

Professors:

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1. Purpose

This course serves two functions. First, it provides students with a thorough coverage of the principles of asset pricing and the basics of risk management. It introduces students to advanced finance theory that forms the foundation of modern finance. Second, the course offers students with hands-on experience of using computable pricing models to analyze and price modern financial instruments such as options and to measure market risk of portfolios of several different instruments.

The course is divided into two parts. The first part covers asset pricing by arbitrage and by equilibrium arguments. The second part deals with basic methods for quantifying market risk of several instruments (stocks, bonds, futures, options, etc). For the second part of the course we'll have one hour of individual hands-on computational experiments using excel or any other software that students are knowledgeable (MATLAB, R, etc.).

Course Lecturers

First eight, three hour lectures: Dimitrios P. Tsomocos

Next four, four hour lectures: Alvaro J. Riascos Villegas

Assessment Method

There will be two problem sets and two exams: one problem set and one exam after each part.

References

Part I

The relevant chapters of the course texts are required for the first five lectures.

T. Copeland and J. Weston (1992), Financial Theory and Corporate Policy, Addison Wesley. A good mixture of theory and evidence.

J-P Danthine and J. Donaldson (2002), Intermediate Financial Theory, Prentice Hall

C.- F Huang and R.H. Litzenberger (1988), Foundations of Financial Economics , Prentice Hall

J. Hull (2003), Options, Futures and Other Derivatives, Prentice Hall.

J. Ingersoll (1987), Theory of Financial Decision Making, Rowman and Littlefield

S. E. Shreve (2004), Stochastic Calculus for Finance I: The Binomial Asset Pricing Model, Springer.

S.F. Le Roy and J. Werner (2001), Principles of Financial Economics, Cambridge University Press.

Part II

Lecture Notes (Alvaro J. Riascos Villegas)

Christoffersen, P (2003). Elements of Financial Risk Management. Academic Press

Luenberger, D (1998). Investment Science. Oxford University Press.

2. Program

Part I

- **LECTURE # 1, 2 : Equilibrium in security markets**
- Consumption-Based Security Pricing / Lucas Model
- First Pass at the CAPM
- Equity Premium Puzzle
- Complete vs. incomplete markets
- Representative vs. heterogeneous agent models

Readings:

- Le Roy and Werner, ch. 14 and 15
- Danthine and Donaldson, ch. 9
- Lucas, R. (1978), "Asset Prices in an Exchange Economy", *Econometrica*, Vol 46 (6), pp 1429-1445
- Mehra, R. and E. Prescott (1985) "The Equity Premium: A Puzzle", *Journal of Monetary Economics*, Vol. 10, pp 335-359
- Weil P. (1992) "Equilibrium asset prices with undiversifiable labor income risk", *Journal of Economic Dynamics and Control* Vol. 16, pp. 769-790
- **LECTURE # 3, 4 : General Equilibrium with Incomplete Markets**
- State prices and risk-neutral probabilities
- Spanning

- Constrained inefficiency
- Modigliani and Miller
- Effectively Complete Markets

Readings:

- Geanakoplos, J.D. 1990. "An Introduction to General Equilibrium with Incomplete Asset Markets," *Journal of Mathematical Economics*, 19:1-38.
- Le Roy and Werner, ch. 5, 6, 16.1-16.7
- Ross, S.A. 1976. "Options and Efficiency," *Quarterly Journal of Economics*, 90: 75-89

• **LECTURE # 5: Options Pricing**

- Binomial Asset Pricing Model
- Options
- Dynamic completion of the markets
- Cox-Ross-Rubinstein
- Radom-Nikodym Derivative Process
- Exotics
- Numerical Procedures

Additional readings:

- Hull, ch. 8-10, 18
- Shreve, ch. 1 and 3
- Cox, J., Ross S.A. and Rubinstein, M. 1979. "Option Pricing: A Simplified Approach," *Journal of Financial Economics*, 7: 229-63
- Polemarchakis, H.M., and Bon-Il Ku. 1990. "Options and Equilibrium," *Journal of Mathematical Economics*, 19:107-112

• **LECTURE # 6: C.A.P.M. and A.P.T.**

- Portfolio theory
- Mutual fund, SML, efficiency theorem
- Factor pricing
- A.P.T.

