
SOCIETY OF ACTUARIES
Advanced Portfolio Management

Exam APM

MORNING SESSION

Date: Friday, April 27, 2012

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 8 questions numbered 1 through 8.
 - b) The afternoon session consists of 9 questions numbered 9 through 17.

The points for each question are indicated at the beginning of the question. Questions 1 - 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.** (8 points) Peter Fish believes that a 30-year zero-coupon bond issued by company XYZ is underpriced relative to bonds from other companies with equivalent risk profile. Based on his research, it has been underpriced by the market for a long time. He recommends taking advantage of this opportunity and asks you to develop an arbitrage strategy.
- (a) (1 point) Describe an arbitrage strategy that attempts to profit from this opportunity in the short term.
 - (b) (2 points) Identify and explain theoretical and practical limitations to this arbitrage strategy.
 - (c) (2 points) Explain the behavioral biases that may influence Peter's recommendation.
 - (d) (2 points) Give a rationale why the Investment Committee might accept and a rationale why they might reject his recommendation if:
 - (i) Peter's compensation is dependent on the projected long term performance of the company.
 - (ii) Peter's long term track record shows below market gains, but his short term track record shows above market gains.
 - (e) (1 point) Critique whether this arbitrage strategy would be appropriate for Wonka's Guaranteed Investment Contract product line.

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

- 2.** (8 points) At Wonka Life, the objective of the employees' pension plan is to maximize the asset return and minimize cash contributions over the long-term. You are an investment actuary and have been asked by the new CFO to assess a liability-relative asset allocation policy.
- (a) (1.5 points) List and describe your role and responsibilities as an investment actuary.
 - (b) (1.5 points) Justify the role of equities in the pension plan.
 - (c) (2 points)
 - (i) Compute the expected liability-relative return on surplus.
 - (ii) Compute the expected asset return and estimate the asset duration required for a Minimum-Surplus-Variance (MSV) portfolio.
 - (d) (1 point) Recommend how you will change the current asset portfolio to minimize surplus variance.

The CFO realized that the asset-only frontier and surplus efficient frontier were very close and challenged the importance of making the distinction.

- (e) (2 points) Explain why you might make investment decisions based on the surplus efficient frontier.

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

- 3.** (7 points) The CFO of Wonka Life has asked you to use the liquidity management framework proposed by Hugh Dodo to calculate the company's liquidity ratio for 12/31/2010.
- (a) (2 points) Calculate the Liquidity Ratio under both the Normal and Panic Scenarios.
 - (b) (1 point) Identify three shortcomings of the liquidity measurement framework mentioned above.
 - (c) (1 point) List key qualitative questions to address when assessing liquidity risk.
 - (d) (1 point) List the steps necessary to forecast the quantity of stand-by liquidity available in a given scenario.

The Chief Investment Officer suggests moving the entire cash position to asset-backed commercial paper to increase the portfolio earned rate. He adds that this move would not affect Wonka's liquidity ratios as measured by Byrd.

- (e) (1 point) Describe the risks involved with asset-backed commercial paper.
- (f) (1 point) Critique the CIO's suggestion.

- 4.** (11 points) Your company, an insurer, issues health insurance in a foreign market. Premiums and benefit payments are made in the foreign currency.
- (a) (1 point) Explain the foreign exchange (FX) risk exposures your company may have from this business.
- (b) (1 point) Explain why your company might want to manage its FX exposure.

The chief actuary is concerned about the potential loss from this business compounding with foreign exchange risk. You are given the following information (all units expressed over a 1-year time horizon):

$S_{F/U}$ = spot exchange rate = 1.2 (foreign currency units per home currency unit)

$E[i_F]$ = expected foreign inflation rate = 4%

$E[i_H]$ = expected home country inflation rate = 2%

r_F = foreign country risk-free interest rate = 5%

r_H = home country risk-free interest rate = 2%

- (c) (2 points) Explain the theoretical basis, and calculate the implied 1-year forward foreign exchange rate for each of the following assumptions:
- (i) Full interest rate parity
- (ii) Full purchasing power parity
- (d) (1 point) Identify and describe three different instruments that your company could use to hedge FX risk.

