

Financial Economic Theory and Engineering Exam

Fall 2008

Important Exam Information

The examination for this course will be given on Thursday, October 30 from 8:30am–11:45am and 1:30pm–4:45pm and will consist of six hours of written-answer questions. A read-through time will be given prior to the start of the exam—15 minutes in the morning session and 15 minutes in the afternoon session. Information regarding registering for exams is available on the [Exam Registration](#) page.

For Fall 2008, this exam includes a [case study](#) for the examination. The case study will also be distributed in the Study Note package. **Candidates will not be allowed to bring their copy of the case study into the examination room.**

Study notes are part of the required Course of Reading and are not available electronically. The [Introductory Study Note](#) has a complete listing of all study notes. Candidates must order the study notes from the Society of Actuaries using the [Study Note Order Form](#). Past exams are available on the Exam Archives page of the SOA web site under [Multiple Choice/Essay Examinations](#).

Candidates should be sure to check the [Updates](#) page of the web site periodically for additional corrections or notices.

The candidate should be very familiar with the Learning Objectives as described in the Basic Education Catalog. These Learning Objectives are the first ingredient in developing the syllabus and also guide the examination committee when writing questions. The Learning Objectives set out the cognitive level needed to pass this exam. You will notice that the candidates are expected to “analyze,” “explain,” “calculate,” “describe,” “apply,” etc. While studying the syllabus material, candidates may want to refer back to the Learning Objectives to remain focused on the goals of the exam.

Financial Economic Theory and Engineering Exam

1. Modern Corporate Financial Theory

Overview: Definitions of Capital, Sources and Uses, and Optimal Structure

- a. Explain the various definitions of capital, including regulatory, rating agency and other risk-based capital requirements, the context in which they are appropriate, and how they affect decisions.

Cost of Capital

- b. Calculate the cost of capital for a venture or a firm using the most appropriate method for given circumstances and justify the choice of method.
- c. Evaluate various profitability measures including IRR, NPV and ROE, etc.

Economic Capital

- d. Define and compare risk metrics used to quantify economic capital and describe their limitations.
- e. Apply the concept of economic capital and describe methodologies for allocating capital within a financial organization.

Regulatory and Rating Agency Issues

- f. Identify regulatory capital requirements and describe how they affect decisions.

Financial Economic Theory and Engineering Exam Fall 2008

- g. Identify the goals and methodologies of rating agencies and how their rating activities affect financial institutions and the choice of capital structure.

Corporate Structure

- h. Recommend a specific legal form of organization and justify the choices.
i. Recommend specific firm governance measures and justify the recommendation.
j. Identify sources of agency costs and methods to address them.

Reading Materials:

Copeland, Weston, Shastri, *Financial Theory and Corporate Policy*, 4th Edition, 2005

- Ch. 2: Investment Decisions: The Certainty Case
- Ch. 9: Multi-period Capital Budgeting under Uncertainty: Real Options Analysis

Chew, D.H., ed., *The New Corporate Finance: Where Theory Meets Practice*, 3rd Edition, 2001

- Ch. 31: "Theory of Risk Capital in Financial Firms," by Merton & Perold

Hardy, *Investment Guarantees: Modeling and Risk Management for Equity-Linked Life Insurance*, 2003

- Ch. 9: Risk Measures (pp. 157-169 only)

FET-109-07: One Step in the Right Direction: The New C-3a Risk-Based Capital Component

FET-112-07: Chapter 14 of *Risk Management* by Crouhy

FET-113-07: Allocation of Risk Capital in Financial Institutions

FET-114-07: Capital Allocation in Financial Firms

FET-115-08: Specialty Guide on Economic Capital, 2004 (**exclude appendices**)

FET-138-07: Risk²: Measuring the Risk in Value at Risk

FET-139-07: VAR: Seductive but Dangerous

FET-141-08: A Principles-Based Reserves and Capital Standard, Friedman & Mueller

FET-142-08: Do Life Insurer RBC Ratios Really Reflect Underlying Risk Levels? (**exclude appendix**)

FET-143-08: Introducing Moody's New Liquidity Model for U.S. Life Insurance Companies

FET-144-08: The New Risk-Based Insurance Capital Model, by Standard & Poor's

FET-145-08: The Cost of Capital for Financial Firms

FET-146-08: Solvency Measurement for Property-Liability Risk-Based Capital Applications

FET-162-08: Chapter 18 of *Financial Markets and Corporate Strategy*, Grinblatt & Titman

FET-163-08: Chapter 19 of *Financial Markets and Corporate Strategy*, Grinblatt & Titman

