

# ECONOMICS OF FINANCIAL MARKETS I

## ECON 659

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Class meeting: Tues 4-6:50pm, KAP 414

### OBJECTIVE

A student taking this course will learn the fundamental theoretical concepts and mathematical models of the modern theory of financial markets. There are two general approaches to analyzing financial markets: the first is *general equilibrium*—this approach is essential for understanding the role that financial markets play in a modern economy, how they achieve risk sharing and coordination of decisions and how new information changes the course of prices over time. The second approach is *partial equilibrium*—no attempt is made to solve for the whole general equilibrium of the economy, most elements are taken as exogenously given (for example prices of primitive securities) and detailed analysis of the remaining financial markets is undertaken. Partial equilibrium analysis is based on the principle of *absence of arbitrage* and the most striking example of this approach is the Black-Scholes theory of option pricing which has so profoundly changed the way the Wall Street thinks about the dynamic management of complex forms of financial risk. The outline that follows sketches the main ideas we will cover: other material will be added as the course evolves.

### GRADING

The final grade will be based on biweekly homeworks (25%), a midterm exam (30%), and a final exam (45%).

### REQUIRED TEXTBOOKS

Magill, M. and M. Quinzii, *Theory of Incomplete Markets*, MIT Press, (MM+MQ).

Hull, J.C., *Options, Futures, and Other Derivatives*, Prentice Hall, New Jersey.

## COURSE CONTENT

**1. Getting Started: Understanding Financial System.** Key facts and basic components: stocks, bonds, options, insurance, futures; the role of government and monetary policy: domestic versus international finance; get to know the numbers, historical time series and basic magnitudes of the key financial sectors for the US and other major countries as we move through the course. For those unfamiliar with the financial system read

Mishkin, F.S., *The Economics of Money, Banking and Financial Markets*, New-York: Harper Collins : Chapters 1,2.

*Basic Financial Time Series* : Magill Excel or pdf files to be posted on Blackboard.

**2. Basic Ideas for Modeling Financial Markets:** describing very well behaved uncertainty: states of nature, events, information partitions and probability. Space of random variables. Decision making under uncertainty: preference orderings expected utility, measures of risk aversion: formalizing the behavior of agents in an environment of uncertainty . The simplifying assumptions that may not always represent the way agents actually behave under uncertainty: we don't have any satisfactory models of boundedly rational behavior, even though we are very sure that is how agents in fact behave! The validity of our models rest on the fact that they are first approximations which seem to be sufficiently good approximations in many settings. What we mean by rational expectations and equilibrium models; understanding the distinction between the real and financial sectors of the economy.

(MM+MQ), sections 1-5.

**3. Basic Concepts for Understanding the General Equilibrium Approach to Financial Markets.** Two period finance economy, agents characteristics: endowments and preferences, discounted expected utility. Feasible and Pareto optimal (PO) allocations. Characterizing Pareto optimal allocations through EPV (equalization of personal valuation vectors) and feasibility. How pricing and optimal risk sharing are dual properties.

**4. Contingent Market Equilibrium:** how optimal allocation of risk bearing can be achieved by markets and a price mechanism using simple securities: contingent contracts and contingent market equilibrium (also called Arrow-Debreu equilibrium). Equivalence between PO and CET (contingent market equilibrium with taxes): this is a fundamental theorem for understanding finance. Its an ideal market structure, not observed in the real world, but of great theoretical importance as a reference concept: the foundation analyzing the efficiency of any other structure of contracts or markets.

MM+MQ, Sections 6,7.

**5. Sequential Markets and Financial Market Equilibrium:** market structure under uncertainty: why real world market structure consists of spot markets for goods, financial markets for income and the use of money: basic types of financial contracts; bonds, stocks, insurance, futures, options; portfolio choice problem, concept of financial market equilibrium. Complete and incomplete markets. Equivalence of CM equilibrium and sequential market equilibrium when markets are complete: this is a fundamental theorem. Agents valuation vectors are distinct when markets are incomplete. Inefficiency of markets. Special conditions when markets are Pareto optimal even with incomplete markets: LRT preferences and CAPM model. Constrained efficiency as a nice way of understanding what financial markets can do.

