APM Model Solutions
Fall 2012

1. Learning Objectives:

6. The candidate will understand the specific considerations relative to managing a fixed income portfolio within an asset allocation framework.

Learning Outcomes:

(6f) Demonstrate how to apply funding and portfolio management strategies to control interest rate and credit risk, including key rate risks.

Sources:

Fabozzi, HFIS, Chapter 48

Commentary on Question:

This question tests basic understanding of dedicated bond portfolio strategies and asks candidates to identify and analyze information that would enable one to affirm or reject a hypothesis that a dedicated bond portfolio strategy is in use.

The question also asks candidates to solve a business problem for Wonka Life to bring the Traditional Life and Non-Traditional Life lines within Asset Liability Matching Guidelines.

Well prepared candidates would be expected to understand key principles of dedicated bond portfolios and be familiar with the case study to quickly identify data to support their conclusions regarding whether the accumulation annuity portfolio gives evidence of utilizing a dedicated bond portfolio strategy. They also should be familiar with how to use derivatives to solve Asset Liability Management problems

Solution:

(a) Describe how a dedicated bond portfolio strategy achieves its objectives.

Commentary on Question:

Most candidates were able to identify that a dedicated bond portfolio matches assets flows with liability cash flows. Fewer candidates identified that this also eliminates interest rate risk.

A dedicated bond portfolio matches monthly cash flows from a portfolio of bonds to a pre-specified set of monthly cash requirements of liabilities. This eliminates interest rate risk.

1. Continued

(b) Critique Tom Lyon's comments and describe what data you reviewed in forming your response.

Commentary on Question:
Most students correctly identified either the accumulation annuity's cumulative net cash flow or partial duration analysis as supporting evidence that the portfolio is not a dedicated portfolio.

Only a limited number of students identified that accumulation annuity cash flows are not fixed, violating a requirement for matching with a dedicated bond portfolio.

In general, accumulation annuity cash flows are not fixed; with policyholder options the monthly cash flows cannot be specified. So they are unable to match with cash flows from assets.
Can see there is not a dedicated portfolio from two different sources:
From accumulation annuity partial duration sensitivity analysis: At the 10 year, 15 year, 20 year and 25 year points there is meaningful sensitivity to changes in interest rates. This would not exist if assets and liabilities are cash flow matched.

From the accumulation annuity cumulative net cash flow chart, there is significant asset build-up starting in 2031 and continuing into 2041. This would not occur if the cash flows were matched.

(c) Determine the minimum and maximum amounts of 20-year swap notional that the lines can trade so that both lines are within dollar duration guidelines.

Commentary on Question:
Students who did not perform well on this section failed to set up the appropriate formulas to solve.

Minimum and maximum amounts based on each line's actual exposure and the minimum amounts to bring the non-traditional line within tolerance and the maximum amount the traditional line can afford to take on.

Minimum amount:
Based on how much dollar duration exposure Non-Traditional line needs to be reduced by.
$2,235,000,000 (actual) – $400,000,000 (target) = $1,835,000,000
$1,835,000,000 dollar-duration / 13.7 duration = $133,941,000 Notional (ok to round to ~$134 million notional)

1. Continued

Maximum amount:
Based on how much dollar duration exposure Traditional Life line can afford to be increased by.
$1,710,000,000 (actual) – (-$300,000,000) (cap) = $2,010,000,000
$2,010,000,000 dollar-duration / 13.7 duration = $146,715,330 Notional (ok to round to ~$147 million notional)

2. Learning Objectives:

4. The candidate will understand and apply quantitative techniques for portfolio management.

8. The candidate will understand the behavior characteristics of individual and firms and be able to identify and apply concepts of behavioral finance.

Learning Outcomes:

(4f) Describe, contrast and assess techniques for risk aggregation and diversification.

(8a) Explain how behavioral characteristics of individuals or firms affect the investment or capital management process.

Sources:

Specialty Guide to Economic Capital

Developments in Modeling Risk Aggregation – Basel October 2010

Commentary on Question:

Candidates must understand the difference between regulatory, economic capital and a company's target capital. They must also understand how the value of these different capital measures can affect the investment policy and understand the pros/cons of various methods to determine economic capital.

Solution:

(a) Explain how a realistic economic capital framework can be used to determine risk tolerance and constraints.

- Economic capital represents the sufficient surplus to cover adverse outcomes at a given level of risk tolerance at a specified time horizon
- Monitor economic capital to impose tolerances and constraints on risks
- An especially useful way to limit risk when the economic capital calculation process is responsive to actual variations in risk levels, rather than just to business volumes
- A specific percentile (e.g. VaR) and conditional tail expectation (CTE) are common methods used to set the risk tolerance levels

(b) Critique Wonka's aggregation approach for economic capital.

Commentary on Question:

Candidates must explain the sources of input and the pros/cons of results of this approach.

- Var-Covar imposes a simple and linear dependency structure on what is believed to be a more complex web of dependencies.

2. Continued

- Linear correlations provide a poor method for capturing tail dependence between risk exposures.
- Historically computed correlation estimates are typically driven by observations during normal times.
- Almost all empirical dependencies are not readily reduced to a single number for each distinct pair of variables.
- Var-Covar also faces difficulty in dealing with circumstances in which standalone risks are not actually exclusive but are believed to be integrated (e.g. market and credit risk).

(c) Recommend an alternative aggregation approach and discuss its strengths and weaknesses.

1. Copula

Strengths:

- Allow the practitioner to precisely specify the independencies in the areas of the loss distributions that are crucial in determining the level of risk.
- Allow direct control over distributional and dependency assumptions used. The copula-based methods use entire loss distributions as inputs to the aggregation process (as opposed to single statistics or risk measures).
- Copulas are usually easy to implement from a computational standpoint.

Weaknesses:

- Most of the copula methods are analytically complex and do not lead themselves to implementation with closed-form formulas. The specification of a copula is very abstract and difficult to interpret for non-experts.
- Fitting the parameters of a copula is a difficult statistical problem. The estimators used are often complex and not always robust.
- Aggregating group-wide across the different risk types would require different copulas. This requires a high level of expertise to implement copulas and the users of the output have to be sufficiently versed in the technical aspects of the copula approach.

2. Scenario-based

Strengths:

- Scenario-based aggregation provides a consistent approach to aggregation, as risk exposures are reflected and aggregated to a common scenario for an entire portfolio, different business activities or throughout the firm.
- Forcing the firm to undertake a deeper understanding of its risk from a more fundamental point of view, as it aggregates the risks at their source, that is in the form of risk drivers.
- The results can usually be interpreted in a much more meaningful economic and financial sense than can arbitrary quantities of distributions.

2. Continued

Weaknesses:

- Judgment and expertise are key to identifying risk drivers and deriving meaningful sets of scenarios with relevant statistical properties.
- Determining risk exposures that correspond to the events in scenario requires significant care and effort.
- Fitting the risk drivers into risk models to estimate full loss distributions and calibrating these risk models often proves to be a huge challenge.

(d) Explain why economic capital is preferred over regulatory capital in determining target capital.

- Economic capital reflects the underlying economics of the business as opposed to political and rating agency conservatism.
- Regulatory capital may actually not allow for some of the risk a company faces.
- Regulatory capital requirements are generally targeted using simplified methods at levels appropriate for the aggregate industry and cannot reflect the nature of the company's risks to the degree to which can be achieved through a customized internal model.
- Regulatory capital requirements are motivated fundamentally by solvency concerns, but the motives behind calculating economic capital concern "appropriate" allocation of capital to the risks undertaken by company.

(e) Explain why economic capital might be less than the current target capital for Wonka.

- The regulatory capital are often based on conservative assumptions and simplified modeling and aggregation methods.
- Regulatory capital assumptions do not truly reflect the risk profile of the company.
- Regulatory capital may cover risks that are considered to be material in the industry.
- Economic capital may not cover risks that are not material to Wonka.

(f) Evaluate how the lower minimum level of target capital based on an economic capital approach might affect the investment strategy, given the current level of actual capital held by Wonka.

- Lower minimum level of target capital = higher level of free surplus.
- Wonka could raise the risk limit in the investment policy.
- This allows a more aggressive investment policy (for instance, adjusting the asset allocation and investing in more risky securities - e.g. equities) to achieve a higher portfolio return.

