public debt is mounting at a staggering rate and current US government debt is currently exceeding 120% of GDP.

In this environment, it is indispensable to have a thorough understanding of the functions and objectives of the major players in debt markets, of the various fixed income instruments and the risks associated with them, and of the models and methods used to value fixed income securities and their derivatives.

This course helps to develop the relevant knowledge and understanding of fixed income instruments and interest rate models for students interested in a career in the fixed income field. The course will provide an overview of the major institutions, organisations and investors, and the recent developments in fixed income, covering both theoretical background and practical implementation. To be clear, the emphasis is on the application of the models, not their mathematical foundations.

We start by discussing the institutional aspects of fixed income markets (players, organizations and conduct of the fixed income markets) and the main fixed income products (government and corporate bonds). Then, we will cover the basic techniques to describe fixed income products, such as curve fitting, bootstrapping, and factor analysis. We will also provide an introduction to fixed income derivatives and discuss hedging of interest rate risk. Furthermore, we will look at various models that allow us to evaluate a wide range of fixed income products (trees, no arbitrage trees, calibration and some continuous time models). Finally, we take a more macro view on debt markets and discuss the goals and the role of central banks in affecting the economy through controlling the interest rate. The discussion also includes monetary policy reactions to crises such as the credit crisis of the COVID-19 pandemic.

Readings: Much of the relevant material will be covered in the lecture notes although they are not intended as a substitute for a textbook. The main textbook is the following:

- Pietro Veronesi, *Fixed Income Securities: Valuation, Risk, and Risk Management*, Wiley and Sons, 2010.

Other recommended textbooks are:

- Suresh M. Sundaresan, *Fixed-Income Markets and Their Derivatives*, Academic Press, 2009, 3rd Edition.
- Frank Fabozzi, *Bond Markets, Analysis and Strategies*, Prentice Hall, 2013, 8th edition.

Additional selected readings will be assigned for individual topics.

Assessment: One group project (25% of the overall mark) and one written examination (120 minutes, 75% of the overall mark).

Delivery: 9×2 hours in-person lectures and 8×1 hour in-person seminars.

Course outline

Topic 1 **Introduction and overview of debt markets**

- Overview of debt contracts and classification of debt securities
- Players and their objectives
- Government debt markets
- The money market
- The repo market
- MBS and ABS markets
- Fixed income derivatives markets
- No-arbitrage and the law of one price
- Risks of debt securities

Supplementary readings:

- Veronesi, Chapter 1.
- Sundaresan, Chapter 1.

Topic 2 **Basics of fixed income securities**

- Discount factors, interest rates and compounding
- Term structure of interest rates
- Zero coupon and coupon bonds
- Bootstrapping and yield to maturity
- Floating rate bonds
- Quoting conventions

Supplementary readings:

- Veronesi, Chapter 2.
- Sundaresan, Chapter 2, 8, 9.

Topic 3 **Interest rate risk management**

- Variation in interest rates and bond price volatility
- Duration
- Portfolio immunization
- Convexity
- Non-parallel shifts of the yield curve

Supplementary readings:

- Veronesi, Chapters 3, 4.
- Sundaresan, Chapters 7, 8, 9.
- Fabozzi, Chapters 4, 5.

Topic 4 Interest rate derivatives

- Forward rates and forward discount factors
- Forward rate agreements and forwards
- Swaps
- Interest rate futures
- Interest rate options

Supplementary readings:

- Veronesi, Chapters 5, 6.
- Sundaresan, Chapters 14, 15, 16, 17.

Topic 5 Binomial trees and derivatives pricing

- One-step binomial trees
 - One-step interest rate trees
 - No-arbitrage on a binomial tree
 - Risk neutral pricing
- Multi-step binomial trees
 - A two-step binomial tree
 - Matching the term structure
 - Multi-step trees and risk neutral pricing
- Risk neutral trees and derivative pricing
 - The Ho-Lee model
 - The Black, Derman, and Toy model
 - Using risk neutral trees
- American options
 - Callable bonds
 - American swaptions

Supplementary readings:

- Veronesi, Chapters 9, 10, 11, 12.

Topic 6 No-arbitrage and equilibrium interest rate models

- Equilibrium interest models
- Vasicek model
- Cox, Ingersoll and Ross (CIR) model
- No-arbitrage models
- Multi-factor models

Supplementary readings:

- Veronesi, Chapters 14, 15, 19, 22.

Topic 7 Government securities and their derivatives

- US Treasury debt securities
- UK Treasury debt securities
- US Treasury futures
- Eurodollar futures
- Options on interest rate futures

Supplementary readings:

- Veronesi, Chapters 6, 7.
- Sundaresan, Chapters 6, 11, 13.

Topic 8 Securitization and mortgage-backed securities

- Securitization
- Mortgages and the prepayment option
- Mortgage-backed securities (MBS)
- Collateralized mortgage obligations (CMO)
- Hedging of MBS portfolios

Supplementary readings:

- Veronesi, Chapter 8.
- Sundaresan, Chapter 12.
- Fabozzi, Chapters 10, 11, 12, 15.

Topic 9 Monetary policy, inflation, and interest rates

- Roles of central banks
- Tools of monetary policy
- The Fed funds rate
- Inflation risk and economic activity

Supplementary readings:

- Veronesi, Chapter 7.
- Sundaresan, Chapters 3, 5.
- Federal Reserve Board, 2005, *Monetary Policy and the Economy*.

Topic 10 Crises and monetary policy reactions

- Securitization and the housing bubble
- The credit crisis of 2007–2009
- Amplification mechanisms
- Monetary policy reactions
- COVID-19 and debt markets

Supplementary reading:

- Brunnermeier, Markus K., 2009, “Deciphering the 2007-08 Liquidity and Credit Crunch,” *Journal of Economic Perspectives* 23, 77–100.
- Gorton, Gary, 2008, “The Panic of 2007,” in *Maintaining Stability in a Changing Financial System*, Proceedings of the 2008 Jackson Hole Conference, Federal Reserve Bank of Kansas City.