APM Complete Illustrative Solutions
Fall 2011

1. Learning Objectives:

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

Learning Outcomes:

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

(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.

(7d) Recommend a performance measurement methodology.

Sources:

Babbel & Fabozzi, Chapter 3 – A Performance Measurement System for Insurers

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe what a liability-based benchmark is and identify key characteristics.

Commentary on Question:

Here we were looking for the idea that the liability benchmark was a collection of assets that were to mimic the theoretical MV of the liabilities. This was generally well done.

A liability benchmark is:

- A portfolio of assets that translates the theoretical market value of the liabilities to a real value under various economic conditions.
- It should be based on traded securities that are found in an active market.

1. Continued

(b) Evaluate briefly each of the above asset(s) as to whether they are appropriate to be selected as sub-liability benchmark portfolio asset(s).

Commentary on Question:
This section was answered reasonably well by most candidates. A number of candidates did not actually tell us whether or not the asset was appropriate or not and lost possible marks. Marks were provided as long as the appropriateness/not appropriateness was based on solid reasoning.

A number of candidates did not answer the question asked and instead provided an answer to whether or not the asset was appropriate to **back** the liabilities. This is completely different then answering whether or not it should be in the benchmark.

Treasuries
- Actively traded (liquid)
- Default risk free which is very similar to the liabilities as viewed by the policy holder
- Used as benchmarks for pricing other securities
- Very appropriate

High Yield Bonds
- Not liquid
- Not default risk free
- Not appropriate

MBS
- Some tranches liquid
- Some tranches very highly rated, seemingly default risk free
- Appropriate given the right tranche

Common Stocks
- Does not have any characteristics in common with the Trad Porfolio (e.g. Stocks have no duration)
- Not appropriate

Private Equity
- Very illiquid
- Default risks usually high
- Not appropriate

1. Continued

(c) Describe construction and composition of Levels III, V, and VI of the proposed performance measurement structure and explain how they can be used in performance attribution.

Commentary on Question:
This was definitely the toughest part of the question and was answered the poorest.

Level III

- Aggregate the sub-liability benchmarks into an overall liability benchmark
- Level III determines the total rate of return on the overall liability benchmark
- Starting place to measure performance between Level III and VII

Level V

- divide the APP into several smaller sub-asset proxy portfolios
- Can map the SAPPs to either SLBs or asset classes
- the APP is just the sum of the SAPPs when considering the investment characteristics and total rate of return

Level VI

- Refine the SAPPs if they cover too much; sub-divide them
- If the SAPP differs from the investments, performance will differ from projections

2. Learning Objectives:

4. 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:

(4b) 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 "Alternative Investments Portfolio Management" Chapter 8

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Critique the choice of using a U.S. equity index as a benchmark for the "Volatility Arbitrage" hedge fund.

Commentary on Question:

A lot of the students looked at this from the point of view of what makes an appropriate benchmark rather than applying their answer directly to this HF. For example they listed desirable characteristics, such as: measurable, investible, specified in advance. This was not the answer we were looking for.

- A simple US equity index, which would be long-only, may not be relevant for the volatility arbitrage fund strategy since it would involve both long and short positions.
- There would likely be a large basis difference as the volatility arbitrage hedge fund may not have exposure to U.S. equities.

(b) Recommend approaches and criteria for evaluating the performance of the hedge fund.

Commentary on Question:

Again most of the students just regurgitated all the things that can be used to measure performance – not specifically a HF. They suggested measures like: mean and variance, skew and kurtosis, volatility and downside risk, Jensen's alpha, Treynor's ratio, Sortino's ratio, gain-to-loss ratio, Sharpe's ratio, volatility, fee structure, etc. A more specific answer was expected.

2. Continued

- Can compare just on alpha, which still requires determination of a benchmark portfolio.
- Hedge fund strategies can be compared within similar styles – constructing comparable portfolios – use a single/multifactor model or using optimization to create tracking portfolios with similar risk and return characteristics.

(c) Explain survivorship bias and why it may be more of a concern in hedge fund indices than large cap equity indices.

- Survivorship bias in an index means that the returns observed in an index over time are biased since only the surviving constituents over time stay in the index and the index composition does not stay constant over time.
- Managers with poor records exist in the business while only those with good records remain in the index.
- Survivorship bias is less of a concern for equities as the group of large cap equities remains more stable over time compared to the number of hedge funds.
- Hedge funds startup and exit more often than large cap equities.
- Stricter rules for inclusion of stocks in large cap indices than for HFs.

(d) Explain the limitations the Sharpe Ratio has in measuring hedge fund performance relative to Wonka Life's overall asset allocation.

Commentary on Question:
Similar to (a) and (b) many answered what made Sharpe not great, as opposed to addressing this HF specifically. .

- The Sharpe ratio does not measure risk-adjusted performance since the annualized standard deviation is used.
- Illiquid holdings bias the Sharpe ratio upwards since the volatility is likely understated.
- The Sharpe ratio is primarily a measurement for stand-alone investments and does not take into consideration the correlations of the investment with other assets in the portfolio.
- Serially correlated returns can cause a lower estimate of the standard deviation and help boost the Sharpe ratio.
- Not appropriate for asymmetric return.

3. 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:

V-C165-09

Commentary on Question:

Assess candidate's understanding of Structured Finance Vehicles and a company's motivation for investing in one or creating one and selling it. Understanding the risks and then due to some of the problems in the marketplace, what is likely to occur in future markets for these products?

Important considerations for receiving maximum points: understanding the facts (which is essential a list-type question for parts (a) and (b)) and then applying them to discuss risk with the proposed adjustments – i.e. investing in one industry vs. a diversified group or investing in just the equity tranches and what this means to Wonka and its risk profile. The final part (e) is essentially a list question but if the candidate commented on implications of future outcomes, that garnered more points (full points vs. less than full if no comment on implications).

Parts (a) and (b) (and (e)) were answered the best since they included lists, which the candidates had memorized well. Parts (c) and (d) which required more analysis were poor performers – most candidates got points stating some facts about the answer (e.g., the risk of the equity tranche or single industry) but very few showed that they understood the implications.

Solution:

(a) Describe the process of creating a Structured Finance investment vehicle.

Pool risks by aggregating underlying risks and splitting the various cashflows into different tranches with different levels of seniority meeting the needs of different investors.

Payouts from the pool are paid to the holders of these tranches in a specific order, starting with the most senior tranches (the least risky) down to the equity tranches (the most risky).

Risk to investor because after an initial cashflow buffer is depleted, the equity tranche is hit first and then next highest according to the hierarchy of the vehicle.

3. Continued

(b) Describe the motivations behind the creation of Structured Finance investment vehicles.

