
SOCIETY OF ACTUARIES
Advanced Portfolio Management

Exam APM

AFTERNOON SESSION

Date: Friday, May 3, 2013

Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 9 questions numbered 10 through 18 for a total of 60 points. The points for each question are indicated at the beginning of the question. There are no questions that pertain to the Case Study in the afternoon session.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam APM.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.

****BEGINNING OF EXAMINATION****

Afternoon Session
Beginning with Question 10

- 10.** (5 points) You are employed by Redsquare, a large multi-line life insurance company that is structured as a mutual company and is very well-capitalized.

Regulators and rating agencies have recently asked questions about liquidity and the Board wants to be educated on this issue. As a member of the Risk Management team, you have been mandated by the CFO to help her prepare an upcoming presentation to the Board on liquidity risk.

The CFO is of the opinion that since Redsquare is a well-capitalized company, liquidity is not a concern.

- (a) (1 point) Describe liquidity risk and explain how it differs in nature from other types of financial risks.
- (b) (1 point) Critique the CFO's opinion.
- (c) (2 points) Compare and contrast the following quantitative frameworks for liquidity risk management:
- Balance Sheet Liquidity Analysis
 - Cash Capital Position
 - Maturity Mismatch Approach
- (d) (1 point) Identify what questions should be answered by Redsquare management in order to provide a sound recommendation to its Board regarding qualitative aspects of liquidity risk management.

11. (7 points) You are a consultant hired by insurance company XYZ to evaluate their ALM process. During your review, you find the following:

- Company XYZ's assets include treasuries, corporate bonds, commercial mortgages and MBS
- XYZ's goal is to match the duration of assets and liabilities
- They calculate and report effective duration of liability and assets quarterly. Below are the results from the ALM model.

Interest Rate Move	Assets	Liability
Shock Up 50 bps	180 M	160 M
No shocks	200 M	180 M
Shock Down 50 bps	210 M	220 M

- (a) (1 point) Compare Macaulay duration, empirical duration, effective duration and key rate duration.
- (b) (1 point) Explain the possible reasons that the value of assets could move differently from the duration predicted value.
- (c) (1 point) Identify risks that XYZ faces in a falling interest rate environment.
- (d) (2.5 points) Estimate the value of assets and liabilities following a 70bps drop in interest rates using duration and convexity.
- (e) (1.5 points) Evaluate suitability of adding the following assets to improve the company's asset liability risk management.
- (i) 30 year high yield bond
 - (ii) 15 year callable investment grade bond
 - (iii) 5 year government bond

- 12.** (7 points) Tom is the portfolio manager for ABC Life's investments in agency MBS, agency CMOs and mortgage bonds.
- (a) (1 point) Describe each of the assets: agency MBS, agency CMOs and mortgage bonds.
 - (b) (1 point) Compare the credit risks of each instrument.
 - (c) (1 point) Compare the prepayment risks of each instrument.
 - (d) (2 points) As part of the company's ALM interest rate risk policy, Tom is required to manage his portfolio to match a target duration and cash-flow profile to fund a specific set of liabilities. ABC Life is looking to better measure Tom's performance by implementing a benchmark for his agency MBS investments.
 - (i) Describe the considerations in selecting a benchmark.
 - (i) Recommend a benchmark for the agency MBS portfolio.
 - (e) (1 point) ABC Life is also looking to setup an index for Tom's mortgage bond portfolio to mitigate risk.

Identify the key risk associated with a fixed income credit portfolio and explain ways to mitigate this risk.
 - (f) (1 point) Tom plans to use a stratified sampling approach to replicate the credit index.

Explain whether this is an appropriate approach.

13. (7 points) You are the portfolio manager of an asset management firm. Due to a series of quantitative easing policies implemented by the Federal Reserve in the past, you are now evaluating the decision of investing in commodities in a balanced fund portfolio using crude oil futures.

- (a) (1 point) Describe the advantages of investing in commodities in the portfolio.
- (b) (1 point) Explain why purchasing oil futures is more effective in getting commodity exposure than purchasing stocks of an oil company.
- (c) (1 point) Propose a formula to determine the relationship between futures price and spot price. Define all terms.
- (d) (1 point) Define the law of one price and describe how it relates to oil ETFs.
- (e) (3 points) The available crude oil futures contracts are shown in the below table:

Contract Maturity	Futures Price as of November 2013 (US\$)	Futures Prices as of October 2013 (US\$)	Change in Spot Price (US\$)
December 2013	92.20	91.20	0.55
January 2014	91.55	90.65	0.55
February 2014	89.50	88.60	0.55

- (i) Describe the three components of returns on a futures contract.
- (ii) Explain the sloping structure of the futures prices listed in the table.
- (iii) Recommend a futures strategy that is expected to provide a positive return with the above oil futures contracts.

14. (6 points) ABC Life is considering issuing corporate bonds, but wants to include mechanisms in the bond's indenture that allow the Company to retire the debt before maturity.

- (a) (1 point) List and describe the mechanisms that ABC can use.
- (b) (2 points) Four years ago ABC issued \$10 million of 10-Year bonds with 6% coupon paying annually. These bonds are redeemable at any time in whole or in part at ABC's option. The make-whole call premium is 10 basis points. Current CMT rates are shown in the table below.

Maturity (years)	1	2	3	4	5	6	7	8	9	10
Yield	0.50%	0.80%	1.10%	1.40%	1.70%	2.00%	2.30%	2.60%	2.90%	3.20%

Calculate the redemption price.

