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SYLLABUS OF BASIC EDUCATION 2017

Financial Risk and Rate of Return – Exam 9

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on the lower numbered examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the 2017 Exam 9 Study Kit that may be purchased from the CAS Online Store. The 2017 Update to the 2016 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the "*Syllabus* Updates" section of the CAS Web Site for any changes to the *Syllabus*.

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Exam 9 focuses on a broad array of finance, investment, and financial risk management topics. This examination assumes a working knowledge of basic ratemaking, finance, probability and statistical modeling, liability and reserve risk, and insurance underwriting. The ability to apply this knowledge and experience may be tested through questions dealing with problems for which there are no generally recognized solutions.

Texts for this Exam

There is one main text for this exam: *Investments* (10th Edition) by Bodie, Kane, and Marcus. The *Investments* text contains references to various websites. Candidates are not responsible for the identity of the websites or the actual content of the websites except to the extent that the content is reproduced in the text. Candidates are also not responsible for any aspect of the Excel applications or the boxes entitled "E-Investments" that are usually placed at or towards the end of a chapter.

While, in general, it is suggested that the candidate cover the learning objectives in the order listed, some references to later chapters in texts may occur before references to earlier chapters. In these cases, the candidate may need to review the earlier chapters first and then return to the learning objectives that reference the later chapters.

For the Financial Risk and Rate of Return exam, the appendices are part of the material covered unless specifically excluded.

There are various numeric tables scattered throughout the readings, illustrating actual observations or hypothetical examples. Candidates are not responsible for the actual numeric values.

Background in Financial Markets and Instruments

Candidates may find it helpful to review Chapters 1-5 of the *Investments* text for background in financial markets and instruments.

A. Portfolio Theory and Equilibrium in Capital Markets

Range of weight for Section A: 20-30 percent

The portfolio theory portion of this section discusses the relationship between the risk and return for different combinations of risky and risk-free investments and discusses the effect of diversification on this relationship. Candidates are introduced to the manner in which investors might select a particular portfolio, from those available, that best suits their individual preferences for risk and return. In the portion of this section on equilibrium in capital markets, various equilibrium models are presented, including the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The concept of market efficiency is presented to help candidates understand the factors that move market prices towards and away from the theoretical prices presented in these models.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Explain key concepts of risk: • Appetite • Tolerance • Aversion • Measurement • Portfolio construction • Strategies for monitoring Range of weight: 0-5 percent	a. Utility functions, utility scores, and utility maximization b. Risk aversion c. Mean-variance criterion d. Capital allocation line e. Complete portfolio f. Reward to volatility ratio (Sharpe ratio) g. Passive versus active strategies: costs of active strategy and free-rider benefit
READINGS	
• BKM, Chapter 6	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Calculate the expected value, variance, and covariance of returns of asset portfolios in a multi-dimensional setting. Range of weight: 0-5 percent	a. Expected return and standard deviation for portfolios of risky and risk-free assets b. Optimal risky portfolio c. Optimal complete portfolio
3. Describe the Markowitz Portfolio Selection Model. Range of weight: 0-5 percent	a. Minimum variance frontier b. Efficient frontier of risky assets c. Optimal capital allocation line d. Separation property e. Asset allocation versus security selection
4. Explain and demonstrate effects of various diversification strategies. Range of weight: 0-5 percent	a. Systematic risk b. Risk pooling c. Risk sharing d. Insurance principle
READINGS	
• BKM, Chapter 7	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
5. Explain and use the single factor models and compare/contrast the process of portfolio construction with the full covariance (Markowitz) model. Range of weight: 3-7 percent	a. Markowitz model b. Single factor model c. Single index model d. Systematic risk e. Alpha, Beta estimating and forecasting f. Covariance and correlation estimates for single index model g. Risk premiums due to market and non-market factors h. Parameter estimation risk i. Macroeconomic factors
READINGS	
• BKM, Chapter 8	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
6. Explain the assumptions and construction of CAPM and use CAPM to calculate expected returns for risky securities. Range of weight: 3-7 percent	a. CAPM assumptions b. Market price of risk c. Capital market line d. Security market line
7. Compare/contrast CAPM and single index model and explain the assumptions that are modified under various extensions of CAPM. Range of weight: 0-5 percent	a. CAPM b. Single index model c. Expected versus actual returns d. Market portfolio versus market index e. Extensions of CAPM • Zero Beta CAPM • CAPM with non-traded assets and labor income • ICAPM • CAPM with liquidity adjustments
READINGS	
• BKM, Chapter 9	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
8. Use APT to determine the expected return for a security and compare/contrast with CAPM and factor models. Range of weight: 0-5 percent	a. Arbitrage and the Law of One Price b. APT and its comparison to CAPM c. Factor betas d. Factor portfolios and factor risk premiums e. Fama and French's 3 Factor Model f. Alternative factors in multifactor models
READINGS	
• BKM, Chapter 10	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
9. Explain market efficiency and its implications for portfolio management, and describe the various tests and studies of market efficiency. Range of weight: 0-5 percent	a. Efficient market hypothesis b. Random walk c. Technical analysis d. Fundamental analysis e. Passive investment strategy f. Portfolio management
READINGS	
• BKM, Chapter 11	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
10. Explain the influence of behavioral finance in understanding certain aspects of market efficiency. Range of weight: 0-5 percent	a. Information processing errors b. Behavioral biases c. Limits to arbitrage d. Violations of Law of One Price e. Behavioral critique f. Technical analysis
READINGS	
• BKM, Chapter 12	