- Pooling risks
- Investors can choose tranches to reflect their own risk-return trade offs
- Attractive to institutional investors seeking higher rated or AAA-rated securities
- Banks could manage regulatory capital more efficiently/arbitrage capital rules
- Potential to lower capital charges to the bank
- Banks could originate more underlying loans while not having to fund them directly
- Some issuers were motivated by large fees

(c) Evaluate the potential risks of the portfolio manager's proposal.

Commentary on Question:
Candidates did poorly against total grading points because they basically said that investing in one industry would lead to higher risk, but that's all they said. They missed stating correlation and any mismatch risk this might create. No one mentioned the ratings piece to this answer.

Exchanging a portfolio exposed to many industries to one that concentrates in one industry exposes the insurer to concentration or contagion risk, as adverse economic conditions may affect firms in the same sector similarly.

Furthermore, firms that are more highly correlated will have greater degrees of losses, given default.

Wonka will be exposed to a mismatch between these assets' cash flows and those of the liabilities. Poor economic conditions that could result in defaults may also incite policyholders to withdraw funds, requiring liquidation of these securities at an inopportune time

(d) Evaluate how your answer in (c) would change if the two tranches under consideration were equity tranches

Equity tranches pose even greater risk, because, in the event of default, it is these tranches that will suffer financial loss first. These tranches would be lower rated and hence will result in greater capital requirements.

3. Continued

(e) Describe how the recent financial crisis is likely to impact the future Structured Finance Product market.

- More stringent regulatory requirements are likely to occur.
- Investors will perform more of their own due diligence in proposed investments, rather than rely on rating agency analysis.
- Rating agencies will provide more insight on their rating processes, as well as their limitations/models.
- Originators may retain some of the risk of the underlying assets' performance.
- Greater standardization of products may occur.

4. Learning Objectives:

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

Learning Outcomes:

(5h) Describe and critique the role of rating agencies in evaluating credit risk.

(5i) Explain and recommend best practices in credit risk management including:

- Credit and underwriting policies
- Comprehensive due diligence
- Diversification requirements and aggregate counter-party exposure limits
- Use of credit derivatives and credit support agreements.
-

(5j) Recommend a credit risk management strategy for a given situation.

Sources:

Crouhy Risk Management, Chapter 7, Section 5-7

Commentary on Question:

Part (a) and (b) are recall type questions; part (c) is analysis type question.

Most candidates got the high level points and some candidates who provided additional details were awarded additional points. However, in general, most candidates did poorly in section (c).

Solution:

(a) Describe the Financial Assessment process used by rating agencies to determine the Obligor's initial risk rating.

Commentary on Question:

Candidates are expected to recall not only the main points of the Financial Assessment process but also the additional aspects that may provide more information to determine the initial rating.

The Financial Assessment process determines the initial obligor rating. The Financial Assessment process takes into account the following:

1. Earnings & Cash Flow (EBITA)
2. Leverage
3. Financial size, flexibility and debt capacity

4. Continued

In addition, the following may provide more information:
1. Various balance sheet ratios (such as liquidity ratio, leverage ratio)
2. Current year is emphasized
3. Previous few years are considered
4. Cyclical adjustments are made when necessary
5. Judgment is essential

(b) Describe briefly the categories of adjustment factors for the obligor credit rating used by rating agencies as listed by Crouhy.

Commentary on Question:
Candidates are expected to list the main categories of the adjustment factors and further explanations will be marginally rewarded

The adjustment factors are meant to downgrade if the standard is not met (do not improve rating) and include the following:
1. Assess management and other qualitative factors
   - Management skills and knowledge
   - Security reporting on timely basis
2. Industry ratings summary
   - Competitiveness
   - Trade environment
   - Regulatory framework
   - Technological change
   - Long term trends
3. Tier Assessment
4. Industry/Tier position
5. Financial statement qualities
6. Country risk

(c) Explain how the Business Review from Byrd Ratings & Analysis' report applies the Financial Assessment process and the adjustment factors.

Commentary on Question:
Candidates are expected to evaluate Wonka Life's Insurance using the Financial Assessment process and the adjustment factors based on Byrd Ratings & Analysis' report.

4. Continued

The business review mentions the following that applies to the Financial Assessment process:

1. Earnings & Cash Flow (EBITA)
   - Poor earnings outlook
2. Leverage
   - Poor investment operation
3. Financial size, flexibility and debt capacity
   - GIC offers nice diversification to other businesses
   - Long history of financial strength

It also mentions the following that applies to the adjustment factor:

1. Competitive market
2. Inconsistent management across products
3. Lack of diversification in products

5. Learning Objectives:

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

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

Learning Outcomes:

(5c) Evaluate situations associated with the presence of embedded options and hedging strategies.

(5e) Show the impact of risk analysis, including interest rate and equity risk, on a portfolio construction.

(5f) Demonstrate how to apply funding and portfolio management strategies to control interest rate and credit risk, including key rate risks.

(5g) Explain how derivatives, synthetic securities and financial contracting may be used to manage risk and recommend appropriate ones for a given situation.

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

Sources:

Babbel & Fabozzi, Investment Management for Insurers, 1999

- Chapter 3, "A Performance Measurement System for Insurers" by Babbel, Stricker & Vanderhoof

Mind the GAP: Using Derivative Overlays to Hedge Pension Funding, Financial Analysis Journal, Volume 65#4, CFA Institute

Commentary on Question:

The performance by the candidates on this question was moderate, particularly on part (a), (c) and (d) for reasons explained in each part.

Solution:

(a) Show that the interest rate hedge ratio of the Wonka Life Employees' Pension Plan is 5.6%.

Commentary on Question:

The main reasons for moderate results are:

- The Fixed Income Investment Allocation (20%) was not used;
- The Funded Ratio was incorrect;
- The formula was wrong.

5. Continued

Fixed Income Duration * Fixed Income Investment Allocation * Funded Ratio / Liability Duration = Interest Rate Hedge Ratio
Where Funded Ratio = Assets / Liabilities
OR
5.1 * 20% * (321.4 / 340.2) / 17.1 = 5.6%

(b) Recommend potential investment asset allocation and derivative overlay strategies which would mitigate the interest rate risk of the Plan.

For Wonka Plan, we are in a situation of a low duration of the assets and a high duration of the liabilities. Specifically, the Employees' Pension Plan has a Fixed Income Duration of 5.1 and a Liability Duration of 17.1 ($D_A < D_L$). So, an important risk is the interest rate risk inherent in duration mismatch (or duration gap).