FET-164-08: Chapter 2 of *Risk Management* by Crouhy

Capital Allocation by Percentile Layer, Bodoff, SOA Monograph, 2007

<http://www.soa.org/library/monographs/other-monographs/2007/august/m-as07-1-03.pdf>

"Recommended Approach for Setting Regulatory Risk-Based Capital Requirements for Variable Annuities and Similar Products," AAA, June 2005, pp. 1 – 18 only.

http://www.actuary.org/pdf/life/c3_june05.pdf

"Investor & Management Expectations of the "Return on Equity" Measure vs. Some Basic Truths of Financial Accounting" by Michelle D. Smith, *The Financial Reporter*, 9/03,

<http://www.soa.org/library/newsletters/financial-reporter/2003/september/frn0309.pdf>

Financial Economic Theory and Engineering Exam Fall 2008

2. Corporate Financial Applications

Sources of Capital

- a. Describe the steps necessary to obtain funds for a given project or firm from any specified source, and be able to recommend a specific approach to raising capital in a given situation.
- b. Describe the process, methods and uses of financial reinsurance (surplus relief) and recommend a structure that is appropriate for a given set of circumstances.
- c. Describe the process, methods and uses of insurance securitizations and recommend a structure that is appropriate for a given set of circumstances.

Uses of Capital

- d. Evaluate alternative options for utilizing capital and recommend the most appropriate use in a given situation.
- e. Describe the process, methods and effects of a potential acquisition or reinsurance of a business including its effect on capital structure, return on equity, price/earnings multiples, and share price.

Optimal Capital Structure

- f. Recommend an optimal capital structure and how to implement it for a given business or strategy and to justify the recommendation.
- g. Describe how behavioral characteristics and biases of users and providers of capital affect the capital structure.
- h. Apply the elements of risk assessment, reduction, and transfer to new product/project proposals based on a cost/benefit analysis.

Reading Materials:

Copeland, Weston, Shastri, *Financial Theory and Corporate Policy*, 4th Edition, 2005

- Ch. 9: Multi-period Capital Budgeting under Uncertainty: Real Options Analysis
- Ch. 15: Capital Structure and the Cost of Capital: Theory and Evidence
- Ch. 16: Dividend Policy: Theory and Evidence
- Ch. 18: Acquisitions, Divestitures, Restructuring, and Corporate Governance (pp. 781-806)

Chew, D.H., ed., *The New Corporate Finance: Where Theory Meets Practice*, 3rd Edition, 2001

- Ch. 17: "Bank of America Roundtable on the Link Between Capital Structure and Shareholder Value" by Allen, Francis, et al

Toole and Herget, *Insurance Industry Mergers & Acquisitions*, 2005

- Ch. 1: Introduction
- Ch. 2: M&A Process Overview
- Ch. 3: Finance
- Ch. 4: Valuation Techniques

Trigeorgis, L., *Real Options*, 1996

- Ch. 1: Introduction and Overview
- Ch. 2: Traditional Capital Budgeting
- Ch. 4 (exclude 4.8): A Conceptual Framework for Capital Budgeting
- Ch. 5 (exclude 5.6): Quantifying Flexibility in Capital Budgeting: Discrete Time Analysis

FET-108-07: Chapter 13 of *Integrated Risk Management* by Doherty

FET-147-08: Financial Decision-Making: A Behavioral Perspective

FET-148-08: Securitization of Life Insurance Assets and Liabilities

Financial Economic Theory and Engineering Exam Fall 2008

- FET-149-08: Are You Paying Too Much for That Acquisition?
- FET-150-08: Insurance Mergers & Acquisitions
- FET-151-08: Real and Illusory Value Creation by Insurance Companies
- FET-160-08: Chapter 9 of *Corporate Finance Theory*, Megginson
- FET-161-08: Chapter 5 of *Life, Health and Annuity Reinsurance*, Tiller and Tiller
- FET-165-08: Chapter 16 of *Integrated Risk Management* by Doherty

Financial Economic Theory and Engineering Exam Fall 2008

3. Advanced Derivatives

- a. Define the cash flow characteristics of complex derivatives including exotic options, interest rate derivatives, swaps, and other non traditional derivatives.
- b. Evaluate the risk/return characteristics of complex derivatives.
- c. Identify embedded options in assets and liabilities.
- d. Evaluate the impact of embedded options on risk/return characteristics of assets and liabilities.
- e. Derive the Black Scholes pricing formula.
- f. Demonstrate mastery of option pricing techniques and theory for equity and interest rate derivatives.
- g. Identify limitations of each option pricing technique.
- h. Describe how option pricing models can be modified or alternatives techniques that can be used to deal with option pricing techniques limitations.
- i. Explain how numerical methods can be used to effectively model complex assets or liabilities.
- j. Define option adjusted spread analysis and its limitations.

