
SOCIETY OF ACTUARIES
Advanced Portfolio Management

Exam APM

MORNING SESSION

Date: Friday, May 3, 2013
Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 120 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 60 points).
 - a) The morning session consists of 9 questions numbered 1 through 9.
 - b) The afternoon session consists of 9 questions numbered 10 through 18.

The points for each question are indicated at the beginning of the question. Questions 1 through 3 pertain to the Case Study, which is enclosed inside the front cover of this exam booklet.

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.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.
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.
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.

CASE STUDY INSTRUCTIONS

The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company. Other advantages should not be listed, as they are extraneous to the question and will result in no additional credit. Further, if they conflict with the applicable advantages, no credit will be given.

****Beginning of Examination****
Morning Session

Questions 1-3 pertain to the Case Study.
Each question should be answered independently.

- 1.** (4 points) Review “Wonka Life Proxy Statement – Dated March 11, 2010,” located on pages 4 and 5 of the case study to answer parts (c) and (d) of this question.
- (a) (1 point) List and describe four behavioral biases that may inhibit an individual from making rational financial decisions.
 - (b) (1 point) List biases that are introduced when relying on committees, instead of individuals, to make decisions.
 - (c) (1 point) Identify examples in the case study reading where these biases may be present.
 - (d) (1 point) Assess the effectiveness of the Investment Committee and Risk Management Committee at Wonka Life.

Questions 1-3 pertain to the Case Study.
Each question should be answered independently.

- 2.** (11 points) You are the investment manager of Wonka Life Insurance Company employees' Defined Benefit (DB) Pension Plan. The financial position of the plan, as well as a summary of its risk profile, are given in the Memorandum to New CFO from Peter Fish (pages 40-41 of the Case Study).

The average age of the workforce, which is making regular contributions to the plan, is 49 years. The retired-lives represent 25% of the total number of plan membership.

At the last meeting of the Board of Trustees of the pension plan, a number of proposals were made by members of the Board:

- (a) One member has asked for a review of the risk objectives and risk tolerance of the plan, as well as its liquidity needs.
 - (i) (2 points) Identify and describe four factors that affect the risk objectives and risk tolerance of the employees' DB pension plan.
 - (ii) (1 point) Comment on the factors affecting the plan's liquidity requirements, and outline an investment strategy to meet any substantial liquidity requirements that may occur.
- (b) (2 points) A second member of the Board has suggested that in order to mitigate the volatility in its funding status, the pension plan should sell all of its holdings in Equity, Real Estate and Hedge Funds and invest the proceeds in longer maturity bonds so that the durations of the assets and liabilities match.

Describe the advantages and disadvantages of the above proposal.

*Questions 1-3 pertain to the Case Study.
Each question should be answered independently.*

2. Continued

- (c) A third member has suggested that there are ways of leaving the current asset allocation unchanged but still mitigate volatility in the funding status, by transforming the risk attributes using derivatives to hedge the duration mismatch.
- (i) (1.5 points) Calculate the impact to the economic surplus of the pension plan if current interest rates were to decrease instantaneously by 25 bps in a parallel shift of the yield curve on 12/31/10, using the risk profile information given on page 40 of the Case Study.
- (ii) (1.5 points) Calculate the amount of 10-year interest rate swap that would be needed to minimize the interest rate risk of the funded ratio (Asset / Liability), assuming that the duration for the available 10-year swaps is 7.2 years and that all assets other than fixed income have a duration of zero.
- (d) (1 point) A fourth member of the Board has commented that due to the long-term nature of the DB plan's liabilities, a substantial holding in equity type investments is necessary. However, in order to take advantage of higher returns in alternate equity investments, he has proposed that all of the current 30% in Domestic Public Equities should be switched to Domestic Private Equities.
- Describe the advantages and disadvantages of the above proposal for the pension plan.
- (e) Another member is worried about the effect of continuing improvement in mortality of the DB plan members. She has suggested that the trustees consider using mortality swaps, mortality futures or longevity bonds to help the plan mitigate the longevity risk.
- (i) (1 point) Compare the advantages and disadvantages of mortality swaps and mortality futures as instruments to manage the longevity risk.
- (ii) (1 point) Describe key considerations in the selection of a longevity bond.