Some possible recommendations include:

- Increase the allocation to fixed income
- Increase fixed income duration
- Increase allocation to domestic fixed income
- Enter into an interest rate swap where you receive fixed and pay floating
- Close the negative duration gap
- Purchase a receiver swaption
- Enter into a swaption collar
- Use other derivative strategies such as:
  - Go long bond (or interest rate) futures
  - Go long bond forwards (or delayed settlement bonds)
  - Sell equities, buy long bonds and get equity exposure via derivatives

(c) Calculate the Notional Portfolio ("NP") required to provide a duration gap of zero given that an interest rate swap is available with a duration of 10.1.

Commentary on Question:
The results were mixed due to:

- The Fixed Income Investment Allocation (20%) was not applied to the Portfolio duration;
- Market Value of Assets and the Market Value of Liabilities were both used within the formula.

Notional Portfolio = Market Value of Assets * (Target Duration - Portfolio duration) / Swap duration

NP = 321.4 * (17.1 - 5.1 * 20%) / 10.1 = 511.7

5. Continued

(d) Formulate the characteristics of a benchmark that would be appropriate to measure the risk characteristics of the pension plan given that pension plan liabilities are not traded on an organized public exchange.

Commentary on Question:
Many candidates referred to the properties of a valid Benchmark (Unambiguous; Investable; Measurable…).

The benchmark should be based on traded securities with an active market. It should behave in a manner that closely parallels the behavior of the pension liabilities.
Consider:

- The Duration
- The Convexity
- The Volatility
- The Cash flows

6. 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:

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

- Ch. 15, "Inflation-Linked Bonds"

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Calculate the settlement price on 6/10/2010 for this TIPS bond.

Commentary on Question:

Nearly nobody got this question right. The calculation is presented in 4 steps at the top of page 355 of the HFIS, chapter 15, in a descriptive manner.

Due to the 3-month lag to incorporate CPI into TIPS indexation the July coupon will be based on the April CPI level. Thus:

Inflation at 7/1/2010 = CPI_{apr} / CPI_{jan} - 1 = 0.375%

Notional at 7/1/2010 = Notional at 1/1/2010 x Inflation = \$100 x 1.00375 = \$100.375

Coupon at 7/1/2010 = Notional at 7/1/2010 x coupon rate = \$100.375 x (6%/2) = \$3.01125

Number of days in the first coupon period=181

Number of days from Jan 1, 2010 to June 10, 2010=160

Accrued Coupon= 3.01125*160/181=2.661878

To calculate the TIPS principal for any settlement other than the first of a month, you need to interpolate between the CPI levels applicable to the beginning of the month and the beginning of the next month.

Inflation applicable to 6/1/2010 = CPI_{mar} / CPI_{jan} - 1 = 0.25%

6. Continued

Inflation applicable to 7/1/2010 = 0.375%
Notional at 6/1/2010 = $100.25
Notional at 7/1/2010 = $100 x 1.00375 = $100.38.
Notional at 6/10/2010 = Notional at 6/1/2010 + (9/30) x (Notional at 7/1/2010 – Notional at 6/1/2010) = $100.25 + (9/30) x ($100.38 - $100.25) = $100.29
[For the fraction (9/30): 9 is the number of days of accrual (the 10^{th} day of the month – the 1^{st} day of the month) and 30 is the number of days in the month]

Settlement prize= Accrued coupon + notional principle
Settlement prize= 100.29 + 2.661878=102.951878

(b) Discuss the approaches that can be used to quantify investment risk in TIPS.

Approaches that can be used to quantify investment risk in TIPS include:

The Real Duration

This is the percentage change in its market value associated with a 1.0% change in its real yield. The formula is identical to that of a nominal bond. This does not quantify the exposure of TIPS to changes in nominal yield. It is important as nominal yield and real yield are correlated

The Effective Duration

This is calculated in practice by multiplying real duration by a factor of 75%. This should only be used as loose metric for nominal interest rate exposure because substantial risk (basis risk) remains. In theory TIP's effective duration measure risk as it relates to changes in nominal yield.

The Volatility

It is the simply the standard deviation of TIPS' prices (or return).

The Relative Volatility

It represents the volatility as a fraction of the volatility of another instrument such as a nominal bond having comparable maturity.

6. Continued

(c) Evaluate using money market instruments to hedge the inflation-linked aspect of the Payout Annuity line.

Money Market securities are primarily short term assets maturing in one year or less. The market is liquid and there is non-existant or low credit risk. This type of asset is easy to invest in. The yield is expected to rise when inflation expectations rise. There is no capital loss when rates rise. However, there is no protection from unexpected inflation.

(d) Evaluate using TIPS to hedge the inflation-linked aspect of the payout line.

TIPs have built in inflation protection. The market is not very liquid.

Inflation-indexed bonds have notional amounts that increase with changes in the consumer price index. Compared to money market they are bonds, which are longer term investments. Therefore, a dedication strategy has to be considered to pay out annuities. However, TIPS may overestimate expected inflation.

(e) Recommend one of the two approaches and justify your recommendation.

Annuity block contains some structured settlements with COLA escalators. The COLA (cost of living adjustment) escalators index the benefit payment to increases in the consumer price index.
The COLA escalators expose Wonka Life to high inflation rates. To hedge the inflation risk, Wonka Life should invest assets in inflation-indexed bonds.

7. Learning Objectives:

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

Learning Outcomes:

(1c) Determine how a client's objectives, needs and constraints affect the selection of an investment strategy or the construction of a portfolio. Considerations include:

- Funding objective
- Risk-return trade-off
- Regulatory and rating agency requirements
- Risk appetite
- Liquidity constraints
- Capital, tax and accounting considerations

(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.

Sources:

V-C140-09: SOA Specialty Guide to Economic Capital (Exclude appendices 2 and 3)

Commentary on Question:

The question was testing the candidate's understanding of why Economic Capital might be a better measure than regulatory capital in managing a business. Candidates seemed to get this point but didn't always remember all relevant arguments. Candidates were also weak on part (b) where they were asked to explain how the given method works in calculating EC.

Solution:

(a) Evaluate how and why Wonka Life should use EC or other measures of risk.

Commentary on Question:

Candidates did well on part (a) if they gave good background on why EC might be an important alternative and then demonstrated understanding how to calculate EC and how to show the impact one line of business has (or not) on the whole company. It was more of a matter of getting into the details and explaining rather than listing.

.

7. Continued

HOW:
EC reflects the underlying economics of the business as opposed to political and rating agency viewpoints
EC accounts for risks not covered in regulatory/rating agency capital, such as interest rate guarantees, guaranteed surrender values, and operational risks to name several examples
Opportunities to hedge the difference between regulatory and economic capital through "rule arbitrage"
Direct comparisons across lines of business can be made

WHY:
Manage risk profiles through different levels of economic capital
Capital budgeting process to allocate economic capital
Evaluation of required capital in M&A situation to uncover the real risks of the potential acquisition
Insurance product pricing to account for "cost of capital"
Imposing risk tolerances and constraints
Measurement of asset liability management effectiveness
Calculating risk-adjusted return on capital (RAROC)
Performance measurement
Adjusting incentive compensation for management
Able to compare to regulatory and rating agency capital for monitoring and discussions

(b) Describe the steps of using full Economic Scenarios approach to calculating EC.