3. Learning Objectives:

1. Candidate will understand and be able to follow the investment management process for insurance companies, pension funds and other financial intermediaries.

4. The candidate will understand and apply quantitative techniques for portfolio management.

Learning Outcomes:
(4e) Describe, contrast and assess techniques to measure liquidity risk.

Sources:
Chapter 3 Managing Institutional Investor Portfolios, pg. 107

Liquidity Risk Measurement, CIA Educational Note

Liquidity Risk, Measurement, and Management: A Practitioner's Guide to Global Best Practices, Matz and Neu, Wiley Finance 2007, Chapter 2 Liquidity Risk Measurement

Commentary on Question:
Commentary listed underneath each question component.

Solution:
(a) Describe the potential sources of liquidity risks for Wonka's UL business line.

Commentary on Question:
Candidates must consider both the product features and the investments that back the product.

- The UL product has uncertain cashflows to be paid at the time of surrender.
- Cash value of the policy is independent of current interest rates.
- If interest rates increase significantly, the crediting rate may not be able to compete and the policyholder may seek to move the money elsewhere despite the surrender charge (Disintermediation risk).
- Private placement and real estate are particularly illiquid assets (Asset marketability risk).
- Even investment grade corporate bonds can become relatively illiquid (compared to Treasuries) in times of market distress.
- Company may need to sell its assets at a loss in the event of rising interest rate environment.

(b) Critique Wonka's proposed liquidity management approach of calculating the liquidity ratio under a normal and panic scenario.

Commentary on Question:
Candidates needed to identify what is missing by using this approach.

3. Continued

- Wonka only considers one stress scenario to understand their liquidity needs: may not be sufficient to capture the range of disintermediation risks on both the asset and liability side.
- Quarterly review may not be frequent enough in a volatile interest rate environment.
- Wonka should also review its liability duration.
- The time horizon of each asset/liability item is ignored.
- This process is impacted by accounting rules (e.g. MV/BV) which do not actually affect the company's liquidity position.
- Any off balance sheet exposures are not factored in.
- The marketability of assets is not considered.

(c) Explain how the following approaches might be used to measure liquidity risk for the UL business line:

Commentary on Question:
Candidate should describe briefly how each approach is applied.

(i) Historical based (VaR/CTE/Extreme Value)

- Sample historical economic environments for interest rates, investment returns, and policyholder behaviors to develop assumptions to be applied to the current block of business and asset portfolio
- Summarize results using a tail measure (Var/CTE/Extreme value)

(ii) Deterministic scenario testing

- Develop assumptions for a number of realistic baseline and stress scenarios
- Assumptions include economic environment/interest rates, competitor rates, policyholder withdrawals and premium payments
- Explicitly model the causes and reactions specific to the individual situation
- This can highlight what can go wrong, how badly, and for how long.
- Can incorporate responses and means to reduce any hypothetical problems
- Results can be summarized in a single metric if needed.

3. Continued

(iii) Stochastic scenario testing

- Similar to deterministic scenario testing
- Develop distributions for assumptions (interest rate, policyholder behavior)
- Develop rules for the reactions and possible responses
- Results can be summarized in a single metric if needed

(d) List five qualitative considerations in determining the UL business line's exposure to a liquidity shortfall.

Commentary on Question:
Candidates were expected to identify what impacts the exposure as well as what determines it.

External circumstances:
- State of economy and expectations of interest rates
- Likely rating changes to country/state
- Consumer confidence in industry (or market/analyst confidence)
- Consumer confidence in company (or market/analyst confidence)

Internal circumstances:
- How tight is the cash management process
- Predictability of business mix and cash flows
- Availability of additional liquidity in worst case scenario
- Strength of company's balance sheet, image
- Loyalty of distribution and customers
- Do products include protection features such as waiting periods, surrender charges and market value adjustments
- Whether these features are enforced

(e) Explain the advantages and disadvantages of using hypothetical assumptions in stress testing.

Advantages
- Can draw from historical data without needing to duplicate assumptions
- Highly customized

Disadvantages
- Is subjective, does not tell you the probability, only severity

3. Continued

(f) Recommend a liquidity measurement approach and explain why you think it best addresses the risks in the UL business line.

Commentary on Question:
Candidates were expected to present their somewhat subjective point of view and any reasonable answer was given credit.

The approach recommended should consider the following in measuring liquidity risk:

Captures

- Liquidity risk is highly inter-related to other risks, driven by other risks
- Low frequency, high severity
- Causes and reactions highly specific to individual situation of product/institution.

Ideally the method should also be able to:

- Highlight what can go wrong, how badly, and for how long
- Identify and implement the means to reduce impact of hypothetical funding problems, be ready ahead of time
- Practical considerations to the measurement process, such as the data availability, ease of communication, should also receive credit.

4. Learning Objectives:

4. The candidate will understand and apply quantitative techniques for portfolio management.

Learning Outcomes:

(4c) Describe, contrast and assess techniques to measure interest rate risk.

(4d) Describe, contrast and assess techniques to measure foreign exchange risk.

Sources:

V-C181-10: Dynamic Credit Models and Credit Derivatives

V-C183-10: Bond-CDS Basis handbook

V-C204-12: Foreign Exchange Rate Risk: Institutional Issues and Stochastic Modeling, by R Gorvett

Commentary on Question:

The purpose of this question is to test whether the candidate can cite the sources of embedded options offered in insurance products and can identify ALM as a way to measure and manage these risks.

Solution:

(a) Compute the credited rate for the separate account GIC for the past year.

Credited rate= Market yield of separate account − Administration fee

+ (MV separate account- BV separate account) / ($Duration of separate account)

Market Yield = 98 / 100 − 1= -2%

$Duration of assets = MV * duration =100*10

Zero-coupon bond $Duration =10

Credited rate = -2% − .5 %+(98-103) / 1000

= -0.03

(b) Describe the embedded option in the 80% of book value guarantee.

Embedded Option

- Put option on bond future
- Put option on credit default
- Put option on EURUSD exchange rate

(c) Identify possible market scenarios where the 80% of book value guarantee would be in-the-money.

4. Continued

Scenarios
1. Rising interest rate
2. Rising default spread
3. Defaults
4. Weakening Euro
5. Combination of above

(d) Recommend a strategy to hedge the embedded option considering that scenarios assumed in (c) could reverse.

Hedging of interest rate risk
- Hedging should pay off when the interest rate rises significantly
- Cap, Long Receive Float Swaption, etc

Hedging of credit risk
- Hedging should pay off when the credit spread widen or default help
- Option on CDS

Hedging on FX risk
- Option payoff when Euro is weaker
- FX Option EURUSD put? Or USDEUR call
- 80% of book value guarantee means that it is an OTM strike option
- Correlated risk means over-hedging if we fully hedge individual risk

Maturity
- 10 year maturity option may not track the loss due to the time value of the money
- Laddered option position will over-hedge if the market subsequently recovers
- Dynamic hedging can be used which includes both long and short position of options

(e) Analyze the weakness(es) associated with the crediting strategy and propose a way to improve the crediting formula.

Candidate should address:
1. Double counting of market yields in (MV-BV) / $Duration
2. (MV-BV) difference amortization
3. Divided by $Duration which is getting shorten each year
4. When rates decrease, the crediting rate is higher than bond market value gain
5. When rates increase, the penalty is applied twice
6. Any reasonable recommendation would receive credit

5. Learning Objectives:

5. The candidate will understand the specific considerations relative to managing an equity and/or alternative asset portfolio within an asset allocation framework.

7. The candidate will understand the purposes and methods of portfolio performance measurement.

Learning Outcomes:

(5b) Assess a portfolio position against portfolio management objectives using qualitative and quantitative techniques.

(7c) Recommend a benchmark for a given portfolio or portfolio management style.

Sources:

Marginn & Tuttle, Chapter 7 and 12

VC-169-09

Commentary on Question:

This is a recall, calculation, and synthesis question testing candidates' understanding of equity index construction methodology.

