

# Financial and Health Economics Module

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## SECTION 1: MODULE OVERVIEW

### Introduction

Financial economics is the discipline underlying all financial services. No matter what your area of specialty or your role in your organization, an understanding of financial economics is essential. As you will learn in this module, financial economics is the study of how individuals and institutions acquire, save, and invest money. These activities are fundamental to institutions and individuals. Thus, not only will this module help you be a more knowledgeable actuary, it will also help you with your personal financial planning.

Health economics deals with the choices made by people, providers of health care, politicians and society as a whole, regarding the flow of funds through the health care system.

### Module Objectives

After you complete this module, you will be able to:

- Explain that financial economics has a world view (along with tools) for all actuaries.
- Explain how economic principles apply and do not apply to health care.
- Demonstrate a basic knowledge of utility theory.
- Explain sources of empirical anomalies.
- Explain modern corporate finance.

If you are a candidate in the Finance/ERM, Investment, Individual Life and Annuities or Retirement Benefits track you will also be able to:

- Describe and discuss the assumptions of mean-variance portfolio theory and its principal results.
- Describe asset pricing models and discuss the principal results, assumptions and limitations of such models.
- Describe derivative securities.
- Explain stochastic models and the behavior of security prices.
- Explain the properties of option prices, valuation methods and hedging techniques.

If you are a candidate in the Group and Health track, you will also be able to:

- Establish a framework for understanding how funds flow through the health care system.
- Contrast the economic concept of demand versus the medical concept of need.
- Analyze cost-benefit and cost-effectiveness of health care alternatives.

## Module Sections

The Financial and Health Economics module consists of fourteen sections. Although all candidates may complete all sections, the section requirements vary by track (Finance/ERM, Investment, Individual Life and Annuities, Retirement Benefits, Group and Health). Major topics are covered in sections completed by all track candidates while depth of coverage varies by track. For each Section, a “GH” indicates that it is required for Group and Health candidates while an “O” indicates that it is required for all but Group and Health candidates.

- Section 1. Module Overview. (You are here, now.)
- Section 2. Introduction to Financial and Health Economics.
- Section 3. Utility Theory.
- Section 4. Mean-Variance Portfolio Theory. (O)
- Section 5. Asset Pricing Models. (O)
- Section 6. Empirical Anomalies and Behavioral Finance.
- Section 7. Review of Derivative Securities. (O)
- Section 8. Stochastic Models of Security Prices. (O)
- Section 9. Option Pricing and Hedging. (O)
- Section 10. Health Economics. (GH)
- Section 11. Flow of Funds in Health Care. (GH)
- Section 12. Health Care Incentives, Behaviors and Decision Making. (GH)
- Section 13. Key Health Economic Analytics. (GH)
- Section 14. Understanding Modern Corporate Finance.

The module pages will direct you to the sections required for your track.

In addition, this module contains an End-of-Module Test and an End-of-Module Exercise. The End-of-Module Exercise includes two parts. Part 1 is completed by all candidates (all tracks); Part 2 is track-specific.

## SECTION 2: INTRODUCTION TO FINANCIAL AND HEALTH ECONOMICS

### Introduction

This section provides an introduction to financial and health economics. The goal of this section is to address the following questions:

- What is financial economics?
- Why should actuaries study financial economics?
- What are the major constructs of financial economics?
- How do financial economics principles apply in the health care industry?

### Objectives

After you complete Section 2, you will be able to:

- Identify the three major branches of financial economics.
- Explain why it is important for actuaries to study financial economics.
- Establish a framework of understanding how funds flow through the health care system.
- Contrast the economic concept of demand with the medical concept of need.

## SECTION 3: UTILITY THEORY

### Introduction

The primary goal of Section 3 is to increase your knowledge of individuals' attitudes toward risk and how they make choices about consumption and savings. In short, the goal is to make you a better advisor.

This section is about utility theory, which is a branch of microeconomics that studies individuals' attitudes toward risk and how they make choices about consumption and savings. The goal of this section is to address the following questions:

- Why does an individual consume X and save Y?
- What is a utility function? How is it used to explain why an individual consumes X and saves Y?
- What are the implications of the Fisher Separation Theorem?
- What does it mean when we say “most individuals are risk-averse?”
- What are the implications of this statement?
- Do these same concepts apply when the decisions are about health care instead of finances?