Commentary on Question:
Some candidates only wrote about the scenarios. They got some basic marks for this but the candidates who mentioned scenarios from Corporate, then described the impact, etc got more marks.

Corporate provides a set of economic scenarios to all business units with appropriate assumptions such as interest rates, inflation, claims – scenarios also reflect correlations for different factors.
Each business unit calculates operating income and surplus for each projection year under each scenario.
Corporate aggregates the results of all business units, ranks them and determines the desired percentile VAR or CTE.

7. Continued

Corporate calculates the EC for operational risk at the enterprise level and allocates it to the business units.

(c) Describe and critique the marginal approach to allocating EC.

Commentary on Question:
Candidates were very basic in answering this part of the question. Some only provided the critique. Candidates that got full marks explained the process and offered the critique.

Calculate the reduction in face capital that occurs if the business unit is removed from consideration.
The reduction is the face capital for the given business unit.
After performing the calculations for all the business units, any remainder is allocated to the corporate line.
Advantage: attempts to allocate true cost of face capital for adding a given line of business.
Disadvantage: It is very complicated.

(d) Demonstrate how to allocate the Enterprise EC to LOBs A-C and Corporate under each of the following approaches:

Commentary on Question:
Comments apply equally to (i), (ii) and (iii). Candidates did relatively well on all three parts here. However, only about half calculated correctly how much gets allocated to the Corporate line.

(i) Marginal

Allocation to A =
The reduction of EC when A is removed = 250,000 – 190,000 = 60,000
Allocation to B =
The reduction of EC when B is removed = 250,000 – 180,000 = 70,000
Allocation to C =
The reduction of EC when A is removed = 250,000 – 140,000 = 110,000
Allocation to Corporate = remainder
= 250,000 – (60,000 + 70,000 + 110,000) = 10,000

7. Continued

(ii) Pro-rata

Allocation to A = 250,000*1,330,800/5,030,800 = 66.1
Allocation to B = 250,000*1,500,800/5,030,800 = 74.5
Allocation to C = 250,000*2,200,000/5,030,800 = 109.2
Allocation to Corporate = 0

Could also allocate based on other appropriate bases (e.g. total economic capital).

(iii) Mono-line

Allocation to A = 75,000
Allocation to B = 90,000
Allocation to C = 110,000
Allocation to Corporate = remainder
= 250,000 – (75,000 + 90,000 + 110,000) = -25,000

8. Learning Objectives:

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

6. The candidate will understand and apply portfolio management Quantitative Techniques.

Learning Outcomes:

(5f) Demonstrate how to apply funding and portfolio management strategies to control interest rate and credit risk, including key rate risks.

(6d) Calculate effective duration and effective key-rate durations of a portfolio.

Sources:

Chapter 17, "Effective and Ineffective Duration measures for Life Insurers"

Commentary on Question:

Overall the candidates did reasonably well on this question. It was an easier calculation question.

Candidates who did not understand the concept of duration or dollar duration did very poorly.

Solution:

(a) Calculate the current Surplus Duration for Wonka Life.

Commentary on Question:

Most lost marks in this part were because candidates either calculated market value incorrectly or used the incorrect market value.

S = A-L
S = 6,031,012 - 5,220,000
S = 811012

Ds = (Da - Dl)*(A/S)+Dl
Ds = (6.0-5.3) x (6,031,012 / 811,012)+ 5.3
Ds = 10.51

(b) Calculate the Surplus Duration for Wonka Life under each of the alternatives above.

Commentary on Question:

Most candidates lost marks because they did not recalculate the durations or market values <u>after</u> the portfolio was sold. They either incorrectly assumed the duration or MV did not change, or plainly forgot to update the MV or duration.

8. Continued

Sale of Pensions

D(A) = (Dollar duration of assets without pensions but with new asset) / (PV new asset base)
= 5.9257

D(L) = (Dollar duration of liabilities without pensions) / (PV new liability base)
= 4.9595

D(S) = (D(A) - D(L)) x (A / S)+D(L)
= (5.9257 - 4.9595)*(5,294,912 / 834,412) + 4.9595
= 11.09

Sale of GB

D(A) = (Dollar duration of assets without GB but with new asset) / (PV new asset base)
= 5.7573

D(L) = (Dollar duration of liabilities without GB) / (PV new liability base)
= 5.1371

D(S) = (D(A) - D(L)) x (A / S)+D(L)
= (5.75733 - 5.1371) * (5,385,112 / 789,112) + 5.1371
= 9.37

(c) Recommend and justify choosing one of the above alternatives to minimize Wonka's exposure to changes in interest rates.

Commentary on Question:
Candidates lost points in this section because they either did not understand what duration was, or they did not make a recommendation and just told us what the values were.

- Duration of surplus measures exposure to changes in interest rates.
- Management wants to minimize this risk so we want to reduce the surplus duration.
- Recommend selling the pension business since this reduces the duration the most out of the two options.

9. **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:

HFIS Chapter 16

Commentary on Question:

Overall this question was poorly answered. This question takes information right out of the textbook and should be well understood by the candidates.

Candidates appeared not to understand what duration was and we saw a number of comments such as "Traditional Life Portfolio has a large duration but is not interest rate sensitive." This is a contradictory statement.

There was a typo in the question. The "Quoted spread" of the floater should have read "75 bps" not "0.75 bps". We accepted both answers since "0.75 bps" is not realistic and the question was not intended to "trick" the candidate or test the candidate's knowledge of basis points.

Solution:

(a) Define the features of Floaters and Inverse Floaters.

Floaters

- Coupon interest varies over instrument's life
- Coupon formula = reference rate +/- quoted margin
- Typical reference rates
  - LIBOR
  - Treasury bill yields
  - Prime rates
  - Domestic CD rates
- Coupon moves in direction of the reference rate
- DURATION is typically small

Inverse Floaters

- General formula: coupon = K - L x quoted margin
- Typically very large DURATION
- Coupon varies inversely with reference rate

9. Continued

(b) Critique the appropriateness of using Floaters and/or Inverse Floaters to support Wonka's Traditional Life Product segment.

Commentary on Question:
A lot of Candidates did not look at the Traditional Life segment from an interest rate risk perspective. The question clearly talks about Duration Mismatch and not cash flow matching, yet a number of candidates answered based on a cash flow matching type of management.