Solution:

(a) Define the following index weighting methods:

(i) Price-Weighted index

(ii) Value-Weighted index

(iii) Float-Weighted index

(iv) Equal-Weighted index

Price-Weighted Index

- The price-weighted index is calculated by adding the share prices of that date and dividing by the number of stocks in the index.
- Each stock in the index is weighted according to its absolute share price.
- It represents the performance of a portfolio that simply brought and held one share of each index component.

Value-Weighted Index

- The value-weighted index is calculated by multiplying the share price by the number of shares outstanding to arrive at each company market value, then summing these values to create an index.
- Each stock in the index is weighted according to its market cap.

5. Continued

- It represents the performance of a portfolio that owns all the outstanding shares of each index component.

Float-Weighted Index

- The float-weighted index is calculated in the same way as the value-weighted index except that each company's market value is adjusted by its free-float factor, which represents the fraction of shares outstanding and available to investors.
- It represents the performance of a portfolio that buys and holds all the shares of each index component that are available to the general public.

Equal-Weighted Index

- The equal-weighted index assumes an equal investment in each of the (3) stocks. The performance would be the average performance of the (3) stocks over the time period.
- It represents the performance of a portfolio in which the same amount of money is invested in the shares of each index component.

(b) Calculate the index return for the 3 stocks under each method.

Price-Weighted Index

- Average of share price Dec. 31, 2011 = (381.32 + 51.83 + 2.96) / 3 =145.37
- Average of share price Dec. 31, 2010 = (322.56 + 55.31 + 7.79) / 3 =128.55
- Index return = 145.37 / 128.55 -1 = 13.1%.

Value-Weighted Index

- Market Value Dec. 31, 2011 = 369,454
- Market Value Dec. 31, 2010 = 317,609
- Index return = 369,454 / 317,609 – 1 = 16.3%.

Float-Weighted Index

- Market value Dec. 31, 2011, adjusted by free-float factor
  = [353,483 x 1.0 + 14,979 x 0.6 + 992 x 0.8] = 363,264
- Market value Dec. 31, 2010, adjusted by free-float factor
  = [299,013 x 1.0 + 15,985 x 0.6 + 2,611 x 0.8] = 310,063
- Index return = 363,264 / 310,063 – 1 = 16.9%.

5. Continued

Equal-Weighted Index

- Determine the percent change of each stock:
  [Share price 12/31/11 divided by Share price 12/31/10] - 1
  - Apple: (381.32 / 322.56 -1) = 18.2%
  - Orange: (51.83 / 55.31 -1) = -6.3%
  - Banana: (2.96 / 7.79 -1) = -62.0%
- Index return = (18.2% - 6.3% - 62.0%) / 3 = -16.7%.

(c) Recommend the appropriate benchmark index weighting method based on the client's investment objective.

- Based on the client's investment objective to overweight small cap stocks, the recommended benchmark is a float-weighted index of the three shares. This benchmark, which reflects the shares actually available to the general public, is generally regarded as the gold standard in indexing.
- Alternatively, an equal-weighted methodology, which introduces a small company bias, could be recommended to the client.
- Price-weighted and Value-weighted indices lead to a number of biases that do not meet the client's investment objective.
  - Price-weighted index - bias towards the highest priced share.
  - Value-weighted index - bias towards shares of companies with the largest market capitalization.

(d) Describe the advantages and disadvantages of using an investment style index as a benchmark.

Advantages of using an investment style index as a benchmark:

- Well known and readily available
- Easily understood and measurable
- Specified in advance
- Can express client objectives clearly

Disadvantages of using an investment style index as a benchmark:

- May contain weightings in certain securities that are larger than what many managers consider prudent
- Selected investment style may not line up with what the manager is actually doing
- Different definitions of investment style can produce extreme return differentials

5. Continued

- Need careful examination of index construction and their applicability

(e) Explain possible reasons for the deficiency in returns.

Possible reasons why DCM returns on investments may be lower than the rest of its competitors include:

- The use of inappropriate benchmarks to measure investment managers performance.
- Competitors may be using inappropriate benchmarks, thereby inflating their performance.
- Competitors may be investing in market sectors with more return, or asset classes with more risk.
- Competitors may be more comfortable taking asset risks that our company is not comfortable taking.
- Competitors may have different objectives and/or liabilities, such that the liabilities may be of different duration and behavior as well.

6. Learning Objectives:

5. The candidate will understand the specific considerations relative to managing an equity and/or alternative asset portfolio within an asset allocation framework.

Learning Outcomes:

(5d) Recommend an investment strategy for a given situation:

- Portfolio policy and objectives
- Asset selection criteria
- Capital market expectations
- Risk management strategy
- Portfolio rebalancing strategy

Sources:

V-C164-09

Maginn & Tuttle, Chapter 6

Commentary on Question:

This question is testing the candidates' understanding of the concept of tracking risk and several styles of fixed income portfolio management. The candidates performed relatively well on this question.

Solution:

(a) Define tracking risk and interpret the meaning of the above target.

The target tracking risk of 55 bps means that at least 2/3 of time periods the return of the fund is within plus or minus 55 bps of the return on the benchmark.

(b) Recommend ways to achieve a lower tracking risk.

One can minimize the mismatch in:

1. Portfolio duration
2. Key rate duration and present value of cash flows
3. Sector and quality percent
4. Sector and quality duration
5. Issuer exposure

(c) Calculate the missing statistics in the table above.

Mean Outperformance

n is the number of available choices

r(i) represents the outperformance of the strategy when choosing option i

p(i) represents the probability of choosing option i

6. Continued

$$\bar{r} = \sum_{i=1}^{n} p_i r_i$$

Duration Strategy

- In 40% of all cases, William will make the correct duration call 100% of the time.
- In the other 60% of cases, he will make the correct duration call 50% of the time, since there are only two choices (go long or go short), so he will have 1/2 chance of success by pure guessing.
- Overall, his odds of making the right call are 0.4 *.1.0 + 0.6 * 0.5 = 70%.
- He will expect to outperform the benchmark 70% of time time by 30 bps and underperform the rest of time time by 20 bps.
- His expected value added is 0.7 * .0030 + 0.3 * (-.0020) = .15% or 15 bps.

Sector Strategy

- William can choose the best sector 10% of the time, and have 1/4 chance of choosing each best sector 90% the rest of the time.
- His probability of choosing the best sector is 10% * 100% + 90% * 25% = 32.5%.
- He is equally likely to choose each of the other three sectors with probabilities of 22.5% each.
- His expected value added is .325 * .0100 + .225 * (.0010 – .0025 – 0.0030) = 22 bps.

Calculate Tracking Error for Each Active Strategy

Tracking error is the standard deviation of the difference between the actual return and the benchmark.

All symbol definitions are same as above.

$$\sigma = \sqrt{\sum_{i=1}^{n} p_i (r_i - \bar{r})^2}$$

Quality Strategy

Variance = 0.6 * $(.01)^2$ + 0.4 * $(-.015)^2$ = 0.00006 + 0.00009 = 0.00015

Tracking error = Sqrt(Variance) = .01225 = 122 bps

6. Continued

(d) Calculate the information ratio for each active strategy.

Information ratio is obtained by dividing the mean outperformance by the tracking error.

$$IR = \frac{\bar{r}}{\sigma}$$

Duration Strategy
IR = 0.15% / 0.23% = 0.65
Sector Strategy
IR = 0.22% / 0.56% = 0.39
Quality Strategy
IR = 0 / 0.0122 = 0

(e) Recommend the strategy that William Write should pursue based on the above analysis.

Duration strategy's information ratio surpasses the other two, leading to the conclusion that William has the most skill in that strategy.
However, on the absolute level, sector selection strategy offers a higher mean outperformance versus the benchmark while only slightly exceeding the fund's target tracking error.

7. Learning Objectives:

2. The candidate will understand the variety of financial instruments available to managed portfolios.

4. The candidate will understand and apply quantitative techniques for portfolio management.

Learning Outcomes:

(2a) Compare and select specialized financial instruments that can be used in the construction of an asset portfolio supporting financial institutions and pension plan liabilities.

(4c) Describe, contrast and assess techniques to measure interest rate risk.