### Objectives

After you complete Section 3, you will be able to:

- Explain why a person consumes X and saves Y.
- Identify how the marginal rate of utility and marginal rate of investment return determine equilibrium of interest rates.
- Describe the utility functions of risk-averse, risk-neutral and risk-loving individuals.
- Explain risk premium.
- Explain why utility theory cannot always be used in health care decisions.

## SECTION 4: MEAN-VARIANCE PORTFOLIO THEORY

### Introduction

Section 4 is a requirement for candidates in the Finance/ERM, Investment, Individual Life and Annuities and Retirement Benefits tracks. The section includes offline readings in Bodie, Kane & Marcus' Investments (Eighth or Ninth Edition). Although candidates in the Group and Health track may find value in completing this section, it is not required and they may proceed to Section 6.

This section, Mean Variance Portfolio Theory, shows how investors may choose optimal portfolios of risky securities, based on mean and variance of asset returns.

The presentation of mean-variance portfolio theory typically involves starting with many simplifying assumptions, which appear to be unrealistic. The simplicity of the theory, however, allows for a greater understanding of the interplay of mean, variance and correlation. Extensions of the basic theory show that many of the simplifying assumptions can be relaxed. There have been numerous tests of the validity of the theory and its extensions, with further extensions enabling closer adherence to prior market return history.

### Objectives

After you complete Section 4, you will be able to:

- Describe and discuss the assumptions of mean-variance portfolio theory.
- Discuss the conditions under which application of mean-variance portfolio theory leads to the selection of optimal portfolios.
- Calculate the expected return and risk of a portfolio of many risky assets, given the expected return, variance and covariance of returns of the individual assets, using mean-variance portfolio theory.
- Explain the benefits of diversification using mean-variance portfolio theory.
- Explain what is meant by efficient frontiers, and optimal portfolios, in the context of mean-variance portfolio theory.

## SECTION 5: ASSET PRICING MODELS

### Introduction

Section 5, Asset Pricing Models, is a requirement for candidates in the Finance/ERM, Investment, Individual Life and Annuities and Retirement Benefits tracks. The section includes offline readings in Bodie, Kane & Marcus' Investments (Eighth or Ninth Edition). Although candidates in the Group and Health track may find value in completing this section, it is not required and they may proceed to Section 6.

Section 5 examines how the concept of market equilibrium can be extended to determine the market price of risk and the appropriate measure of risk for a single asset.

### Objectives

After you complete Section 5, you will be able to:

- Describe the assumptions and the principal results of the Capital Asset Pricing Model (CAPM).
- Discuss the limitations of the basic CAPM and some of the attempts that have been made to develop the theory to overcome these limitations.
- Discuss the assumptions, principal results and limitations of the Ross Arbitrage Pricing Theory model (APT).
- Perform calculations using the CAPM.

## SECTION 6: EMPIRICAL ANOMALIES AND BEHAVIORAL FINANCE

### Introduction

The Financial and Health Economics module has thus far focused on “rational” behavior. Section 3 (completed by all candidates in all tracks) described rational decision making, that is, utility theory, for decisions with certainty and with uncertainty.

Sections 4 (Mean-Variance Portfolio Theory) and 5 (Asset Pricing Models) were completed by candidates in the Finance/ERM, Investment, Individual Life and Annuities and Retirement Benefits tracks. Section 4 showed how a rational investor would behave if he/she had preferences about mean and variance of wealth. Section 5 examined how markets would behave if all individuals are rational and trade in complete markets. In complete markets, financial security prices reflect all publicly available information (efficient markets), reflecting systematic risk, but not idiosyncratic risk (mean-variance portfolio choice, Capital Asset Pricing Model and Arbitrage Pricing Theory). No other factors affect prices and excess returns are not possible.

A common reaction among people hearing these theories for the first time is that people aren't that rational, there are all kinds of information gaps and disparities, some people are better at figuring out risk than others, prices reflect many things that we don't understand, some people seem to make more money than others and certain prices behave very differently than what you should expect with an efficient market.