Questions 1-3 pertain to the Case Study.
Each question should be answered independently.

- 3.** (10 points) Wonka Life is reviewing its Asset Liability Management Report for December, 2009. You are responsible for managing the ALM profile for Wonka's Traditional Life Products Portfolio.
- (a) (1 point) Estimate the market value of surplus for the Traditional Life Products Portfolio assuming the yield curve shifts downwards by 70 bps.
- (b) (1 point) Describe how the following interest rate derivatives can be used to manage Wonka's Traditional Life Products Portfolio risks.
- (i) Futures
 - (ii) Swaps
 - (iii) Options
- (c) (2 points) Compare the advantages and disadvantages of the derivatives in (b) to manage Wonka's Traditional Life Products Portfolio risks.
- (d) (2 points) The 2009 ALM Report reveals that the Traditional Life Products Portfolio is outside its tolerance for interest rate risk. To restore compliance with the suggested guidelines you decide to extend duration in this portfolio using Treasury bond futures.

T-Bond Futures	CTD Issue
Duration	7
Price	\$100,000
Conversion Factor	1.10

Assume the following:

- All yield betas = 1,
- The liability duration does not change as a result of the derivative overlay.

Determine the minimum T-Bond Futures trade to bring Wonka's Traditional Life Products Portfolio within the suggested dollar duration guideline.

**Questions 1-3 pertain to the Case Study.
Each question should be answered independently.**

3. Continued

- (e) (2 points) During a discussion on using interest futures and options to manage interest rate risk of Wonka's Traditional Life Products Portfolio your colleague, Walter, makes the following comments:

“A futures hedge is great for managing interest rate risk when I have no view of the market, but I like using options when I have good sense of where the bond market is going. For example, I usually execute a covered call strategy when I'm feeling bullish and a protective-put strategy when I am feeling bearish.”

Critique Walter's comments.

- (f) (2 points) Senior management has reservations about using duration hedging. A proposal has been submitted to replace duration hedging with duration/convexity hedging.
- (i) Describe the shortcomings of duration/convexity hedging.
- (ii) Recommend a hedging strategy that overcomes these shortcomings.

4. (5 points)

- (a) (0.5 points) List the key requirements for the fixed income portfolio performance attribution framework.
- (b) (1.5 points) Describe the components of fixed income portfolio total return as used by the factor attribution model.
- (c) (3 points) You are given the following information on a 30-year risk-free government bond:
- Face value of 1,000
 - Annual coupon of 5%
 - Market value at time 0 was 1,150
 - Market value at time 1 after coupon payment is 1,047
 - Modified duration of the bond at time 0 was 16.4
 - Convexity at time 0 was 385

You are also given the government par bond yield curve at time 0 and 1:

Maturity	Time 0	Time 1
1	2.95%	3.60%
2	3.02%	3.80%
3	3.06%	4.00%
5	3.20%	4.12%
7	3.44%	4.30%
10	3.53%	4.35%
15	3.78%	4.60%
20	4.02%	4.70%
29	4.12%	4.70%
30	4.13%	4.70%

Calculate

- (i) The total return over the period.
- (ii) The price return.
- (iii) All term structure components of the price return.

- 5.** (7 points) ABC Life splits a 5-year fixed-rate bond with a market value equal to par value of \$100 million, and a yield of 5.5% into a floater and an inverse floater with par value of \$80 million and \$20 million, respectively. The coupon rate for the floater will equal the 3-month LIBOR. The inverse floater has neither a cap rate nor a floor rate.
- (a) (1 point) Determine the coupon formula for the inverse floater.
 - (b) (2 points) Determine whether the duration of the inverse floater is higher or lower than that of the original fixed-rate bond and explain why.
 - (c) (2 points) Describe a situation where it would be appropriate to include an inverse floater in the asset portfolio to manage the interest rate risk of a fixed payout liability portfolio.
 - (d) (2 points) Your manager suggested using the “discount margin” method to evaluate a callable floater.
 - (i) Explain how “discount margin” method works.
 - (ii) Assess the manager’s suggestion.