Additional readings:

- Geanakoplos, J. and Shubik M. 1990. "The Capital Asset Pricing Model as a General Equilibrium with Incomplete Markets." *The Geneva Papers on Risk and Insurance Theory*, 15(1): 55-71
- Huberman, G. 1982. "A Simple Approach to Arbitrage Pricing Theory," *Journal of Economic Theory*, 28: 183-91.
- Markowitz, H.M. 1952. "Portfolio Selection," *Journal of Finance*, 7:77-91

- Mossin, J. 1965. "Equilibrium in a Capital Asset market," *Econometrica*, 34(4):768-783.
- Sharpe, W.F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance*, 19(3):425-442.
- Tobin, J. 1958. "Liquidity Preference as Behaviour Towards Risk," *Review of Economic Studies*, 26:65-86.

- **LECTURE # 7 : Money and Default**

- Liquidity / Cash-in-advance
- Endogenous Default
- Collateral Equilibrium

Additional readings:

- Dubey P., Geanakoplos J., and Shubik M. (2005), "Default and Punishment in General Equilibrium", *Econometrica*, vol. 73 No. 1 (Jan.), 1-37
- Espinoza, R. A and Tsomocos, D. P. (2007), "Asset Prices in an Exchange Economy with Money and Trade", working paper
- Geanakoplos J. (2003), "Liquidity, Default, and Crashes: Endogenous Contracts in General Equilibrium", *Advances in Economics and Econometrics: Theory and Applications, Eighth World Conference, Volume II, Econometric Society Monographs*, pp. 170-205
- Geanakoplos J., and Zame, W. R. (1997), "Collateral, Default and Market Crashes", *Cowles Foundation Discussion Paper*
- Goodhart CAE, Sunirand P. and Tsomocs D.P. 2004, "A model to analyse financial fragility", *Journal of Financial Stability*, 1:1-30

- **LECTURE # 8 : The informational role of prices and rational expectations equilibria (REE)**

- REE: Concept and problems
- Aggregation and transmission of information
- Dynamic models
- Crashes
- No-trade theorems

Additional readings:

- The informational role of prices and rational expectations equilibria (REE)
- *Books:* Grossman (1989), Brunnermeier (2001)
- REE: Concept and problems
- Grossman (1976),
- Grossman (1981),
- Jordan and Radner (1982),

- Milgrom and Stokey (1982)
- Aggregation and transmission of information
- Grossman (1976),
- Grossman and Stiglitz (1980),
- Hellwig (1980),
- Admati (1985)
- Information acquisition
- Grossman and Stiglitz (1980),
- Diamond and Verrecchia (1981),
- Verrecchia (1982),
- Admati and Pfleiderer (1990)
- Dynamic models
- Brown and Jennings (1989),
- Grundy and McNichols (1989),
- He and Wang (1995),
- Crashes
- Genotte and Leland (1990),
- Romer (1993)

Part II

- **LECTURE # 1: Risk Management, Financial Returns, Volatility Models and Correlation Modelling**
 - Stylized facts about asset returns
 - GARCH variance model
 - Estimation
 - Model Evaluation
 - Using intraday information
 - VaR of simple portfolios.
 - Portfolio variance
 - Modelling conditional correlation
 - Quasi-Maximum likelihood estimation

Readings:

- Christoffersen, P (2003), Chapters 1, 2 and 3.

- **LECTURE # 2: Modelling the Conditional Distribution and Simulation-Based Models**
 - The standardized $t(d)$ distribution
 - Cornish Fisher approximation to VaR
 - Extreme value theory
 - Expected shortfall risk measure
 - Historical simulation

- Multi-period risk calculations
- Montecarlo simulation
- Filtered historical simulation

Readings:

- Christoffersen, P (2003), Chapters 4 and 5.

- **LECTURE # 3: Option pricing, option risk and backtesting**

- Option pricing under normality
- Introducing skewness and kurtosis
- GARCH option pricing
- Implied volatility
- Delta and portfolio risk under delta
- Gamma and portfolio risk
- Portfolio risk under full valuation
- Backtesting VaR's
- Backtesting expected shortfall
- Stress testing

Readings:

- Christoffersen, P (2003), Chapters 6, 7 and 8.

- **LECTURE # 4: Portfolio Optimization**

- Resampled efficient frontier
- Bootstrap estimates of performance
- Introduction Bayesian approach to portfolio selection
- Shrinkage estimators
- Full Bayesian approach
- The Black-Litterman model.

Readings:

- Lecture notes (Alvaro J. Riascos)