Also, a candidate needs to clearly explain what they mean by "interest rate sensitive." Many candidates would say the floater is very interest rate sensitive. This is true if you are describing the cash flows of the floater, but if you are describing the market value of the floater, this statement is just wrong. Interest rate sensitivity is generally measured by duration and usually refers to the market value of the asset.

Portfolio Observations
- Asset duration is shorter than liability duration of portfolio
- Asset duration is approximately 7.8 years
- Need to purchase assets longer than 7.8 years to lengthen asset duration

Floater Appropriateness
- Very short durations
- Inappropriate if we want to lengthen duration

Inverse-floater Appropriateness
- Very long durations
- May be appropriate for lengthening duration

(c) Calculate the price of the floating rate security assuming the annual Treasury yield at issue on July 10, 2009 was 1.55%, as of:

(i) July 9, 2010

Commentary on Question:
There were two ways to solve this using PV of future cash flows. The first method is recognizing that the price of a floater is just the PV of the coupon and par value from the **next reset date**. The second method involves understanding which discount rate to use to discount all future cash flows.

This question was meant to test the candidate's understanding of how the price of a floater changes during reset periods before the coupon has been paid and at the reset date after the coupon has been paid.

9. Continued

First Solution

Coupon = \$30M x .(1.55% + 0.75%) = \$0.69M (has not been paid yet)

Time to reset is 1 day. (negligible time so price is just the cash flow plus par value at the next reset date)

Price = Par + Coupon
Price = 30M + 0.69M
Price = 30.69

Second Solution

$$\text{Price} = \sum \frac{CF_t}{(1+i)^t} = 0.69 + \frac{0.69}{(1.023)} + \frac{30+0.69}{(1.023)^2} = 30.69$$

i = current floater rate = 1.55% + 0.75% = 2.30%
CF_t = 0.69 (for non-maturity date)
CF_t = 30.69 (at maturity)

(ii) July 10, 2010

Both methods described in (i) can be used here. Since the coupon has already been paid the price is simply 0.69 less than part (i).

Price = 30

(d) Calculate the July 10, 2010 coupon amount received from the inverse floater.

Commentary on Question:
This was an extremely easy question. We were surprised not more people were able to calculate it. The most common mistake was people tried to add the yields of the Floater and Inverse Floater instead of the actual dollar amounts.

Fixed Bond Coupon (\$) = Floater Coupon (\$) + Inverse Floater Coupon (\$)

Fixed Bond Coupon = 100 x 6% = 6
Floater Coupon = 30 x 2.30% = 0.69

Inverse Floater Coupon = 6 – 0.69 = 5.31

10. Learning Objectives:

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

Learning Outcomes:

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

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

Sources:

Maginn & Tuttle, Managing Investment Portfolios

- Ch.12, "Evaluating Portfolio Performance"

Commentary on Question:

The candidates did very well on the question as it was relatively easy.

Solution:

Calculate for each economic sector:

(i) Pure Sector allocation

Total sector benchmark return

$r_b = \sum w_{pj} * r_{Bj}$

25%*-4.5%+20%*3%+55%*1%=0.025%

$\sum (w_{pj} - w_{Bj}) * (r_{Bj} - r_b)$

(20% - 25%) * (-4.5% - 0.025%) = 0.2265%

+ (30% - 20%) * (3.0% - 0.025%) = 0.2975%

+ (50% - 55%) * (1.0% - 0.025%) = -0.04875%

Sum = 0.475%

(ii) Allocation/ Selection Interaction

$\sum (w_{pj} - w_{Bj}) * (r_{Pj} - r_{Bj})$

(20% - 25%) * (-5.0% - -4.5%) = 0.025%

(30% - 20%) * (3.0% - 3.0%) = 0.0%

10. Continued

(50% - 55%) * (-1.0% - 1.0%) = 0.1%

Sum = 0.125%

(iii) Within-Sector selection

$\sum w_{Bj}*(r_{Pj}-r_{Bj})$

(25% * (-5.0% - -4.5%)) = -0.125%

(20% * (3.0% - 3.0%)) = 0.0%

(55% * (-1.0% - 1.0%)) = -1.1%

Sum = -1.225%

(iv) Total Value- Added

Pure Sector allocation+ Allocation/ Selection Interaction+ Within-Sector selection

-0.625%

11. Learning Objectives:

6. The candidate will understand and apply portfolio management Quantitative Techniques.

Learning Outcomes:

(6a) Define and evaluate credit risk as related to fixed income securities and derivatives counter parties.

(6c) Describe, contrast and assess credit risk measurement techniques and models.

Sources:

Crouhy, Galai & Mark, Risk Management, 2001

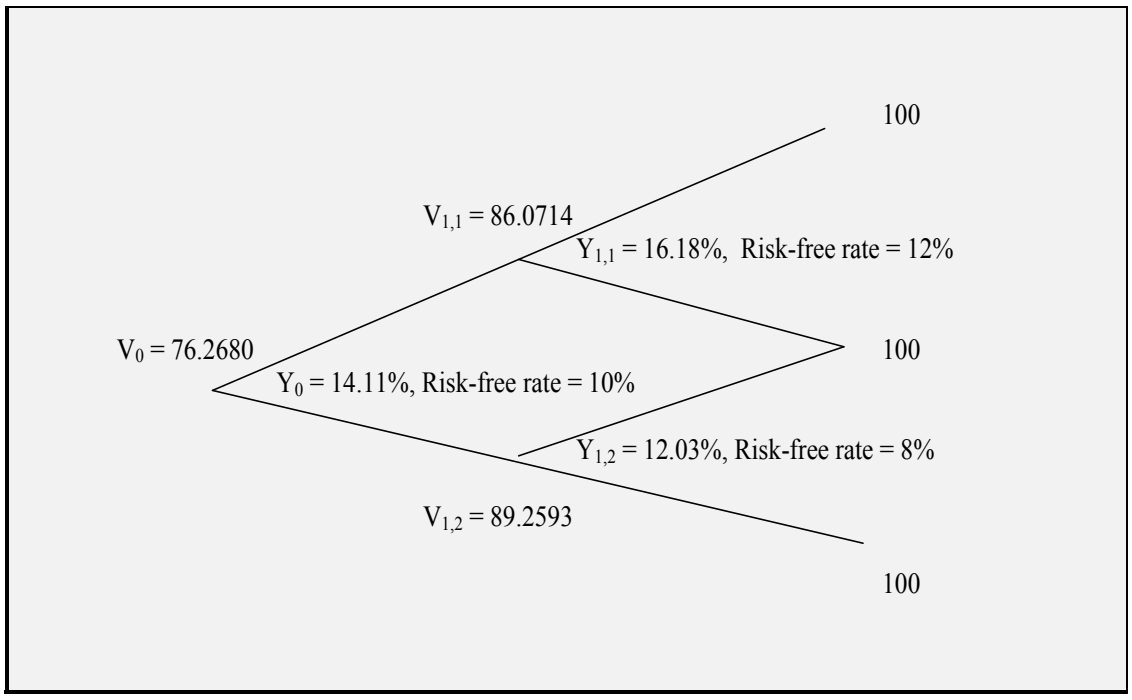
- Chapter 10, "Other Approaches: The Actuarial and Reduced-Form Approaches to Measuring Credit Risk"

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Calculate the price of the bond using the Reduced-Form Approach.