Sources:

Fabozzi, Handbook of Fixed Income Securities, 7th Edition, 2005

Default Risk and the Effective Duration of Bonds

Ineffective Duration Measures for Life Insurers

Commentary on Question:

The purpose of this question is to test whether the candidate can describe various bond features and sources of basis risk between bonds. This is tested via recall type questions as well as computational questions requiring the use of a basis risk adjustment factor to calculate the effective duration of surplus. Basic calculations using effective durations are also tested.

Solution:

(a) Explain how bonds with sinking fund provisions work.

The sinking fund features require the issuer to liquidate all or portion of their bond issues periodically before maturity. Usually, the sinking-fund call price is the par value if the bonds were originally sold at par. When issued at a price in excess of par, the sinking-fund call price generally starts at the issuance price and scales down to par as the issue approaches maturity. May have a deferment period which prevents the feature from being exercised within the first few years. There are two ways to retire the bonds:

1. The issuer pays cash of the face amount of the bonds to the trustee, who then calls the bonds by lottery for redemption, or
2. The issuer retires the bonds in the open market if the price is below par , although few corporate bond indentures may prohibit the open-market purchase of the bond by the issuer.

(b) Describe the make-whole call feature and explain why it's attractive to borrowers and lenders.

7. Continued

Firm can buy back the bond issues prior to maturity at the call price that is the higher of the following:

1. Par value plus interest
2. Present value of remaining coupons and principal, discounted at a Treasury rate that matches with the bond's remaining maturity plus a spread specified in the indenture

The cost for the issuer is lower. The make-whole call price increases as the interest rate decreases, therefore the issuer will have less incentive to exercise the call simply because the interest rate is declining. Therefore, the bondholder has more protection and thus demand lower return

(c) List two benefits of having the effective duration of assets based on changes in the same reference yield.

- Easier to compare the interest rate sensitivities of different securities
- Isolate the impact of credit risk
- Compute portfolio duration when multiple types of securities are present

(d) List some examples of basis risk.

- Long-term and short-term financial instruments
- Domestic currency and foreign currency
- Liquid and illiquid investments
- Bonds with high versus low sensitivity to changes in interest rate volatility
- Taxable and tax-free instruments
- Spot and futures contracts
- Default free and non-default free securities

(e) Recommend a re-allocation of investments within the two available asset classes to achieve surplus immunization.

Step 1 – Calculate the Duration of Assets such that Ds = 0

$D_S = (D_A - D_L) * (A/S) + D_L$

Immunization is achieved when Duration of Surplus, Ds, equals 0.

Rewrite the equation for D_S in terms of DA; $DA = (D_S - D_L) * (S/A) + D_L$

Setting $D_S = 0$; $D_A = (0 - 8) * (7 / 100) + 8 = 7.44$

7. Continued

Step 2 - Solve for the AA% that achieves the target portfolio duration of 7.44 using the individual assets' effective durations:

$7.44 = AA\% * 8 * .97 + (1 - AA\%) * 8 * .92$

$AA\% = (7.44 - 8 * .92) / (8 * .97 - 8 * .92) = 20\%$

Thus, Class AA allocation = \$20M, Class BB Allocation = \$80M

(f) Describe financial market conditions and XYZ insurance product features that create an interest rate risk profile known as a "short-straddle."

Asset displays negative convexity due to prepayment and call provisions.
Liability displays positive convexity due to:

- Guarantees on credited rates
- Book value withdrawal (i.e. receive AV - surrender charge from insurance company)

Short straddle position means the insurance company takes a loss regardless of which direction the interest rate moves.

- When interest rate increases, PH lapse more to take advantage of book value withdrawal and seek other more attractive investment options, the depreciation in assets supporting liability could be more than the surrender charge, hence insurance company takes a loss.
- When interest rate decreases, PH lapse less to take advantage of minimum guaranteed credit rate, the assets tend to get called by the issuer, which leaves the insurer with large sums of cash to reinvest in a low interest rate environment, hence insurance company takes a loss.

8. Learning Objectives:

5. The candidate will understand the specific considerations relative to managing an equity and/or alternative asset portfolio within an asset allocation framework.

8. The candidate will understand the behavior characteristics of individual and firms and be able to identify and apply concepts of behavioral finance.

Learning Outcomes:

(5a) Explain how an investment policy affects the selection of an investment strategy or the selection of an optimal portfolio.

(5b) Assess a portfolio position against portfolio management objectives using qualitative and quantitative techniques.

(8a) Explain how behavioral characteristics of individuals or firms affect the investment or capital management process.

Sources:

Maginn & Tuttle, Managing Investment Portfolios, 2007, Chapter 18, pg. 516

V-C119-07: Form Efficient Market Theory to Behavioral Finance, by R. Shiller, Journal of Economic Perspectives, Winter 2003

Byrne & Brooks, "Behavioral Finance: Theory and Evidence"

Commentary on Question:

This question addressed topics related to investing in commodities and their role as an inflation hedge. The question also asked to explain, using behavioral finance theory, changes in commodity prices. The performance by the candidates on this question was moderate.

Solution:

(a) Contrast the two approaches to investing in commodities as described in Maginn and Tuttle.

Direct Investing:

- Cash market purchase of physical commodity or derivative (e.g. future)
- Involves carry and storing costs

Indirect Investing:

- Involves acquisition of indirect claim on commodity such as equity in company specializing in commodity production

(b) Describe components of commodity index return.

- The spot return or price return: return caused by changes in commodity futures price that come from changes in the underlying spot price via the cost-of-carry model.

8. Continued

- Collateral return or collateral yield: return comes from the assumption that the fund value of the underlying futures contracts is invested to earn the risk free interest - that is investor long a future contractor post 100 percent margin in the form of T-bills.
- Roll returns or roll yield: returns arise from rolling long futures position forward through this.

(c) Critique the university president's belief.

- Many commodity classes exhibit negative correlation. These commodities are not effective inflation hedges.
- Return of overall index is impacted by dominant component, e.g. energy.
- Results suggest direct investing in energy, and to a lesser extent industrial and precious metals may provide significant inflation hedge.

(d) Explain this spike in commodity prices using behavioral finance theory, assuming the president is right.

- Feedback models: When there's speculation in the market that prices will go up, it creates success for some investors. This may attract public attention, promote word-of-mouth enthusiasm, and heightened expectations for further price increases.
- Overconfidence and over-optimism - investors overestimate their ability and the accuracy of the information they have.
- Irrational investors

9. **Learning Objectives:**

1. Candidate will understand and be able to follow the investment management process for insurance companies, pension funds and other financial intermediaries.

5. The candidate will understand the specific considerations relative to managing an equity and/or alternative asset portfolio within an asset allocation framework.

Learning Outcomes:

(1a) Explain how an investment policy and an investment strategy can help manage risk and create value.

(1d) Identify and describe the impact on investment policy of financial and non-financial risks including but not limited to: Currency risk, credit risk, spread risk, liquidity risk, interest rate risk, equity risk, product risk, operational risk, legal risk and political risk.

(5d) Recommend an investment strategy for a given situation:

- Portfolio policy and objectives
- Asset selection criteria
- Capital market expectations
- Risk management strategy
- Portfolio rebalancing strategy

Sources:

Maginn & Tuttle, Chapters 1, 3, and 11

Commentary on Question:

Candidates must understand the construction of an investment policy and the relationship between rebalancing and investment objectives.

Solution:

(a) Develop an outline of your recommended investment policy statement for this foundation.

- Client Description
  - Foundation to provide scholarships to foreign students
- Purpose of IPS
  - Governing document for all investment decision-making
- Duties and responsibilities
  - Investment committee has operational accountability
  - Investment manager manages funds within the guidelines
  - Bank custodian responsible for security transactions and reporting

9. Continued

- Return objectives
  - Earn highest inflation-adjusted return consistent with risk objectives
  - Real return needs to exceed 5% minimum payout, plus expenses
- Risk objectives
- **grader's note – candidates received credit for writing either high or low risk tolerance, provided there was an explanation to back it up**
  - As we need to achieve a high expected return over a long time horizon, risk tolerance is high
- Liquidity
  - Keep small amount in cash to fund 5% minimum
- Time horizon
  - Long-term, ideally in perpetuity
- Tax concerns
  - Minimal, tax-exempt
- Regulatory factors
  - 5% spending rate
- Unique circumstances
  - None
- Strategic asset allocation
- **grader's note – any reasonable asset allocation recommendation received credit**
  - Recommend 30% in corporate bonds with laddered maturities; 40% in equities, both U.S. and international; 15% in real estate trusts; 15% alternative asset classes, such as hedge funds
- Investment style
  - Needs to be suitable for long-term objectives
- Schedule for rebalancing and reviewing performance
  - Suggested quarterly for both
  - **grader's note – many candidates focused their time detailing risk and return objectives, and did not outline all the parts of an IPS

(b) Describe how your recommendation in (a) would change in the case of this defined benefit plan.