Reading Materials:

Chew, *The New Corporate Finance: Where Theory Meets Practice*, 3rd Edition, 2001

- Ch. 32: "How to Use the Holes in Black-Scholes" by F. Black

Hardy, *Investment Guarantees: Modeling and Risk Management for Equity-Linked Life Insurance*, 2003

- Ch. 6: Modeling the Guarantee Liability
- Ch 12: Guaranteed Annuity Options
- Ch 13: Equity-Indexed Annuities

Hull, J.C., *Options Futures & Other Derivatives*, 7th Edition, 2008

- Ch. 2(2.7-2.10 only): Mechanics of Futures Markets
- Ch. 7: Swaps
- Ch. 8 (8.3-8.12 only): Mechanics of Options Markets
- Ch. 12: Wiener Processes and Ito's Lemma
- Ch. 13: The Black-Scholes-Merton model
- Ch. 15: Options on Stock Indices, Currencies, & Futures
- Ch. 17: The Greek Letters
- Ch. 18: Volatility Smiles
- Ch. 19 (19.4, 19.5 and 19.8 only): Basic Numerical Procedures
- Ch. 24: Exotic Options
- Ch. 26: (26.1, 26.2, 26.3, and 26.5 only) More on Models and Numerical Procedures
- Ch. 28: Interest Rate Derivatives: The Standard Market Models
- Ch. 29: Convexity, Timing, and Quanto Adjustments
- Ch. 30: Interest Rate Derivatives: Models of the Short Rate
- Ch. 31: Interest Rate Derivatives: HJM and LMM
- Ch. 32: Swaps Revisited

Candidates may also use the 6th Edition of the text. The following chapter references apply:

Hull, J.C., *Options Futures & Other Derivatives*, 6th Edition, 2006

- Ch. 2(2.7-2.10 only): Mechanics of Futures Markets
- Ch. 7: Swaps
- Ch. 8 (8.3-8.13 only): Mechanics of Options Markets

Financial Economic Theory and Engineering Exam Fall 2008

- Ch. 12: Wiener Processes and Ito's Lemma
- Ch. 13: The Black-Scholes-Merton model
- Ch. 14: Options on Stock Indices, Currencies, & Futures
- Ch. 15: The Greek Letters
- Ch. 16: Volatility Smiles
- Ch. 17 (17.4,17.5, 17.8 only): Basic Numerical Procedures
- Ch. 22: Exotic Options
- Ch. 24: (24.1- 24.4 only) More on Models and Numerical Procedures
- Ch. 26: Interest Rate Derivatives: The Standard Market Models
- Ch. 27: Convexity, Timing, and Quanto Adjustments
- Ch. 28: Interest Rate Derivatives: Models of the Short Rate
- Ch. 29: Interest Rate Derivatives: HJM and LMM
- Ch. 30: Swaps Revisited

FET-101-07: Equity-Indexed Life Products

FET-102-07: Variable Annuities: "No Loss" Propositions" (Sections 1 through 3.6 only)

FET-105-08: Fabozzi, *The Handbook of Mortgage Backed Securities*, 6th Edition, 2006. Ch. 31,
Valuation of Mortgage-Backed Securities

FET-152-08: Model Risk

FET-153-08: What Does An Option Pricing Model Tell Us About Option Prices?

FET-154-08: Efficient Stochastic Modeling Utilizing Representative Scenarios: Application to
Equity Risk

FET-155-08: Use of Stochastic Techniques to Value Actuarial Liabilities Under Canadian GAAP

FET-159-08: Chapter 13 of *Investment Management for Insurers*, 3rd Edition

Financial Economic Theory and Engineering Exam Fall 2008

4. Financial Markets Modeling Techniques

The candidate will be able to:

- a. Critique the following modeling methods:
 - deterministic vs. stochastic
 - single period vs. multiple period
 - one vs. multiple factors
 - realistic vs. risk-neutral
 - equilibrium vs. arbitrage-free
 - actuarial vs. capital markets
 - simulation vs. formula-based
 - mean-reversion
- b. Recommend a modeling method for a given situation
- c. Define and apply the concepts of martingale, market price of risk and measures in single and multiple state variable contexts
- d. Describe and evaluate equity and interest rate models
- e. Contrast commonly used equity and interest rate models
- f. Recommend an equity or interest rate model for a given situation
- g. Describe issues and best practices in the estimation or calibration of financial models