Present Value of Bond at time 1, if interest rate increases to 12%:

$V_{1,1} = [(1-\lambda)*100 + \lambda*(1-LGD)*100]/(1.12)$

$= [(1-0.09)*100 + 0.09*(1-0.4)*100]/(1.12)$

$= 86.0714$

Expected Payoff at time 1,

11. Continued

$= V_{1,1}*[(1-\lambda) + \lambda*(1-LGD)]$
$= 86.0714 *[(1-0.09) + 0.09*(1-0.4)]$
$= 82.9728$

Present Value of Bond at time 1, if interest rate decreases to 8%:
$V_{1,2} = [(1-\lambda)*100 + \lambda*(1-LGD)*100]/(1.08)$
$= [(1-0.09)*100 + 0.09*(1-0.4)*100]/(1.08)$
$= 89.2593$
Expected Payoff at time 1:
$= V_{1,2}*[(1-\lambda) + \lambda*(1-LGD)]$
$= 89.2593 *[(1-0.09) + 0.09*(1-0.4)]$
$= 86.046$

Present Value of Bond at time 0, interest rate of 10%:
$V_0 = [82.9728 * 0.7 + 86.046 * 0.3] / 1.1$
$= 76.2680$

Commentary on Question:
An alternative solution was to do (b) first – get the default risk adjusted interest rate and divide it into 100. If a candidate did this – we gave full point for (b) if rate was calculated correctly and then full marks for (a) if the final answer was OK. This was for Expected payoff.

Then, $V_{1,1} = 100/ (1+ Y_{1,1})$ $= 100/1.1618$ $= 86.0714$	Then, $V_{1,1} = 100/ (1+ Y_{1,2})$ $= 100/1.1203$ $= 89.2593$	$V_0 = [82.9728 * 0.7 +$ $86.046 * 0.3] / 1.1$ $= 76.2680$

(b) Determine the equivalent default risk-adjusted short-rate process for the life of the bond.

$1/(1+Y) = [1/(1+R)] *[(1-\lambda) + \lambda*(1-LGD)]$
$Y = [R + \lambda LGD]/[1- \lambda + \lambda(1-LGD)]$
Where Y is the default risk-adjusted interest and R is the risk-free interest rate

Default risk-adjusted rate at time 1 if the risk-free rate increases to 12%:
$Y_{1,1} = [0.12+ \lambda LGD]/ [1- \lambda + \lambda(1-LGD)]$
$= [0.12 + 0.09*0.4]/[1-.09+.09(1-0.4)]$
$= 16.18\%$

11. Continued

Default risk-adjusted rate at time 1 if the risk-free rate decreases to 8%:
$Y_{1,2} = [0.08+ \lambda LGD]/ [1- \lambda + \lambda(1-LGD)]$
$= [0.08 + 0.09*0.4]/[1-.09+.09(1-0.4)]$
$= 12.03\%$

Default risk-adjusted rate at time 0 when the risk-free rate is 10%:
$Y_0 = [0.10+ \lambda LGD]/ [1- \lambda + \lambda(1-LGD)]$
$= [0.10 + 0.09*0.4]/[1-.09+.09(1-0.4)]$
$= 14.11\%$

(c) Propose enhancements that can be incorporated into a continuous time model of the default risk-adjusted short rate process.

Commentary on Question:
Most students did not answer this and it was only vaguely answered as below. The detail and how the detail matched the issue or item from the formula (liquidity premium or gamma) was NEVER mentioned.

The basic continuous-time continuously compounded default risk-adjusted short rate process in this case is $Y(t) = R(t) + \lambda(t)LGD$
Factors that can be added to the model:

1. Liquidity adjustment premium, l
   $Y = R + \lambda LGD + l$
   There is positive liquidity adjustment premium when there is a lack of liquidity in the market. A negative liquidity premium exists when there is a shortage of the security.
2. Default intensity level extended to depend on the state of the economy.
   (i) The intensity process λ can be modeled to depend on an unexpected change in the market index.
   (ii) l, liquidity premium can depend on risk-free rate, stock market index, intraday volatility.
3. Default intensity level extended to depend on the credit rating of the issuer.
   Incorporate credit migration approach by having term structure of credit spreads and loss rates for each credit category & credit rating transition matrix.

12. Learning Objectives:

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

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

4. 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.

(1b) Identify the obligations of a fiduciary in managing investment portfolios and explain how they apply in a given situation.

(1c) Determine how a client's objectives, needs and constraints affect the selection of an investment strategy or the construction of a portfolio. Considerations include:

- Funding objective
- Risk-return trade-off
- Regulatory and rating agency requirements
- Risk appetite
- Liquidity constraints
- Capital, tax and accounting considerations

(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.

(4d) 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:

Chapter 1 Managing Institution Investor Portfolios, Magin & Tuttle, Page 11

Chapter 3 Managing Institutional Investor Portfolios, Maginn& Tuttle, page 92

12. Continued

Chapter 11 Managing Institutional Investor Portfolios, Maginn & Tuttle, Page 701

Chapter 5 "Asset Allocation," by Sharpe, Chen, Pinto & McLeavey, Pages 241-244

Commentary on Question:
This was an integrated question addressing issues relating to the governance and investment policy setting for an Endowment Fund. The candidates did relatively well on this question.

Solution:

(a) Design a risk/return objective and constraints for the Endowment Fund including a description of relevant factors.

Description of Risk Factors:

- Endowments that do not use a smoothing rule may have less tolerance for short-term portfolio risk.
- An institution's risk tolerance depends on the endowment's role in the operating budget and the institution's ability to adapt to drops in spending.
- On a short-term basis, endowment funds with poor recent returns and a spending rate above the long-term average run the risk of a severe erosion of the endowment's corpus.
- High spending needs often imply a high willingness to accept risk.

Example of Risk Objective

- In the short term, the Endowment should produce a reliable and somewhat stable flow of funding for programs.

Description of Return Factors:

- Endowments have high return objectives.
- Endowment funds should maintain their long-term purchasing power after inflation.

Example of Return Objective:

- The goal of the endowment is to provide a significant annual distribution to support the school's programs while maintaining the fund's long-term purchasing power. The goal is to achieve a total return sufficient to fund the annual budget on an inflation-adjusted basis. Long-term growth orientation with a 7% return objective (4% above CPI of 3%).