- Client Description
  - DB plan
- Purpose of IPS
  - No change
- Duties and responsibilities
  - Likely more complex structure and additional fiduciary responsibilities

9. Continued

- Return objectives
  - Fund future pension benefits
  - Return may be related to discount rate
  - Target x%, minimize contribution volatility
- Risk objectives
  - Affected by
    - Plan funded status
    - Sponsor's financial status
    - Sponsor and fund common risk exposures
    - Plan features and workforce characteristics
    - Liquidity
  - Must cover retirement benefits and possible lump sum benefits
  - Possible to off-set with ongoing contributions
  - Liquidity needs will increase as block ages
- Time horizon
  - Shorter, since plan is closed
- Tax concerns
  - Tax-sheltered
- Regulatory factors
  - ERISA
- Unique circumstances
  - None
- Strategic asset allocation
- **grader's note – any reasonable asset allocation recommendation change received credit**
  - Increase fixed income allocation to 80%
- Investment style
  - Needs to be suitable for long-term objectives
- Schedule for rebalancing and reviewing performance
  - Similar

(c) Compare and contrast the two strategies.

Calendar Rebalancing

- Portfolio is rebalanced to set percentages at specific time intervals (e.g. monthly, quarterly)
- Simple approach
- No need for continuous monitoring
- Must rebalance if only off by a little – can add expense
- Unrelated to market behavior

9. Continued

Constant-Proportion Strategy

- Equity allocation is a function of the portfolio value
- Adjusts when allocation cross pre-determined threshold
- Target equity investment = m × (portfolio value – floor value)
- Trades can occur at any time
- Produces high returns by increasing exposure in a bull market and reducing exposure in a bear market
- Performs well in trending markets
- Performs poorly in markets characterized by reversals
- Momentum oriented

(d) Recommend a rebalancing strategy for the defined benefit plan and justify your recommendation.

Grader's note – reasonable justification for either strategy, or a combination of both strategies received credit

Recommend Calendar Rebalancing

- Volatility should be lower with high allocation to fixed-income
- Less risk of large movements in asset weightings
- Rebalance quarterly to save on transaction costs
- Simple, easy to administer

10. Learning Objectives:

8. The candidate will understand the behavior characteristics of individual and firms and be able to identify and apply concepts of behavioral finance.

Learning Outcomes:

(8a) Explain how behavioral characteristics of individuals or firms affect the investment or capital management process.

(8b) Describe how behavioral finance explains the existence of some market anomalies.

(8c) Identify and apply the concepts of behavioral finance with respect to individual investors, institutional investors, portfolio managers, fiduciaries and corporate managers.

Sources:

Byrne & Brooks, "Behavioral Finance: Theory and Evidence"

How Psychological Pitfalls Generated the Global Financial Crisis, Hersh Shefrin, CFA Institute, 2009

V-C122-07: Anomalies: The Law of Once Price in Financial Matters

Commentary on Question:

This question tested comprehension of behavioral finance theory and how to apply it in specific situations. The candidates did not perform very well on this question.

Solution:

(a) Describe the types of psychological pitfalls that may be present in the following three scenarios:

Commentary on Question:

An explanation must be given to be awarded full points.

(i) At the risk of losing deals, rating agency XYZ has been strongly lobbied by financial institutions to apply less stringent requirements on concentration of risks for mortgage backed securities.

- Reference point – Induced risk seeking behavior: At the risk of losing deals, the rating agency XYZ may behave in a risk-seeking fashion to avoid an outcome that lies below the reference point.
- Agency issue: Agent's incentives are not properly aligned to the interest of the investors. Rating agencies are paid by financial institutions.

10. Continued

(ii) An insurance company is facing financial distress and an increasing probability of bankruptcy due to low interest rates and volatile returns in stock markets. Its CFO strongly believes that low interest rates will persist and the only way to survive is to invest in alternative high yield assets coupled with equity linked derivatives.

- Reference point – Induced risk seeking behavior: At the risk of bankruptcy, the CFO behaves in a risk-seeking fashion to avoid an outcome that lies below the reference point.
- Overconfidence: The CFO may be too sure of their opinions and underestimate risk.
- Extrapolation: The CFO forecasts that the low interest rate environment will continue into the future.
- Narrow Framing: The CFO may be simplifying a multidimensional decision problem and ignoring other risks.

(iii) The financial institution, MyGold, has hired external consultants to analyze their competitive position. The report shows that MyGold is trailing all of their competitors. MyGold has decided to close the gap by selectively investing in new types of Collateralized Debt Obligations (CDOs), believing that it would provide significant revenue growth opportunities. However, little independent risk analysis has been performed because CDOs are believed to behave the same way as corporate bonds.

- Reference point – induced risk seeking behavior: MyGold is trailing behind their competitors, and may behave in a risk-seeking fashion to improve their company's position.
- Opaque Framing: The institution is taking risk beyond what they can understand and process.
- Narrow Framing: The institution makes the simplifying assumption that CDOs behave the same way as a bond and completely ignores the differences between the two asset classes.

(b) Explain possible violations of the law of one price for the following:

(i) Closed-end fund

- Political or legal barriers between countries
- Portfolio manager charges a fee or portfolio manager may have superior asset selection skills
- Liquidity/availability of shares limiting ability to sell short

10. Continued

(ii) American deposit receipts

- There can be imbalances in supply and demand and/or political barriers preventing the purchase of shares in the local market
- Investor may have preference between local and foreign investors

(iii) Twin Share

- Two firms have claims on the assets of the combined firm. The split should dictate what the relative price relationship is between the two shares and often there will be discrepancy between this price ratio.
- Whether one member of the twin is in a stock index, or is in a geo-political friendly country or provides diversification benefits can influence the price disparity.

(iv) Dual share classes

- Usually they trade at the same price but can vary during times of control battles
- Inclusion of one vs. the other in a stock index
- Investors may believe the stock offers more value than simply the claim on the company's cashflows such as voting rights

11. Learning Objectives:

4. The candidate will understand and apply quantitative techniques for portfolio management.

7. The candidate will understand the purposes and methods of portfolio performance measurement.

Learning Outcomes:

(4c) Describe, contrast and assess techniques to measure interest rate risk.

(7a) Describe and assess performance measurement methodologies for investment portfolios.

Sources:

Tuckman, Chapter 5 and 6

Fixed Income Attribution, A Unified Framework – Part I

Commentary on Question:

The purpose of this question is to test whether the candidate is able to use DV01 to determine the notional amount of a hedge, is adept at applying various measurements of interest rate sensitivity to evaluate two different investment strategies to manage interest rate risk, and can list the criteria for investment performance attribution.

Solution:

(a) Calculate, using DV01, the amount of face value that would need to be purchased under Strategy A.

- DV01 measures the change in the value of a fixed income security for a one-basis point change in rates.
  - DV01 of the call option = -(4.71 − 3.28) / ((0.0475 − 0.0525) * 10000) =0.0286 {Formula 5.3}
  - DV01 of a $100 Face Value 7 year zero coupon bond =T / (100 * (1 + y / 2) ^ (2T + 1)) = 7 / (100 * (1 + 5% / 2) ^ (7 * 2 + 1)) = 0.0483 {Formula 6.23}
- Face Amount of 7 year zeros = -Face Amount of Call Options * (Call Option DV01 / 7 year zeros DV01)= --$1,000,000 * (0.0286 / 0.0483) = $591,733 {Formula 5.7}

(b) Evaluate the two investment strategies being considered by comparing the modified duration and convexity of each strategy to that of the embedded option. Assume the modified duration of the embedded call option is 6.8293 and the convexity is 49.9703.