A stream of thought has emerged to address these “empirical anomalies” using a somewhat different approach known as “behavioral finance.” Later in this section you will read “The Law of One Price in Financial Markets” by Owen A. Lamont and Richard A. Thaler who note:

*“Economics can be distinguished from other social sciences by the belief that most (all?) behavior can be explained by assuming that rational agents with stable, well-defined preferences interact in markets that (eventually) clear. An empirical result qualifies as an anomaly if it is difficult to rationalize or if implausible assumptions are necessary to explain it with the paradigm.”*

### Objectives

After you complete Section 6, you will be able to:

- Describe some anomalies that exist.
- Explain that the anomalies can sometimes be justified by a broader version of the underlying efficient markets and rational behavior theories as well as by entirely different theories.
- Explain that some anomalies appear beyond the reach of classical rational decision theory/efficient markets theory.
- Explain how understanding irrational behavior is important when making health care delivery decisions.

## SECTION 7: REVIEW OF DERIVATIVE SECURITIES

### Introduction

Section 7, required for candidates in the Finance/ERM, Investment, Individual Life and Annuities and Retirements Benefits tracks, reviews the different types of derivative securities and some of the language and notation of options. You will learn about some of the ways that options are embedded in insurance products.

### Objectives:

After you complete Section 7, you will be able to:

- Define basic types of derivatives.
- Describe the options embedded in insurance products.



## SECTION 8: STOCHASTIC MODELS OF SECURITIES PRICES

### Introduction

Section 8 is required for candidates in the Finance/ERM, Investment, Individual Life and Annuities and Retirement Benefits tracks. In this section, you will learn about modeling long-term stock returns and maximum likelihood estimation for stock return models.

### Objectives

After you complete Section 8, you will be able to:

- Explain the lognormal model for asset prices.
- Describe some alternatives to the lognormal model including key differences and their advantages and disadvantages, compared with the lognormal model.
- Determine estimates for long-term stock return model parameters.

## SECTION 9: OPTION PRICING AND HEDGING

### Introduction

Section 9 is required for candidates in the Finance/ERM, Investment, Individual Life and Annuities and Retirement Benefits tracks. In this section, you will learn about option pricing and hedging. You will learn how liabilities of equity-linked insurance can be modeled using an actuarial approach and also a dynamic-hedging approach. You also have the option of reviewing the Black-Scholes Theorem and real-world and risk-neutral measures.

### Objectives

After you complete Section 9, you will be able to:

- Describe the principles of option pricing and the Black-Scholes equation.
- Compare actuarial and financial risk management in the context of variable annuity contracts.

## SECTION 10: HEALTH ECONOMICS

### Introduction

In the first sections of this module, studied by all candidates, you were provided with an introduction to many concepts of financial economics and utility theory. You learned about health economics overall, read Chapters 1 and 4 of Health Economics and Financing by Thomas Getzen and studied other material. These introductory readings are relevant to all actuaries by helping them better understand the economics and financing of health care.

Sections 10, 11, 12 and 13 are required for Group and Health candidates only and include deeper content:

- Section 10: Health Economics.
- Section 11: Flow of Funds in Health Care.
- Section 12. Health Care Incentives, Behaviors and Decision Making.
- Section 13: Key Health Economic Analytics.

Each of these sections includes readings in Health Economics and Financing by Thomas Getzen. Each section also includes links to a variety of articles.

## SECTION 11: FLOW OF FUNDS IN HEALTHCARE

### Introduction

Section 11, required for candidates in the Group and Health track, traces cash inflows and outflows for the many participants in the health care system: physicians, hospitals, government and payers. You will learn about the roles each of the four main participants play in directing the flow of funds throughout the entire system. You will also learn about the financial incentives that influence the behavior of each participant.

### Objectives

After you complete Section 11, you will be able to:

- Interpret the role that physicians, hospitals and government play in directing the flow of funds.
- Describe the objectives of physicians and hospitals (as organizations).
- Describe government's role in policy and regulation.
- Describe how funds flow in/out; categorize the sources of funds.
- Describe characteristics of the health care market that affect physician supply.
- Describe the market power of hospitals and how hospitals compete for patients, physicians, and contracts.
- Describe and quantify the sources of funding for health care in the United States.
- Contrast the sources of funding in the United States versus other countries.