Constraints:

- Liquidity
- Tax
- Time Horizon

12. Continued

- Regulatory
- Liquidity
- Unique Circumstances

(b) Assess if the current benchmark allocation meets the risk/return objective and recommend changes if necessary.

- If returns had no volatility, an endowment could set spending at a rate that equated to the real return, that is, the nominal return net of inflation.
- Current expected portfolio return based on benchmark is 7.6%.
- 7.6% = 30% x 8% + 30% x 9% + 30% x 5% + 10% x 10%
- Real Return = 7.6% - 3% = 4.6%
- Returns above spending rate (currently at 4%) would be reinvested to compensate for inflation, and the endowment would retain its purchasing power.
- Therefore, in order to maintain the fund's purchasing power with a 4% percent spending rate, net of investment management expenses the portfolio must generate a long-term return greater than 4% above inflation.
- No change recommended if inflation remains at 3% and assumed no volatility.

(c) Explain the benefits and costs of rebalancing.

Benefits:

- Reducing the present value of expected losses from not tracking the optimum
- Risk management benefits risk level can drift upward if riskier asset represent higher proportion
- Type of risk exposures drift (rebalancing maintains the client's desired systematic risk exposures)
- Not rebalancing means holding assets that have become overpriced, offering inferior future rewards
- Dissuade clients from abandoning policy at inauspicious moments
- Reduce risk while adding to returns

Costs:

- Transaction costs: transaction costs can never be recovered and can deteriorate performance. Transaction costs can offset the benefits of rebalancing.
  - Illiquid assets more difficult to estimate
  - Commissions costs and market impact
  - Opportunity cost

12. Continued

- Tax costs: sell appreciated asset classes and buys depreciated asset classes to bring the asset mix in line target proportions. In most jurisdictions, the sale of appreciated assets triggers a tax liability for taxable investors and is a cost for such investors.

(d) Assess different rebalancing strategies that could be considered for the Endowment Fund.

Calendar Rebalancing:

- Involves rebalancing a portfolio to target weights on a periodic basis. Rebalance to benchmark target
- Simplest discipline
- Does not involve continuously monitoring portfolio values
- Can suffice in ensuring actual mix does not drift far away from target
- Drawback: unrelated to market behavior (might incur unnecessarily high costs if mix is close to target)

Percentage-of-Portfolio:

- Involves setting threshold or trigger points stated as a % of the portfolio's value. (e.g. for a 30% target, it can be 25%-40%) as the corridor or tolerance band. Portfolio is rebalanced when an asset class' weight; first passes through one of its rebalancing thresholds.
- On any calendar date
- Can exercise tighter control on divergences from target proportions
- Monitoring of portfolio values should occur more frequently.
- Factors to play a role in setting corridor: transaction costs, risk tolerance, correlation with other asset classes, volatility, volatilities of other asset classes, liquidity, time horizon.

(e) Evaluate the role of commodities in the Endowment Fund portfolio.

Endowment funds have an extremely long time horizon because they are expected to support activities in perpetuity. Funds need to provide protection against inflation to protect donated capital and cover annual budget.

Commodities offer many benefits to investors:

- Diversification
- Negative correlation to equities and fixed income
- Positive correlation to inflation and unexpected change to inflation
- Return and volatility comparable to equities
- Commodities react to economic factors differently from equities and bonds
- Most commodities are prices in USD, suggesting that exchange rate risk may also improve the return from commodities

12. Continued

- Global demand continues to growth for commodities as worldwide population expands (more nations become industrialized, more houses, more cars, more demand for commodities…Rising demand for all commodities (oil, wheat, etc…)

(f) Define the duties of the Trustee.

The Duty of Loyalty
Administer the trust for the benefit of the beneficiaries of the trust.
Or
It is improper for a trustee to make investment decisions on the basis of the benefit to be derived by parties other than the participants and beneficiaries

The Duty of Care
Manage the trust with attention and skill.
Or
Prudent man, prudent investor. Act the way a prudent investor would act

The Duty to Diversify
Diversify the investments so as to minimize the risk of large losses, unless under the circumstances it is clearly prudent not to do so.

The Duty of Impartiality
Act in a manner that does not excessively favor one beneficiary at the expense of another.

The Duty to Delegate
The trustee is personally responsible for the management of the fund, unless this responsibility has been removed to some extent through the appointment of an investment manager. The trustee may delegate authority, but he remains responsible for the actions of the party to whom he delegated.

The Duty to Follow Statutory Constraints
Many jurisdictions have statutory constraints on investments and transactions that can be made by trustees. In general, these constraints usually involve self-dealing and investments that are considered inherently imprudent.

The Duty to Make the Property Productive
Prudent investor should seek a reasonable return on the investment.

Duties Regarding Co-Trustees
Cooperate with any co-trustees for the benefit of the participants and beneficiaries.

12. Continued

The Duty to Act in Accordance with the Trust Agreement
Obligation to manage the trust in accordance with the trust agreement. Trustee should not engage in a transaction that breaches another duty to the detriment of the participants and beneficiaries.

(g) Determine whether the Current Allocation or the Benchmark Allocation would be preferred if the decision is based on:

(i) maximizing the expected utility for your client, or

UX = E(RX) – 0.005*RA*σ(RX)^2 = 7 – 0.005 * 4 * 8.5^2 = 5.55
UY = E(RY) – 0.005*RA*σ(RY)^2 = 7.6 – 0.005 * 4 * 11^2 = 5.18
Allocation X has higher risk-adjusted expected return, therefore should choose X (current allocation).

(ii) minimizing the probability of returns below 3%.

Use Roy's safety-first criterion with a return threshold (RL) of 3%
Roy's SFRX = (E(RX) – RL)/ σ(RX) = (7 – 3)/8.5 = .47
Roy's SFRY = (E(RY) – RL)/ σ(RY) = (7.6 – 3)/11 = .42
should choose allocation with the largest SFR, should choose X (current allocation)

13. Learning Objectives:

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

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

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.

(4d) Recommend an investment strategy for a given situation.

Sources:

Litterman, Modern Investment Management: An Equilibrium Approach, 2003

- Chapter 26 Strategic Asset Allocation and Hedge Funds
- Chapter 27 Managing a Portfolio of Hedge Funds

Maginn & Tuttle, Managing Investment Portfolios, 3rd Ed, 2007

- Chapter 8 Alternative Investments Portfolio Management

V-C174-09: Anson, Chapter 20 Handbook of Alternative Assets, 2nd Ed.

Commentary on Question:

Candidates were expected to demonstrate their understanding of alternative investments such as hedge funds and private equity, as well as their role in a portfolio.