- 6.** (8 points) The CFO of Company XYZ is reviewing the company's capital structure. He believes that the company's asset volatility has gone up and is now 100%. He is concerned that this may increase the company's default risk, and thus is thinking of paying down debt through new equity issuance.

Currently, XYZ has market value of assets of \$100 and market equity value of \$75. The only outstanding debts the company currently has are all short term loans, which are all due in one year with total payable amount of \$30. The expected return on assets is 25% and the prevailing risk free rate is 5%.

- (a) (2 points) Calculate the amount of debts that the company needs to repay to achieve the goal of lowering default probability to 2.5% using the Black-Scholes-Merton model and assuming that the default distance follows the normal distribution.
- (b) (4 points) Assume the debts in (a) have been repaid through successful new equity issuance.
- (i) Calculate the value of the remaining debt using the Black-Scholes-Merton model.
- (ii) Calculate the impact on the company's credit spread.
- (c) (2 points)
- (i) Criticize using the assumption that default distance follows normal distribution in the real world.
- (ii) Recommend an alternative approach.

7. (6 points) You are an actuary working for a life insurance company heavily invested in structured securities.

Your manager understands that prepayments are the primary distinguishing feature of Agency Mortgage Backed Securities, but does not know what factors will impact prepayment behavior.

- (a) (1.5 points) List and describe key factors that impact prepayment behavior.

He came across an article that discusses different prepayment conventions. He wants to learn more, and asks you to:

- (b) (1.5 points) Describe the following conventions:

- (i) Single Monthly Mortality
- (ii) Conditional Prepayment Rate
- (iii) Public Securities Association Model

- (c) (1.5 points) Compute the prepayment rate using above conventions, assuming:

- Scheduled Balance: \$150,000
- Actual Balance: \$148,000
- Age (months): 24

- (d) (1.5 points) Your manager told you that AAA rated CDOs are far riskier than AAA rated corporate bonds.

Explain the rationale behind his assertion.

- 8.** (5 points) You are working for Bauxite Bank. Your company's Chief Risk Officer (CRO), Carmen Santiago, is concerned with the bank's exposure to credit risk. She has assigned you to a working group that has been tasked with developing a Credit Risk Rating System (RRS) as well as solutions to help the bank mitigate its credit risk exposure.

The RRS will offer both obligor ratings and facility ratings. Carmen has come up with the following steps for the RRS that would assign obligor ratings:

- A financial assessment of the borrower
- Analyze the managerial capability of the borrower
- Examine the borrower's absolute and relative position within the industry
- Review the quality of the financial information
- Assess the country risk

- (a) (1 point) List additional steps that would expand this RRS to assign facility ratings.

Your working group is now considering the use of Total Return Swaps to mitigate the bank's credit risk.

- (b) (1.5 points) Describe the mechanics of how a generic Total Return Swap would work between your bank and a hedge fund.
- (c) (1 point) Compare and contrast a Total Return Swap to a Credit Default Swap.
- (d) (1.5 points) Carmen is considering a 3-year credit default swap for Bauxite Bank's largest outstanding loan. The notional value of the CDS is \$75M and the fixed swap fee is 40bps annually (payable at the beginning of each year). Cash settlement has been specified. In a projection, no default event occurs in years 1 and 2, but a default event occurs at the end of year 3 causing the loan's price to fall to \$30 per \$100 of face value.

Calculate the net amount Bauxite Bank would pay/receive under the CDS in each of the first 3 years of the projection.

9. (4 points)

- (a) (1.5 points) List and describe the duties of a trustee as they relate to tax-favored retirement plans.
- (b) (0.5 points) Explain the difference in the prudent investor standard between ordinary trusts and retirement plan trusts.
- (c) (2 points) For a defined-contribution retirement plan with self-directed accounts, the following investment choices are available to plan participants:
- Foreign Stock Fund
 - Short-term Government Bond Fund
 - Gold Mining Sector Equity Fund
 - Commercial Real-Estate Investment Trust
 - Company Stock of Employer
- (i) Assess the appropriateness of the offerings and recommend any changes.
- (ii) Compare the legal liability of the trustee and plan participants as it relates to investment selection and performance.

****END OF EXAMINATION****
Morning Session

USE THIS PAGE FOR YOUR SCRATCH WORK