11. Continued

- Strategy A can be considered a "bullet portfolio"
  - Modified Duration of T year zero = T / (1 + y / 2)= 7 / (1 + 5% / 2) = 6.8293 {Formula 6.24}
  - Convexity of a T year zero = (T * (T + 0.5)) / (1 + y / 2) ^ 2 = (7 * (7 + 0.5)) / (1 + 5% / 2) ^ 2 = 49.9703 {Formula 6.36}

- Strategy B can be considered a "barbell portfolio"
  - Modified Duration of Strategy B is a weighted average of the individual durations = (1/3) * (3 / (1 + 5% / 2)) + (2/3) * (9 / (1 + 5% / 2)) =6.8293
  - Convexity of Strategy B is a weighted average of the individual convexities
    = (1/3) * ((3 * (3 + 0.5)) / (1+5% / 2) ^ 2) + (2/3) * ((9 * (9 + 0.5)) / (1 + 5% / 2) ^ 2) = 57.5852

- Both strategies provide a matching duration to the liabilities, and are viable options.

- Due to a higher convexity, Strategy B will perform better in a volatile interest environment. If the price of the two strategies is the same, Strategy B would be the preferred option.

(c) Describe how to attribute this change to the duration and time components of a factor performance attribution model.

- Duration Component:
  - Shift: The percentage change in a security's value attributable to a parallel change in the overall level of interest rates over the period.
  - Twist: The percentage of change in the security's value attributable to a change in the slope of the yield curve.
  - Shape: The percentage of change in the security's value due to the change in the interest rates that cannot be explained by shift or drift of the yield curve.
  - Roll down: Represents the change in a bond's price as it ages.

- Time Component:
  - Accretion: Return due to the convergence of a bond's price to par as it approaches maturity.
  - Drift: Results from predictable changes in a bond's duration as time elapses, reflecting a change in a bond's placement along the yield curve.

12. Learning Objectives:

6. The candidate will understand the specific considerations relative to managing a fixed income portfolio within an asset allocation framework.

Learning Outcomes:

(6c) Evaluate situations associated with the presence of embedded options and hedging strategies.

(6f) Demonstrate how to apply funding and portfolio management strategies to control interest rate and credit risk, including key rate risks.

(6g) Explain how derivatives, synthetic securities, and financial contracting may be used to manage risk and recommend appropriate ones for a given situation.

Sources:

Saunders and Allen, Chapter 12, pgs. 247 – 249 and 257 - 259

Commentary on Question:

The focus of this question is on the return on capital for a bank. Furthermore, the candidates were asked to compare using either a CDS or a total return swap to hedge the bank's risk. Not many candidates performed well on this question.

Solution:

(a) Calculate the expected return on capital for Bank A when it lends $100 to XYZ Corporation. Assume XYZ does not default.

Capital charge = 100 * 1 * .08 = 8

Amount borrowed = loan amount − capital charge
= 92

Revenue = (libor + .005) * 100 minus (libor − .002) * 92
= 1.1

Return on Capital = Revenue / Capital
= 0.1375

(b) Compare Bank A entering into either a CDS or a total return swap to hedge the risk on this loan.

Total return swap

Seller of a total return swap (TRS) pays to buyer coupons and any appreciation in loan portfolio to buyer.

12. Continued

Buyer pays to seller a floating rate plus a fee to the seller plus any price depreciation in the portfolio.

Due to difficulty of determining the value of some loan portfolios, buyer may commit to taking delivery of loan portfolio at expiration of swap for the initial value of the portfolio.

A TRS is equivalent to a synthetic long position in the loan portfolio for the buyer.

A TRS includes both interest rate risk and credit risk, because changes to interest rates and the price of the loan will affect the cash flows.

CDS

In a CDS, the seller will make a payment to the buyer when a specified credit event occurs.

A credit event is usually defined as one of the following: bankruptcy, prepayment, and default, failure to pay, repudiation / moratorium or restructuring.

A CDS only involves interest rate risk.

The CDS must specify either physical settlement or cash settlement.

With physical settlement, the borrowers consent may be needed to transfer the loan.

(c) Show how much Bank A can improve its return on capital by buying the CDS from Bank B. Assume XYZ does not default and that Basel II capital requirements are in effect.

The risk weight of the counterparty in the credit default swap is substituted for the risk weight of XYZ.

The capital charge for Bank A after buying the swap = '(notional amount − collateral) * XYZ's risk weight of 20% * 8%

= 0.8
Borrowed amount = loan amount – capital charge = 99.2

12. Continued

Revenue = libor + 50bp from XYZ on 100 notional, minus funding cost equal to libor − 20bp times borrowed amount, minus swap fee

(5.2% + 0.5%) * 100 − (5.2% − 0.2%) * 99.2 – 0.55% * 100

= 5.7 – 4.96 – 0.55 = 0.19

Return on Capital = revenue/capital charge

= 0.2375

Improvement = 0.2375 – 0. 1375

= 0.1

13. Learning Objectives:

4. The candidate will understand and apply quantitative techniques for portfolio management.

Learning Outcomes:

(4a) Describe, contrast and assess techniques to measure credit risk, including spread risk.

Sources:

JP Morgan "Bond-CDS Basis Handbook"

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Compute the market value of the liability.

Commentary on Question:

Overall candidates did well on this question. Candidates will get full credit if using correct discount rate in the calculation. Many candidates used only risk free rate and got partial credit.

- Discount Rate = Risk-free + Z-spread = 5% + 7%
- MV = PV of Cash Flows = $20 * (1/1.12 + 1/1.12^2 + 1/1.12^3 + 1/1.12^4 + 1/1.12^5) = 72.10$

(b) Describe each of the following bond-CDS trading strategies:

Commentary on Question:

This question tests candidates' understanding of 1) objective, 2) notional and 3) maturity for each of the strategies. Overall candidates' performance was poor. Candidates either got this correctly or totally missed it in most cases.

(i) Lock-in risk-free spread

- Objective: lock-in the negative basis
- Trade notional: equal
- CDS maturity: match the bond maturity

(ii) Trade the basis

- Objective: profit from the basis becoming more positive/less negative in the short/medium term
- Trade notional: duration weighted
- CDS maturity: higher CDS maturity means higher CDS duration

13. Continued

(iii) Profit from default

- Objective: profit from default
- Trade notional: equal
- CDS maturity: enough to include the period expecting default

(c) Determine the amount and timing of cash flows for each of the following strategies:

Commentary on Question:
Overall candidates' performance was average. Candidates tended to do well with this question if they got the previous question correctly.

(i) Buy Bond A and buy CDS protection with 5-year maturity under the lock-in the risk-free spread strategy.

Bond A Price = $2 * (1/1.12 + 1/1.12^2 + 1/1.12^3 + 1/1.12^4 + 1/1.12^5) + 100 * 1/1.12^5 = 63.95$

Time	Cash Flow In	Cash Flow Out	Net Cash Flow
0	0	-63.95	-63.95
1	2	-5	-3
2	2	-5	-3
3	2	-5	-3
4	2	-5	-3
5	102	-5	97

(ii) Buy Bond B and buy CDS protection with 3-year maturity under the profit from default strategy.

Bond B price=$15 * (1/1.12 + 1/1.12^2 + 1/1.12^3 + 1/1.12^4 + 1/1.12^5) + 100 * 1/1.12^5 = 110.81$

Time	Cash Flow In	Cash Flow Out	Net Cash Flow
0	0	-110.81	-110.81
1	15	-5	10
2	15	-5	10
3	100	-5	-3
4	0	0	95
5	0	0	0

14. Learning Objectives:

5. The candidate will understand the specific considerations relative to managing an equity and/or alternative asset portfolio within an asset allocation framework.

7. The candidate will understand the purposes and methods of portfolio performance measurement.

Learning Outcomes:

(5b) Assess a portfolio position against portfolio management objectives using qualitative and quantitative techniques.

(7b) Describe and assess techniques that can be used to select or build a benchmark for a given portfolio or portfolio management style.