B. Asset-Liability Management

Range of weight for Section B: 10-20 percent

This section exposes the candidate to factors that influence the price sensitivity of fixed income securities and presents various ways in which a portfolio manager might manage the interest rate and cash flow risk in a portfolio of these instruments. The same concepts are also applied to the interest rate risk associated with a firm's liabilities and the interest rate risk associated with a firm's total market value, inclusive of their franchise value.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Explain the different Term Structure Theories Range of weight: 0-5 percent	a. Expectations hypothesis b. Liquidity preference theory c. Segmentation theory d. Forward rate versus expected spot rate
2. Determine U.S. Treasury zero rates at different maturities. Range of weight: 3-7 percent	a. Determining zero rates from coupon bonds using both continuous and semi-annual compounding b. Determining forward rates from spot rates (zero rates) c. Spot rates d. Short rates e. LIBOR zero rates f. Forward Rate Contracts
READINGS	
• BKM, Chapters 15 and 16	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Utilize various strategies to manage interest rate risk and cash flow risk in a bond portfolio. Range of weight: 3-7 percent	a. Duration (Macaulay, modified, and effective) b. Convexity c. The effect of interest changes on bond prices d. Immunization e. Cash flow matching and dedication f. Rebalancing g. Use of interest rate swaps, mortgage-backed securities, and other derivative securities to alter the interest rate risk for a bond portfolio h. Currency swaps
READINGS	
• BKM, Chapters 16 and 23 (Section 23.4)	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Quantify franchise value, evaluate the impact of interest rate sensitivity, and demonstrate how interest rate sensitivity of the franchise value can be managed. Range of weight: 0-5 percent	a. Total economic value b. Franchise value—magnitude and exposure to interest rate risk (duration) c. Pricing strategy d. Advantages of managing the interest rate sensitivity of the firm's total economic value through pricing strategy
READINGS	
• Panning	

C. Financial Risk Management

Range of weight for Section C: 25-35 percent

This section addresses financial risks as well as risks related to the insurance industry from the financial economics perspective. The concepts and techniques presented in this section are important components in the field of enterprise risk management.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Estimate the credit risk due to default and default correlation associated with fixed income securities. Range of weight: 0-5 percent	a. **Default risk** b. Bond safety determinants c. Expected loss from default d. Yield spread
2. Describe the credit risk in derivatives transactions and various mechanisms to manage the risk. Range of weight: 0-5 percent	a. Counterparty default risk b. Collateralization
READINGS	
• BKM, Chapter 14	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Describe the reasons for the development of credit derivatives market, the valuation of credit derivative contracts, and the complexity of trading credit risks. Range of weight: 0-5 percent	a. Credit default swaps (CDS) b. Mark-to-market c. Total return swaps d. Collateralized debt obligation (CDO) and synthetic CDO e. The role CDS played in the 2008 financial crisis
READINGS	
• BKM, Chapter 14 • Coval, Jurek, and Stafford	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Discuss the development and the complexity of financial engineering products such as mortgage-backed securities and other forms of securitization. Range of weight: 0-5 percent	a. Effect of securitization on sources of funds for mortgage holders and on interest rate risk retained by the mortgage originators b. Mortgage pass-throughs and the effect of mortgage prepayment on cash flows to investors c. Collateralized mortgage obligations (CMOs) and the effect of prepayments on cash flows to investors in particular tranches d. Market liquidity and credit rating e. Lessons from the recent subprime crisis
5. Describe the market for securitizing catastrophe risk in the insurance industry and explain the reasons for its growth. Range of weight: 0-5 percent	a. Products on the market: • Risk-linked securities • CAT bonds • Sidecars • Cat-E-puts • Catastrophe risk swaps • Industry loss warranties b. Factors influencing interest in insurance securitization in relation to traditional reinsurance c. Factors impeding the growth of the market: • Regulatory • Accounting • Tax • Rating issues
READINGS	
• BKM, Chapter 16 (Section 16.2) • Coval, Jurek, and Stafford • Cummins CAT Bond	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
6. Describe various risk measures and the need for practicing sound financial risk management. Range of weight: 3-7 percent	a. Capital structure and risk taking incentives b. Regulation and rating agency c. Value at risk (VaR) d. Risk-based capital e. Expected policyholder deficit (EPD) f. Capital associated with a constant EPD ratio g. Risk-adjusted return on capital (RAROC), including alternative measures of income and alternative measures of risk-adjusted capital h. Economic value added (EVA) i. Percentile layer of capital j. Lessons from past failures due to poor financial risk management