**MM+MQ**, Sections 8, 11-13

**6. Absence of Arbitrage and Partial Equilibrium Asset Pricing Theory:** fundamental idea of absence of arbitrage opportunities: show that it can be characterized equivalently by existence of vector of strictly positive state (present value) prices such that the price of every security equals the present discounted sum of its future dividends (under these state prices). This is a fundamental theorem for finance. Its consequences first for *equilibrium*, and second for *partial equilibrium* theories of valuation using no-arbitrage.

**MM+MQ**, Sections 9, 14-17.

**7. Understanding Options and Derivative securities.** What are they really used for? Trading strategies involving options in discrete time: single option and equity, spreads and combinations. Bounds on prices of options derived using no arbitrage arguments. Multiperiod binomial tree valuation of European and American options. Risk neutral pricing.

**Hull**, Chapters 8, 9, 10, 11

**8. Continuous Time Models.** Wiener process, stochastic differential equations and Ito's Lemma. Lognormal process. Deriving Black-Scholes formula for option on equity: solving the PDE and Feynman-Kac formula for value of option.

**Hull**, 12, 13. **Bjork**, chapters 3, 4, 6.

**9. Term Structure of Interest Rates.** Affine term structure models. Single factor Vasicek model, derivation of PDE and its solution: what can the single factor model deliver. Various multifactor models with affine term structure: relating finance to monetary theory using Taylor rules and term structure.

**Bjork**, chapter 15,16,17. **Duffie**, chapter 7, **Hull** 23.1-23.6.

Vasicek, O. A., "An Equilibrium Characterization of the Term Structure", (1977), *Journal of Financial Economics*, 5, 177-188.

**10. Dynamic Representative Agent Equilibrium Pricing Model.** Discrete time infinite horizon model of Prescott-Mehra with stationary markov endowment process and understanding the equity premium problem. Even when markets are very incomplete you get similar results if the endowment process is stationary: carryover strategies are the new element.

**11. Dynamic Markets: Martingale property of asset prices and informational efficiency.** extending analysis of financial markets to dynamic framework. Martingales and gambling gain. How it relates to the informational efficiency of asset prices. An asset price is the best estimate of the present value of its future dividend stream based on current information.

**MM+MQ**, Sections 18-22 and 26-28.

**12. Money and Financial Markets.** Two approaches: quantity theory versus Taylor rules. How it can be related to term structure models.

## **VERY RECOMMENDED READING**

*The Financial Crisis Inquiry Report*, (2011) Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States, Public Affairs, New York.

This is an excellent report which you can buy very inexpensively on Amazon: I thoroughly recommend it to motivate you on a more earthy level to the material of this class: its kind of surreal cinema which takes you straight onto the street where the action is---but this is no ordinary Western style gun fight---it involves highly sophisticated financial instruments, used on a huge scale (like the Grand Canyon) which end up having a major impact on the whole US....and ultimately the whole World Economy in 2008, giving rise to the biggest economic turmoil since the Great Depression of the 1930's.

It gives you an excellent picture of financial markets in action, how the many parties involved pursue their own interests at each stage & explains in simple ways how many of the mortgage backed securities got introduced and more generally the plurality of people, firms, politicians, Wall Street companies, hedge funds, commercial and investment banks who were all involved in one big party...which ended in a big mess. Thousands of people ended up constructing a huge mega phenomenon any one of them only contributing a tiny part to the assembly of whole giant. Each part had its local logic and incentives that were at work, but the end result had properties not anticipated by anyone...

You should make your own summary in a notebook of what the book describes: you will find it a most rewarding experience.

## **OTHER BOOKS & TEXTBOOKS**

- Duffie, D., *Dynamic Asset Pricing Theory*, Princeton: Princeton University Press.
- Bjork, T., *Arbitrage Theory in Continuous Time*, Oxford: Oxford University Press.
- Cvitanic, J. and F. Zapatero, *Introduction to the Economics and Mathematics of Financial Markets*, Cambridge: MIT Press.
- Cochrane, J. H., *Asset Pricing*, Princeton: Princeton University Press.
- Duffie, D. and K. J. Singleton, *Credit Risk*, Princeton: Princeton University Press.
- Cox, J.C. and Rubenstein, *Options Markets*, Prentice-Hall.
- Brigo, D. and F. Mercurio, *Interest Rate Models: Theory and Practice*, Springer Verlag.
- Huang, C. and R.H. Litzenberger, *Fundamentals of Finance*, Amsterdam: North-Holland.
- Rebonato, R., *Interest Rate Option Models*, Wiley, Chichester