(7c) Recommend a benchmark for a given portfolio or portfolio management style.

Sources:

Maginn & Tuttle, Managing Investment Portfolios: A Dynamic Process, Third Edition, Chapter 12 "Evaluating Portfolio Performance," by Bailey, Richards & Tierney

Fabozzi Handbook of Fixed Income and Securities, Chapter 44

V-C169-09 - Fixed Income Attribution, a Unified Framework

Commentary on Question:

The purpose of this question was to test whether the candidate could assess the properties of a valid benchmark and is familiar with benchmark tracking methods.

Candidates did relatively well on this question.

Solution:

(a) Explain the importance to investors of having a good benchmark in performance measurement.

A good benchmark is critical in performance measurement because absolute returns are meaningless and a point of reference is needed to compare returns. This is essential for evaluating strategic risk investment as well as investment manager performance.

(b) Verify with benchmark testing that the current benchmark is not suitable. Explain your response.

14. Continued

The current benchmark is not suitable for the following reasons:

- The tracking error is very high and there are other benchmarks available in the market that have less tracking error, namely Toro's Benchmark Index.
- The current benchmark has poor coverage. Not all of the portfolio's allocations are captured in the benchmark such as Junk Bonds. The manager's opportunity set should be captured in the benchmark.
- The current benchmark has different risk characteristics; specifically it is taking on much less risk than the actual portfolio. In addition, the equity component is 4 times as risky in the portfolio and the inclusion of junk bonds is a risky addition not captured by the benchmark.
- The current benchmark has different active positions. For example, the benchmark is long real estate, but the portfolio is short real estate. Also, the benchmark invests heavily in government bonds unlike the portfolio.

(c) Explain whether you agree or disagree with the portfolio manager.

I agree that the benchmark should be specified in advance to the manager, so the manager is aware of how his performance is being evaluated. However, I disagree that the benchmark should not be modified during the performance evaluation period.

A benchmark may have to be modified if the strategic asset allocation of risk changes or if the manager's investment opportunity set changes. In addition, a benchmark may have to be modified if the original benchmark contained errors and is inappropriate for the existing portfolio.

Any changes made to the benchmark should be communicated to the manager.

(d) Propose reasons for and against this investment strategy.

Reasons for:

- Efficient market hypothesis – difficult to consistently outperform the market with active management strategies
- Minimize tracking error risk
- Appropriate if the manager has no view of the market/sector performance

14. Continued

Reasons against:

- May not be possible to replicate the index and may not be cost-effective
- Give up the benefits of investment management expertise
- Cannot outperform the benchmark after accounting for fees

(e) Describe methods that can be used to track such a benchmark cost effectively.

Because there are many securities in the benchmark, full replication is not practical.

Several methods could be used to track the benchmark cost effectively.

- Stratified Sampling – Subdivide benchmark assets, and sample from subdivisions
- Optimization – Use a multifactor model that selects securities and minimizes the tracking error of the portfolio to the benchmark
- Replication with Derivatives

(f) Recommend a method to track the benchmark if management is concerned about matching the risk profile of the benchmark and justify the recommendation.

I would recommend Optimization. By setting appropriate constraints on risk factors in our multifactor model and selecting sufficient securities, the benchmark and its risk profile can be reasonably replicated with tracking error minimization.

This method has the additional benefits of being able to account for historical variances and correlations between risk factors that are not captured by methods like stratified sampling.

15. Learning Objectives:

2. The candidate will understand the variety of financial instruments available to managed portfolios.

Learning Outcomes:

(2a) Compare and select specialized financial instruments that can be used in the construction of an asset portfolio supporting financial institutions and pension plan liabilities.

Sources:

John Brynjolfsson, Handbook of Fixed Income Securities, 7th Edition, 2005, Chapter 15 Inflation-Linked Bonds, pgs. 353 – 357, 368 and 372

V-C154-09: Robert G. Bertram, Balancing the Opportunities in Real Return Investments, 2007, pgs 46 – 47 and 49

Commentary on Question:

This question is testing the candidates' understanding of TIPS. It is also testing the knowledge of other asset classes that could hedge against unexpected changes in inflation.

Solution:

(a) List the tactical and strategic advantages of TIPS for investors.

Tactical Advantages

Investor can speculate using TIPS on changes in inflation and real interest rates.

Strategic Advantages

- TIPS can enable the investors to obtain a high real yield.
- Diversification: TIPS have a low correlation to traditional financial assets.
- TIPS have muted volatility.

(b) Calculate the break-even inflation rate priced into the zero coupon TIPS.

$$Base\ Index = 175.60$$

CPI-U for any valuation date incorporates a 3-month lag

Calculate Index Factor

$$Index\ factor_{July\ 22,2012} = \frac{RefIndex_{Apr\ 1,2012} + \frac{day-1}{30}(RefIndex_{May\ 1,2012} - RefIndex_{Apr\ 1,2012})}{Base\ Index}$$

15. Continued

$$= \frac{214.118 + \frac{22-1}{30}(215.304 - 214.118)}{175.60}$$
$$= 1.2241$$

Calculate TIPS real yield

$$Settlement\ Price = Index\ factor_{July\ 22,2012} \frac{Face\ Value}{(1 + TIPS\ real\ yield)^{x}}$$

$$115{,}000{,}000 = 1.2241 * \frac{100{,}000{,}000}{(1 + TIPS\ real\ yield)^{\left(\frac{37.29}{360}\right)}}$$

TIPS real yield = 0.6%

Calculate breakeven inflation rate

$$Breakeven\ inflation\ rate = \frac{(1 + nominal\ yield)}{(1 + TIPS\ real\ yield)} - 1$$
$$Breakeven\ inflation\ rate = \frac{(1.025)}{(1.006)} - 1 = 1.9\%$$

(c) Outline the challenges and concerns this inflation hedging strategy might face.

Two key concerns:

- Inflation mismatch – TIPS are based on the U.S. CPI, which may not necessarily grow at the same rate as the Canadian CPI. This introduces basis risk.
- Currency mismatch – The strategy is exposed to exchange rate risk. Investing in TIPS creates US dollar exposure, which may necessitate the need for Canadian/US currency hedging thus incurring additional costs.

(d) Assess how the inflation hedging strategy would perform if both U.S. and Canada experience deflation over a decade.

The inflation hedging strategy should perform well if both the U.S. and Canada experience deflation over a decade.

15. Continued

Under a prolonged deflationary environment, the plan liabilities will decrease since the benefits are indexed to the Canadian CPI, but TIPS are guaranteed to at least pay out the original principal payment. This floor allows the hedge to be beneficial when both countries experience prolonged deflation.

(e) Describe the advantages and disadvantages of investing in each of the following asset classes to hedge against unexpected changes in inflation.

(i) Infrastructure

(ii) Timberland

Infrastructure
Advantages
- Earn stable income while unexpected inflation hedged
- Low correlation with traditional assets

Disadvantages
- Illiquid
- High maintenance and due diligence costs
- Increasing investor awareness – so cost of asset is increasing and prospective returns are declining

Timberland
Advantages
- Returns are largely dependent on organic growth
- Low correlation with traditional assets

Disadvantages
- Illiquid
- Neighborhood deterioration risk (e.g. fires)
- Increasing investor awareness – so cost of asset is increasing and prospective returns are declining

16. **Learning Objectives:**

2. The candidate will understand the variety of financial instruments available to managed portfolios.

3. The candidate will understand the importance of the techniques and theory behind portfolio asset allocation.

Learning Outcomes:

(2a) Compare and select specialized financial instruments that can be used in the construction of an asset portfolio supporting financial institutions and pension plan liabilities.

(3c) Evaluate the significance of liabilities in the determination of the asset allocation.

(3d) Demonstrate how to include risk management principles in the establishment of investment policy and strategy including asset allocation.

Sources:

V-C184-11: Deciphering the Liquidity and Credit Crunch 2007 – 2008

V-C174-09: Anson, The Handbook of Alternative Assets, Second Edition, 2006, Chapter 20

Commentary on Question:

This questions tests a candidates understanding of specialized assets, their risks and potential effects on insurance companies that might include them in their portfolios and various conditions that contributed to the economic crises of 2007-2008.