READINGS

- Bodoff
- Butsic
- Cummins Capital
- Goldfarb

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
7. Describe the concept of economic capital (or risk capital) in the insurance industry and various methods of allocating the risk capital to business units or lines of business. Range of weight: 0-5 percent	a. Financial and insurance risks b. Economic capital or risk capital c. Risk aggregation d. Strengths and weaknesses of the various allocation methods using risk measures such as: • Percentile (VaR) • Conditional tail expectation (CTE) • EPD Ratio • Merton-Perold method • Insolvency Put/EPD ratio risk measure • Myers-Read method • Co-Measures • Co-CTE • Percentile Layer of Capital
8. Apply the RAROC framework to risk management in the insurance industry. Range of weight: 0-5 percent	a. Economic profit as income measure b. Cost of capital c. RAROC d. Additional risk margin in price e. Multi-period capital commitment
9. Assess the performance of business units and set prices for insurance policies on a risk-adjusted basis. Range of weight: 0-5 percent	a. Economic profit as income measure b. Cost of capital c. RAROC d. Additional risk margin in price e. Multi-period capital commitment
READINGS	
• Bodoff • Cummins Capital • Goldfarb	

D. Rate of Return, Risk Loads, and Contingency Provision

Range of weight for Section D: 25-35 percent

This section explores the relationship between insurance concepts (such as underwriting profits, premium-to-surplus ratios, and investment income) and financial concepts (such as interest rates, inflation rates, cost of capital, and risk premiums). The readings build on a background of finance as related to the insurance business, and deal with specific techniques used by actuaries to develop an appropriate profit loading in insurance prices.

Because insurance claims are fortuitous, the expected profit loaded in rates may not be realized. Some models discuss insured events that are predictable in time and amount while other models consider when insured events are uncertain, particularly where capacity is limited and/or sufficient diversification of exposure is impossible.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Evaluate the internal rate of return framework. Range of weight: 3-7 percent	a. Inter-relationship between the product market and financial market b. Capital structure of insurance company compared to other industries c. IRR Model calculations d. Decision rule of the IRR model e. Distinction between equity flows and all other cash flows f. Impact of surplus allocation and timing on equity flows g. Methods of allocating surplus and impact on IRR h. Potential pitfalls in IRR analysis
READINGS	
• Feldblum Financial	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Evaluate the components of total return to stockholders and how leverage can be used to maximize shareholder value. Range of weight: 0-5 percent	a. Relationship between profitability measures from investors' perspective, society's perspective, and regulators' perspective b. Insurance leverage and reserve capital c. Influence of leverage on stockholders' equity d. Optimal capital structure e. Dynamic relationship among formula variables
READINGS	
• Ferrari	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Assess insurance profitability. Range of weight: 0-5 percent	a. Policyholder versus investor perspectives b. Return on equity versus return on sales c. Methods to determine benchmark rate of return
READINGS	
• McClenahan	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Describe the underwriting profit provision. Range of weight: 0-5 percent	a. Evolution of the profit provision b. Policyholder versus stockholder return c. Types of underwriting profit
5. Calculate and compare the provision for underwriting profit in property and casualty insurance rates Range of weight: 3-7 percent	a. Calendar Year Investment Offset procedure b. Present Value Offset procedure c. Calendar Year Return on Equity method d. Present Value of Income over Present Value of Equity method e. Present Value Return on Cash Flow method f. Risk-Adjusted Discounted Cash Flow method g. Internal Rate of Return on Equity Flows method
READINGS	
• Robbin IRR • Robbin UW	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
6. Use Riskiness Leverage models to determine risk loads. Range of weight: 3-7 percent	a. Relate capital needs and risk loads b. Forms of riskiness leverage models c. Expressing various risk attitudes with riskiness leverage models d. Properties of riskiness leverage models e. Evaluating reinsurance purchases with riskiness leverage models from the cedant perspective
READINGS	
• Kreps Ratios	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
7. Calculate and compare the risk loads for property catastrophe insurance. Range of weight: 3-7 percent	a. Order dependency b. Marginal Surplus method c. Marginal Variance method d. Sub-additive and super-additive properties e. Renewal additivity f. Shapley Value method g. Covariance Share method
READINGS	
• Mango	