Reading Materials:

Hardy, *Investment Guarantees: Modeling and Risk Management for Equity-Linked Life Insurance*, 2003

- Ch. 1 (pp.11-14): Provision for Equity-linked Liabilities
- Ch. 2: Modeling Long-term Stock Returns
- Ch. 3: Maximum Likelihood Estimation for Stock Return Models
- Ch. 4: The Left-Tail Calibration Method
- Ch. 5: Markov Chain Monte Carlo (MCMC) Estimation
- Ch. 7 (pp.115-123): A Review of Option Pricing Theory

Hull, J.C., *Options Futures & Other Derivatives*, 7th Edition, 2008

- Ch. 13: The Black-Scholes-Merton Model
- Ch. 18: Volatility Smiles
- Ch. 21: Estimating Volatilities and Correlations
- Ch. 26: More on Models and Numerical Procedures, (26.1,26.2, 26.3 only)
- Ch. 27: Martingales and Measures
- Ch. 28: Interest Rate Derivatives: The Standard Market Models
- Ch. 30: Interest Rate Derivatives: Models of the Short Rate
- Ch. 31: Interest Rate Derivatives: HJM and LMM

Candidates may also use the 6th Edition of the text. The following chapter references apply:

Hull, *Options, Futures, and Other Derivatives*, 6th Edition, 2006

- Ch. 13: The Black-Scholes-Merton Model
- Ch. 16: Volatility Smiles
- Ch. 19: Estimating Volatilities and Correlations
- Ch. 24: More on Models and Numerical Procedures (24.1–24.3 only)
- Ch. 25: Martingales and Measures
- Ch. 26: Interest Rate Derivatives: The Standard Market Models

Financial Economic Theory and Engineering Exam Fall 2008

- Ch. 28: Interest Rate Derivatives: Models of the Short Rate
- Ch. 29: Interest Rate Derivatives: HJM and LMM

FET-106-07 Ho & Lee, *The Oxford Guide to Financial Modeling*

- Ch. 5: Interest Rate Derivatives: Interest Rate Models
- Ch. 6: Implied Volatility Surface: Calibrating the Models

FET-152-08: Model Risk

FET-158-08: Chapter 11 of *Investment Management for Insurers*

Validation of Long-Term Equity Return Models for Equity-Linked Guarantees" by Hardy, Freeland and "Till, NAAJ Vol. 10 No. 4, October 2006 (Sections 1-4 only)

http://www.soa.org/library/journals/north-american-actuarial-journal/2006/october/naaj0604_3.pdf

Financial Economic Theory and Engineering Exam Fall 2008

5. Efficient Markets & Information Theory

- a. Define capital market efficiency and the value of information.
- b. Describe tests of efficiency and their implications for capital structure, portfolio management, and risk management.
- c. Explain information asymmetry and how it can affect financial markets, especially insurance markets.
- d. Define principal-agency theory and explain how it affects capital structure, portfolio management and risk management.
- e. Define the elements of a game, including information sets, etc., Nash equilibrium, mixed strategies.
- f. Explain the prisoners' dilemma and other special cases of a two-person, two-state, single period game.
- g. Explain the qualitative implications of repeated games.

Reading Materials:

Copeland, Weston, Shastri, *Financial Theory and Corporate Policy*, 4th Edition, 2005

- Ch. 6: Market Equilibrium: CAPM and APT (pp. 164-188)
- Ch. 10: Efficient Capital Markets: Theory
- Ch. 11: Efficient Capital Markets: Evidence
- Ch. 12: Information Asymmetry and Agency Theory

Rasmussen, E., *Games and Information: An Introduction to Game Theory*, 4th Edition, 2007

- Ch. 1: Rules of the Game
- Ch. 2: Information
- Ch. 3 : (sec. 3.1, 3.2, 3.5, 3.6 only) Mixed and Continuous Strategies
- Ch. 4: Dynamic Games with Symmetric Information
- Ch. 5: (sec. 5.1–5.4) Reputation and Repeated Games with Symmetric Information
- Ch. 7: Moral Hazard: Hidden Actions
- Ch. 8: (sec 8.1, 8.2, 8.5 only) Further Topics in Moral Hazard
- Ch. 9: (sec. 9.1–9.4 only) Adverse Selection
- Ch. 11: (sec. 11.1–11.4 only) Signaling

FET-156-08: An Introduction to Applicable Game Theory

FET-157-08: Finance Applications of Game Theory