Overall candidate performance on this question was poor.

Solution:

(a) Explain what a CDO is and describe the potential "borrower's balance sheet effects" for ABC Life.

Commentary on Question:

Overall, candidates did reasonably well in describing CDOs but generally did not do well in describing the balance sheet effects.

CDOs are structured asset back securities. Diversified portfolios of assets are pooled and sliced into different tranches. Each tranche offers a varying degree of risk and return.

Senior tranche is the safest. It offers low interest rate and it is the first to be paid out of the cash flows of the portfolio. An "equity tranche" or "toxic waste" is the most junior tranche and the last to be paid off. It offers the highest interest rate to compensate for additional default risk.

16. Continued

ABC Life is highly leveraged. If the asset values of the underlying CDOs decline, it could cause two liquidity spirals – loss spiral and margin spiral. This effect is called the "borrower's balance sheet effects."

Loss spiral - arises when a decline in the asset value forces leveraged investors to unwind their positions and sell assets when the price is low. These sales depress the price further, inducing more selling and more losses on existing positions.

Margin spiral – a price reduction also causes higher margin and haircuts, leading to a general tightening of lending, which in turn exacerbate the funding problems and forces leveraged investors to sell even more in order to reduce its leverage ratio.

(b) Describe the risks inherent in mezzanine and distressed debt.

Commentary on Question:
Most candidates covered mezzanine and distressed debt credit loss aspects but very few described mezzanine debt downside protection, equity appreciation opportunities and distressed debt concentration risk.

1. Mezzanine Debt
   - Is unsecured, subordinate (or junior) debt. It may not be fully repaid after all senior obligations have been satisfied.
   - It has debt-like components such as coupon payments and a fixed maturity date so it provides investors some downside protection.
   - It also provides for equity appreciation in the form of warants of an equity conversion factor.

2. Distressed Debt
   - Exposes investors to considerable business risk associated with trouble companies.
   - Exposes investors to concentration risk.

(c) Explain what a CDS is and describe the potential "network risk" inherent in these arrangements.

Commentary on Question:
Most candidates did not correctly or fully describe the network risk

Buyers of regular bonds or CDO tranches can protect themselves by purchasing CDS, which are contracts insuring against the default of a particular bond or tranche.

16. Continued

Network effects arise when financial institutions are lenders and borrowers at the same time.

- In this case, ABC Life is fully hedged in a network of CDS arrangements in which, theoretically, all positions could be fully netted out in a multilateral netting agreement.
- In reality, each party only knows its own contractual obligations, and fear of counterparty credit risk might prevent netting.
- Gridlock can occur in which multiple trading parties fail to cancel out offsetting positions because of concerns about counterparty credit risk.

(d) Describe economic mechanism(s) that contributed to the financial market turmoil in 2007-08 other than those noted in the above examples.

Commentary on Question:
For the most part candidates only provided one valid example.

In addition to borrowers' balance sheet effects and network effect, the following 2 economic mechanisms also contributed to the financial market turmoil in 2007-08:

1. Interbank lending channel also dried up when banks became concerned about their future access to capital markets and started hoarding funds.

2. "Runs on financial institutions" – occurs when an institution is in trouble and every investor has an incentive to be the first to withdraw their invested funds because those who withdraw late might not get their full amount.

Other examples from 2007-08 are: Bear Stearns essentially experienced a bank run in March, 2008 when hedge funds pulled out their funds. AIG faced a "margin run" in Sep. 2008 when several counterparties requested additional collateral from AIG for its credit default swap positions.

17. Learning Objectives:

2. The candidate will understand the variety of financial instruments available to managed portfolios.

3. The candidate will understand the importance of the techniques and theory behind portfolio asset allocation.

Learning Outcomes:

(2a) Compare and select specialized financial instruments that can be used in the construction of an asset portfolio supporting financial institutions and pension plan liabilities.

(3b) Critique and propose asset allocation strategies that can be used to construct an asset portfolio.

Sources:

V-C143-09: Hedge Funds: Past, Present, and Future, R. Stulz, Journal of Economic Perspectives, Spring 2007

Litterman, Modern Investment Management: An Equilibrium Approach, 2003, Chapter 26

Commentary on Question:

This question was about hedge funds and hedge fund allocation strategy. It was not very effective at discriminating between the candidates.

Solution:

(a) Explain the advantages and disadvantages of adding hedge funds to the existing investment portfolio.

Advantages:

1. Less regulation – unlike mutual funds, hedge funds are mostly unregulated so there would be less regulatory filings or issues for implementation.
2. Enhance return – hedge funds are allowed to use complex investment strategies such as short positions, borrowing, and the extensive use of derivatives to enhance returns.
3. Reduce volatility – hedge funds can use long/short strategies to reduce the portfolio's exposure to the market risk.

Disadvantages:

1. Severe tail risk – hedge funds are highly leveraged so it could potentially result in large financial losses.
2. Liquidity risk – there would be a liquidity risk associated with investing in hedge funds as withdrawals are typically allowed on a quarterly basis (vs. daily for mutual funds).

17. Continued

3. Lack of transparency – most hedge funds are not registered with the SEC so they are not required to disclose their holdings and financial statements. The lack of transparency and the potential large losses associated with hedge funds could be a potential threat for the company.
4. Higher fees associated with fund manager compensation – hedge fund managers are compensated a lot more than the mutual fund managers. They typically receive a fixed fee (1%-2% of NAV) and a performance fee (15%-25% of fund returns above a hurdle rate).

(b) Describe the following two hedge fund strategies and how they can help the overall portfolio performance under the current economic expectations.

(i) Long-short equity

(ii) Event-driven

Long/Short Equity:

1. These types of hedge funds tend to hedge their positions against market risks by taking both long and short positions in stocks.
2. Given the volatility of the stock market, these types of hedge funds can significantly outperform the stock market as they have short positions to hedge the downside risk in the current volatile market environment.

Event-driven:

1. These types of hedge funds attempt to take advantages of opportunities created by significant transactional events, such as spin-offs, M&A, reorganizations, bankruptcies and other extraordinary corporate events.
2. Given the economic downturn and the uncertainty for the future, many corporations have to take strategic actions to reorganize, downsize or even file bankruptcies. These are good opportunities for event-driven hedge funds as they could construct trades to extract values as these events occur.

(c) Identify the funding options viable to the company based on the chart.

1. Substitute bonds for hedge fund would increase current portfolio volatility. It does not meet the 8.5% risk tolerance investment objective.

2. Allocate 10% or more of the portfolio into hedge fund by substituting it out of the equity fund would meet the risk tolerance requirement.

17. Continued

(d) Discuss the considerations in selecting a hedge fund allocation strategy.

Commentary on Question:
The mean score was low for this part of the question. Looking at the source material [Manning Chapter 26], we see that some answer items come from sparse sentences within a dense text and it may be difficult to identify them as the expected answer. It is also unlikely that different candidates would have identified the same answer items.

1. First, an investor should consider how much risk they would like to take in overall portfolio (set a risk budget) and evaluate the impact of the hedge fund allocation strategy on total portfolio risk.
2. Investor should also consider the impact of each funding option on the marginal contribution to the total portfolio risk.
3. In addition to assessing the impact on the overall portfolio risk, we should also assess the hurdle rate:

   The hurdle rate is the minimum return required by the investor to hold the hedge fund allocation and all other asset class in the indicated proportion. We should make sure that adding the hedge fund to the portfolio can still achieve the company's hurdle rate objective.

4. The relationship between the implied returns and the hedge fund allocation will depend on the actual structure of the hedge fund portfolio:

   - A more volatile hedge fund portfolio such as the long/short equity hedge fund will have a higher implied return.
   - Alternatively, a hedge fund portfolio that is not especially highly correlated with the other assets will have a lower implied return at every allocation.

5. We should also be careful in selecting the appropriate hedge fund:

   - Hedge funds are not transparent and their reported historical returns could be unreliable so we should be careful in doing the due diligence work.
   - We should also be careful in selecting the hedge fund managers given the significant variation in historical performance across hedge fund managers within each hedge fund sector. One should analyze the characteristics of the hedge fund programs and historic performance to see if positive excess returns are generated by luck or by manager skill.