4. Continued

For the purpose of calculating solvency capital, your company uses the following correlation matrix to aggregate different marginal loss distributions:

	FX	Morbidity
FX	1	0.05
Morbidity	0.05	1

The Chief Actuary suggests using the above matrix to set the pricing for this line of business.

- (e) (2 points) Assess the Chief Actuary's suggestion.
- (f) (3 points) Contrast alternative approaches to the approach in (e) for aggregating FX and morbidity risks, identifying advantages and disadvantages.
- (g) (1 point) Identify the possible challenges you may face when validating the suggested risk aggregation method.

5. (10 points) You are managing a \$500 million endowment for Coruscant University and are considering a strategic allocation to direct equity real estate.

(a) (1 point) Identify issues with direct equity real estate investing from the perspective of the university's endowment.

The overall investment objective for the university endowment is to preserve the inflation-adjusted value of the assets after spending. To prepare for a presentation to the university's board of trustees, you review the following information:

- The endowment's spending rate has been 4% of the 12-month average assets
- Risk-free interest rate: 3.0%
- Forecasted inflation rate in the next year is 1.5%

An initial analysis of two different proposals with strategic allocations to direct real estate yields the following forecasts:

	Proposal 1	Proposal 2
Expected Return	5.40%	5.70%
Standard Deviation of Return	9.50%	11.50%

(b) (1.5 points) Recommend Proposal 1 or Proposal 2 for the endowment and justify your recommendation.

During the meeting with the board, one of the trustees makes the following statement:

“We should not be considering direct real estate. If we want exposure to real estate we should invest in REITs, which usually provide risk diversification comparable to direct real estate while offering substantially more liquidity.”

- (c) (1 point) Compare the features of direct property markets and REIT public markets.
- (d) (1.5 points) Explain with which part of the trustee's statement you would agree or disagree.

5. Continued

To improve your understanding of the fundamental value of real estate your team is developing an econometric model that could be used to predict future real estate capitalization rates. Having reviewed existing literature on the determinants of real estate capitalization rates, your colleague presents the following draft model for discussion:

$$\begin{aligned} \text{Log}(C_{j,t}) = & a_0 + a_1 \log(C_{j,t-1}) + a_2 \log(C_{j,t-4}) + a_3 \log(RRI_{j,t}) + a_4 RTB_t \\ & + a_5 Q2_t + a_6 Q3_t + a_7 Q4_t + a_8 D_j \end{aligned}$$

The variables are defined as follows:

Variable	Description
j	Metropolitan Statistical Area (MSA)
t	Time (quarters)
$C_{j,t}$	Capitalization Rate Calculated from net operating income and asset values.
$RRI_{j,t}$	Real Rent Index Calculated as a ratio of real rent data for a given MSA in a given quarter to the historical average of real rent for this MSA
RTB_t	Real T-bond yields Calculated as nominal yield – inflation rate
$Q2_t, Q3_t, Q4_t$	Seasonal dummies to remove seasonality
D_j	Fixed market-level effects associated with each MSA

Your colleague also shares the following estimation results after running historical data through the model:

Independent Variable	Coefficient	t-statistic
Constant	0.40	8.0
$\log(C_{j,t-1})$	0.60	23.0
$\log(C_{j,t-4})$	0.20	7.0
$\log(RRI_{j,t})$	-0.05	-3.0
RTB_t	-0.01	-4.0

- (e) (2 points) Explain whether it is reasonable to have negative coefficients for the $\log(RRI_{j,t})$ and RTB_t variables.

Question 5 is continued on the next page

5. Continued

- (f) *(1 point)* Identify one additional variable that could enhance the success of the model in explaining capitalization rates.

After finalizing the model you start using it to predict future capitalization rates and real estate prices. However, in comparing the prediction for this month with actual prices, you found that the actual prices were much higher than predicted. In addition, the difference cannot be explained by the model.