## SECTION 12: HEALTH CARE INCENTIVES, BEHAVIORS AND DECISION MAKING

### Introduction

Section 12, required for candidates in the Group and Health track, covers the role of insurance and third-party payments in the flow of funds, the incentives that consumer-driven health care is intended to create, emerging outcomes, key issues that affect patient decision making and economic incentives that may be put in place for physicians and/or allied health professionals.

### Objectives

After you complete Section 12, you will be able to:

- Describe key behaviors that affect a consumer's health status and/or the cost of health care overall.
- Describe the key factors driving consumer decision making, including cost-share and communications.
- Describe how consumer decision making creates opportunities and challenges for actuaries.

## SECTION 13: KEY HEALTH ECONOMIC ANALYTICS

### Introduction

Candidates in the Group and Health track are required to complete Section 13, Key Health Economic Analytics. How much health care costs—an insurer's premiums, the large corporation's benefits budget, a patient's out-of-pocket expenses—is the most common focus of health actuaries' work, but what other economic analytics are critical in understanding the dynamics of health care?

### Objectives

After you complete Section 13, you will be able to:

- Describe the basic economic metrics central to describing a particular health care program.
- Describe how other professionals approach analyzing the health care system flow of funds.

## SECTION 14: UNDERSTANDING MODERN CORPORATE FINANCE

### Module Wrap-up

Financial economics is studied and applied throughout the world and has gained influence among accountants, stock analysts, investment bankers and other users of actuarial work. Therefore, it is important for actuaries to gain a solid understanding of financial and health economics. This section is to be completed by candidates in all tracks. Near the end of the section there are three different case studies that apply the concepts to different practice areas.

This section reviews the basics of corporate finance. Specifically, this section covers:

- How corporations add value.
- Debt/equity structure, total firm value, dividends and return on equity.
- How corporate and personal income tax rates affect total firm value, firm equity and return on equity.
- The costs of financial distress and bankruptcy and the effect of debt levels on these costs.
- The role of agency costs and the need to address asymmetrical information.

### What is Corporate Finance?

Corporate finance considers how corporations make decisions about raising and deploying capital. Corporations exist to add economic value and, in theory, all corporate decisions should add value and some or all of that value should inure to the corporations' owner/shareholders. Thus, corporations are often described as value maximizers.

Corporations add economic value by investing in projects whose expected returns exceed the cost of capital. Capital is provided by shareholders and lenders. Corporations borrow from lenders and suppliers, including employees who supply labor in exchange for current and deferred compensation. (Note: Since a pension plan is a form of deferred compensation, an underfunded pension plan can be considered a form of corporate borrowing from plan participants.)

Economists refer to corporations as pass-through entities; all of the value generated by a corporation's assets passes through to the shareholders after satisfying higher priority claims of liability holders. The standard finance model treats shareholders as diversifiers because they invest only a small fraction of their personal portfolio in any one security. It is the shareholder's role to balance risk and return (i.e., maximize expected utility) at the aggregate portfolio level and it is the corporation's role to create value.

### Objectives

After you complete Section 14, you will be able to:

- Describe how the purpose of the corporation is to add value beyond what is available in the market.
- Explain how Modigliani-Miller Propositions I and II relate to debt/equity structure, total firm value, dividends and return on equity.
- Explain how taxes and other imperfections affect Modigliani-Miller Propositions I and II.
- Identify the costs of financial distress and bankruptcy and the effect of debt levels on these costs.
- Describe agency theory with regard to agency costs and the need to address asymmetrical information.

To help you achieve these objectives, you will complete several readings with exercises (or review quizzes) and you will read a review paper by Stewart Myers, co-author of *Principles of Corporate Finance*, on what firms in the United States and elsewhere do with respect to issuing debt and equity. This section concludes with three case studies, which will allow you to apply what you have learned about corporate finance to realistic scenarios.

You will note that review quizzes are not employed extensively in this section. You will be able to test your understanding of the section's key concepts by completing the exercises integrated within the readings and by completing the case studies.

## **END-OF-MODULE TEST**

## **END-OF-MODULE EXERCISE**