- (c) (1 point) Compare the convexity of a bond with the fixed-priced call provision relative to a bond with the make-whole call provision.
- (d) (1 point) Recommend a provision to be included in the bond's indenture that helps mitigate the credit risk for ABC's bondholders.
- (e) (1 point) ABC's CFO believes that an extendible reset bond is the same as a floating-rate asset because the coupon rate may reset annually or even more frequently.

Critique this statement.

15. (10 points) You are a financial advisor hired to manage a children's college education fund that is invested in stocks and bonds. The market value of the assets currently covers 90% of the market value of the liabilities. For your asset allocation recommendation, you are using two frameworks:

- #1: the strategic asset allocation framework under uncertain liabilities, and
- #2: the liability-relative asset allocation policy framework.

- (a) (1.5 points) Describe the approach to, as well as the advantages and disadvantages of modeling the liability (i.e. the college education fund) using bond indices under these frameworks.
- (b) (1 point) Describe the advantages and disadvantages of the Asset/Liability Management (ALM) approach over the asset-only approach to the strategic asset allocation process.
- (c) (3.5 points) Your final recommendation is to lower the allocation in equity and increase the allocation in short term bonds. Upon your final review of the recommendation, you realize that you made some modeling errors.

For the projection work using framework #1:

- (i) You underestimated the correlation between existing assets and the liabilities.
- (ii) You underestimated the payouts in the projection.

For the projection work using framework #2:

- (i) You only used the Minimum Surplus Variance portfolio without considering other asset mixes.
- (ii) You overestimated the liability discount rate.

Explain the individual impact of each error on the recommended asset allocation.

15. Continued

- (d) (2 points) Your client has stated the following:
- (i) In the current low interest rate environment, the fund should lower the allocation in bonds.
 - (ii) With the nearly flat yield curve, the fund should reduce the duration of the assets to stay liquid in case interest rates spike up.
 - (iii) The fund should invest more in emerging market equity because last year it achieved a high rate of return.

Critique the statements above separately.

- (e) (2 points) Due to the current shortfall of assets relative to the anticipated tuition costs, your client suggests adding private equity to the portfolio, either Venture Capital or Distressed Debt.
- (i) Describe the differences between the two types of private equity.
 - (ii) Compare and contrast their risk/return profiles.
 - (iii) Select which of the two types would be more appropriate for the portfolio. Justify your answer.

16. (8 points)

- (a) (0.5 points) Define the Bond-CDS basis.
- (b) (2 points) Determine whether the impact on Bond-CDS basis is negative or positive for each of the following events. Justify your answer.
- (i) Bond issued in illiquid credit condition
 - (ii) Recognize maturity extension as a credit event
 - (iii) CDS buyer can choose the cheapest bonds to deliver
 - (iv) Bond issuer can call back bonds
- (c) (5.5 points) You are given the following information.

Bond	Bond A	Bond B
Coupon	3.65%	5.125%
Maturity	10 years	8 years
Price	\$98.50	\$105.50
Asset Swap Spread	45 basis points (bps)	120 basis points (bps)
Z-Spread	50 bps	125 bps
CDS Price	5-year CDS: 55 bps 10-year CDS: 65 bps	5-year CDS: 75 bps 7-year CDS: 95 bps 10-year CDS: 115 bps 8-year Interpolated: 110 bps
Repo Rate	LIBOR minus 35 bps	LIBOR plus 5 bps

- (i) Propose a bond-CDS basis trade to generate credit risk-free income for each bond.
- (ii) Calculate the credit risk-free income for each trade.
- (iii) Determine which trade is better. Justify your answer.

17. (5 points)

- (a) (2 points) Describe the differences between a reduced-form and a structural (Merton) model of default.
- (b) (3 points) You are given the following 1-year credit rating transition matrix:

	To A	To B	To Default	Recovery at Default
A	0.80	0.15	0.05	70%
B	0.20	0.70	0.10	70%

You are given the following information on a zero coupon bond X maturing in two years:

Bond	Face Value	Price	Credit Rating
X	1000	900	A

Assume that:

- All defaults occur at the end of the year
- Recoveries from defaults are received immediately
- Money recovered after default is invested in a savings account earning 3% per year

Calculate the default-adjusted expected 2-year return of bond X.

- 18.** (5 points) You are the Chief Investment Officer of Rookie Life Insurance Company (RLIC). The company is only 2 years old, but has had enormous success in writing new annuity business. The company has sold \$1 billion in deferred payout annuities. A deferred payout annuity is a single premium contract sold to 30 year old individuals and begins making monthly payments at age 65.

The company is risk adverse, wishes to maximize surplus, and wants to duration match when the contracts are in their payout period.

The liability duration will initially be 25, but will be 8 in the payout stage. You have decided on the following initial investment mix:

Asset Class	Weight	Expected Return	Duration
Common Stock	20%	7.5%	-
Private Preferred Stock	30%	6.0%	15.0
Municipal Bonds	30%	5.0%	20.0
Short Term Bonds	20%	2.5%	2.0
Total	100%	5.3%	10.9

- (a) (1.5 points) Explain what aspects of the portfolio should be monitored for changes in RLIC's circumstances and constraints, and how each will likely change over time.
- (b) (1.5 points) If the stock market decreases by 30%, explain the benefits and costs of rebalancing the portfolio.
- (c) (2 points) You are considering the following rebalancing disciplines
- Calendar rebalancing
 - Percentage of portfolio rebalancing
- (i) Explain why the calendar rebalancing might be more appropriate during the deferral period.
- (ii) Explain why the percentage of portfolio rebalancing might be more appropriate during the payout period.

****END OF EXAMINATION****
Afternoon Session

USE THIS PAGE FOR YOUR SCRATCH WORK

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