- (g) *(2 points)* Describe, using behavioral finance theory, two explanations for this observation.

6. (6 points) You are considering investing in one of two inflation-linked securities:

- (i) A U.S. Treasury inflation-protected security (TIPS), which pays an annual coupon of 2%.
- (ii) An inflation-floater, which pays annual coupons at a rate of 2% plus the percentage change in the same consumer price index (CPI) that is used to adjust TIPS principal. The floater has a minimum coupon rate of 0.

Inflation-protected security (TIPS)		Inflation-floater security	
Principal	\$10,000	Principal	\$10,000
Coupon rate	2.00%	Spread	2.00%
Maturity (years)	2	Maturity (years)	2

- (a) (1 point) List three factors that affect a floater's price.
- (b) (1.5 points) Consider an inflationary environment where the CPI is constant at three percent (3%) in the year prior to issuance as well as during the holding period. Show the annual cash flows of each of the two inflation-linked securities.
- (c) (1.5 points) Consider a deflationary environment where the CPI is constant at negative three percent (-3%) in the year prior to issuance as well as during the holding period. Show the annual cash flows of each of the two inflation-linked securities.
- (d) (2 points) Design a two-year inflation scenario in which the sum of the cash flows for the inflation-floater security would be larger than that for the TIPS.

7. (4 points) Your company has recently issued a 30-month zero coupon GIC with a 3.5% annual effective crediting rate and a maturity value of \$10,000,000.

(a) (2 points) Describe the advantages and disadvantages of the following potential investment strategies for assets backing this GIC.

(i) Zero coupon government bond with maturity in 30 months and 3.00% annual effective rate

(ii) 3-year BB-rated corporate bond with 5.8% yield to maturity

Consider a portfolio with the following characteristics:

Bond	Type	Par amount	Market Value	Coupon rate	Maturity	Modified Duration
A	Fixed rate, semi-annual coupon	5,200,000	5,282,000	3.5%	3 year	2.8
B	Fixed rate, semi-annual coupon	4,200,000	4,257,000	3.0%	2 year	1.9

You are given the following discount factors for liability valuation.

Time in years	0.5	1	1.5	2.0	2.5	3.0
Discount Factor	0.995	0.985	0.975	0.955	0.935	0.915

A co-worker has verified your calculation that the dispersion of the portfolio is 0.35 and that the present values of the cashflows of the bonds using the discount factors are equal to their market values.

(b) (2 points) Demonstrate that this portfolio meets the requirements for single period immunization for the recently issued GIC.

8. (6 points) Mr. Krang was an investment manager for a large asset management firm. He was responsible for managing an equity Portfolio Q. Due to an unexpected client withdrawal, \$600,000 had to be taken out of portfolio Q on June 1. Portfolio Q had the following end-of-month values:

Month-end	Portfolio Value
April	1,000,000
May	900,000
June	400,000

- (a) (1.5 points) Calculate the monthly time-weighted return and the money-weighted return for portfolio Q. Explain why the two returns are not the same.
- (b) (1 point) Recommend either the time-weighted or money-weighted return calculation methodology for the purpose of assessing Mr Krang's performance. Justify your recommendation.
- (c) (1 point) Several years have passed and Mr. Krang has been replaced with a new investment manager, Ms. Bijou. In the first year of managing portfolio Q, Ms. Bijou achieved a return of 20%. In the second year, the portfolio's return was -5%.

Explain why the performance of Ms. Bijou cannot be evaluated based on these return figures alone.

- (d) (1.5 points) Ms. Bijou suggests that the current custom security based benchmarks for individual managers be replaced. She suggests using the median return of all portfolio managers at the firm as the benchmark because it differentiates strong investment managers from weak ones.

Recommend whether the median-based benchmark or the current custom-security based benchmark should be used for individual managers. Justify your answer.

- (e) (1 point) Ms. Bijou has started adding derivatives to her portfolio.

Assess whether it is appropriate to continue using the same benchmark.

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

USE THIS PAGE FOR YOUR SCRATCH WORK