Complete Text References for Exam 9

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Bodie, Z.; Kane, A.; and Marcus, A.J., *Investments*, 10th Edition, McGraw-Hill/Irwin, 2014. Chapter or section citations are listed under the appropriate learning objective.	BKM	A1-A10, B1-B3, C1-C5	**B**
Bodoff, N.M., "Capital Allocation by Percentile Layer," Casualty Actuarial Society *Forum*, Winter 2008.	Bodoff	C6-C9	**OP NEW**
Butsic, R.P., "Solvency Measurement for Property-Liability Risk-Based Capital Applications," *The Journal of Risk and Insurance*, American Risk and Insurance Association, Inc., December 1994, Vol. 61, No. 4, pp. 656-690.	Butsic	C6	**SK**
Coval, J.; Jurek, J.; and Stafford, E., "The Economics of Structured Finance," *The Journal of Economic Perspectives*, American Economic Association, Winter 2009, Vol. 23, No. 1.	Coval, Jurek, and Stafford	C3-C5	**SK**
Cummins, J. D., "Allocation of Capital in the Insurance Industry," *Risk Management and Insurance Review*, American Risk and Insurance Association, Inc., Spring 2000, Vol. 3, No. 1, pp. 7-27.	Cummins Capital	C6-C9	**SK**
Cummins, J. D., "CAT Bond and Other Risk-Linked Securities: State of the Market and Recent Developments," *Risk Management and Insurance Review*, American Risk and Insurance Association, Inc., 2008, Vol. 11, No. 1, pp. 23-47.	Cummins CAT Bond	C4-C5	**SK**
Feldblum, S., "Pricing Insurance Policies: The Internal Rate of Return Model," CAS Study Note, May 1992. Only Sections 1, 3, and 6 will be directly tested, but the other sections may provide useful background.	Feldblum Financial	D1	**OP**
Ferrari, J.R., "The Relationship of Underwriting, Investment, Leverage, and Exposure to Total Return on Owners' Equity," *PCAS* LV, 1968, pp. 295-302. Includes discussion: Balcarek, R.J., *PCAS* LVI, 1969, pp. 58-60.	Ferrari	D2	**OP**
Goldfarb, R. "Risk-Adjusted Performance Measurement for P&C Insurers," CAS Study Note, October 2010.	Goldfarb	C6-C9	**OP**
Kreps, R.E., "Riskiness Leverage Models," *PCAS* XCII, 2005, pp. 31-60.	Kreps Ratios	D6	**OP NEW**
Mango, D.F, "An Application of Game Theory: Property Catastrophe Risk Load," *PCAS* LXXXV, 1998, pp. 157-186.	Mango	D7	**OP**

Citation	Abbreviation	Learning Objective	Source
McClenahan, C.L., "Insurance Profitability," *Actuarial Considerations Regarding Risk and Return in Property-Casualty Insurance Pricing*, Casualty Actuarial Society, 1999, Chapter 8.	McClenahan	D3	**OP**
Panning, W.H., "Managing Interest Rate Risk: ALM, Franchise Value, and Strategy," Willis Re Working Paper, July 2006.	Panning	B4	**OP**
Robbin, Ira, "IRR, ROE, and PVI/PVE," Casualty Actuarial Society *Forum*, Winter 2007. Excluding Sections 6 and 7.	Robbin IRR	D4-D5	**OP NEW**
Robbin, Ira, "The Underwriting Profit Provision," CAS Study Note, as updated in 1992. Excluding Sections V, VI, and IX and related exhibits.	Robbin UW	D4-D5	**OP**

Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Text References.
SK	Material included in the 2016 Study Kit.
SKU	Material included in both the 2016 CAS Study Kit and the 2016 Update to the 2015 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

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