Solution:

(a) Describe the characteristics of hedge funds.

Characteristics of hedge fund:

1. Constraints
   a. No consideration of a benchmark
   b. No constraints on short position
   c. No constraints to style change
2. Low Regulation
3. Fee Structure
   a. Fixed fee and performance fee, subject to high water mark
4. Low Transparency
   a. Hedge funds are secretive
5. Short Lives
6. Illiquidity
7. Capability Constraints
   a. Some hedge funds turn away new capital

13. Continued

(b) Firm A is considering the following recommended change to their investment portfolio:

(i) Explain how Firm A's portfolio volatility could decrease after the addition of a long position in Hedge Fund X.

Volatility could decrease since hedge funds typically have low correlation to traditional asset classes.
There is a diversification benefit because a correlation of .3 is relatively low.
This lowers overall volatility because hedge fund returns can move differently from traditional assets with hedge fund strategies such as equity long-short.

(ii) Calculate the proportions of the existing portfolio and hedge fund X to achieve the targeted volatility.

Let the assumed proportion of hedge fund be X
9% = [((1-X)^2)(10%^2) + (X^2)(12%^2) + 2(.3)(X)(1-X)(10%)(12%)]^.5
$0.0081 = (X^2 – 2X + 1)(0.01) + 0.0144X^2 + 0.0072(X)(1-X)$
$81 = 100(X^2 – 2X + 1)(0.01) + 144X^2 + 72(X-X^2)$
$81 = 172\ X^2 – 128X + 100$
$172\ X^2 – 128X + 19 = 0$

X = [128 ± (128^2 – 4(172)(19))^.5]/(2*172)
= 0.5394 or 0.2048

To achieve the target volatility, the fund should invest
- 53.94% in X, 46.06% in Po or
- 20.48% in X, 79.52% in Po

(iii) Calculate the proportions of the existing portfolio and hedge fund X to achieve the minimum portfolio volatility.

Let the assumed proportion of hedge fund be X
[((1-X)^2)(10%^2) + (X^2)(12%^2) + 2(.3)(X)(1-X)(10%)(12%)]^.5
$\text{Min}[100(X^2 – 2X + 1)(0.01) + 144X^2 + 72(X-X^2)\ ]$
$\text{Min}[172\ X^2 – 128X + 100]$
$d/dx\ 172\ X^2 – 128X + 100 = 0$
$2(172)X – 128 = 0$
$X = 0.3721$

Invest 37.21% in X and 62.79% in Po to achieve the lowest volatility.

13. Continued

(c) Compare the pros and cons of investing in a fund of hedge funds or a single hedge fund.

Pros of fund of funds over single hedge fund:
- Access to professional management
- Access to more information about funds
- Diversification benefit
- Allow to invest smaller capital

Cons of fund of funds over single hedge fund:
- Higher costs than single hedge fund
- May lead to unwanted style exposure

(d) Compare the risk-return profiles of:

(i) Venture Capital

- Less diversification
  - Highly specialized
- Business risk
- Liquidity risk
- It has positive skewness due to select skill and high kurtosis
  - Returns are much different from a normal distribution

(ii) Leverage Buyouts

- Return distribution more symmetric than VC
  - Near zero skew and kurtosis
- More diversified than VC
- Highly leveraged
- Tend to take public companies private to have less risk than VC
- Mitigate risk with auction deals but increase market efficiency
  - Decrease returns
- Illiquid holdings as well

13. Continued

(e) Describe practical considerations involved when deciding to invest in private equity.

- Observe inflows to private equity as they have impact on pricing private equity investments
  - Too much money chasing too few deals
  - Positive valuation might be due to new capital inflows instead of real economic value
- Check if young venture capital firms bring private companies to public market earlier than older venture capital firms in order to establish positive reputation. This signalling could cause real wealth losses – for example underpriced IPOs and lower-valued equity stakes.

14. Learning Objectives:

5. The candidate will understand the specific considerations relative to managing a fixed income 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

Commentary on Question:

This question relates to analyzing performance of fixed income portfolios and evaluating fixed income managers.

Solution:

(a) Calculate the following for the Corporate Sector:

(i) the allocation weights to the Short and Long Half duration buckets of this sector to create a duration-neutral portfolio with respect to the Grouping

XS – allocation to the Short Half bucket; DS – its duration
XL – allocation to the Long Half bucket; DL – its duration
XS+XL = 1
XS*DS+XL*DL = DB
DB = 7.78; DS = 6.6; DL = 7.9
XS = 9.16%; XL = 90.84%

(ii) the sector return

Return = 9.16% x 0.40% + 90.84% x 0.43% = 0.43%

(iii) the sector outperformance

Outperformance = 0.43% - -0.18% = 0.61%

(b) Calculate the mean, standard deviation of outperformance, and information ratio of the Sector Allocation Strategy within the Grouping assuming:

(i) Investment Manager A selects sectors randomly

14. Continued

The probabilities of selecting each of the sectors:
P(Treasury) = P(MBS) = P(Corporate) = P(Foreign) = 25%
Mean Strategy Return = (25%) * (0.00% + -0.98% + 0.61% + 0.59%) = 0.05%
Variance (Strategy Return) = $E(R^2) - E(R)^2$

$E(R^2)$ = 25%* ($0.00\%^2$ + $-0.98\%^2$ + $0.61\%^2$ + $0.59\%^2$) = 0.0042%
Variance = 0.0042% - $0.05\%^2$
Std Dev = 0.65%
IR = mean/standard deviation
IR = 8.40%

(ii) Investment Manager B is 40% skilled in selecting outperforming sectors

The outperforming sectors are Corporate and Foreign.
P(Corporate) = P(Foreign) = (1-40%)*P(random) + 40%*P(Perfect)
P(random) = 25%; P(Perfect) = 50%
P(Corporate) = P(Foreign) = 35%
P(Treasury) = P(MBS) = (1 - 2*35%)/2 = 15%
Mean Strategy Return = 15% * (0.00% + -0.98%) + 35%*(0.61% + 0.59%) = 0.27%
$E(R^2)$ = 0.0039%
Variance (Strategy Return) = $E(R^2) - E(R)^2$
Std Dev = 0.57%
IR = 48.02%

(iii) Investment Manager C is 40% skilled in selecting the single best outperforming sector

The best outperforming sector is Corporate.
P(Corporate) = (1-40%)*P(random) + 40%*P(Perfect)
P(random) = 25%; P(Perfect) = 100%
->P(Corporate) = 55%
P(Treasury) = P(MBS) = P(Foreign) = (1-55%)/3 = 15%
Mean Strategy Return = .277
$E(R^2)$ = 0.00%
Variance (Strategy Return) = $E(R^2) - E(R)^2$
Std Dev = 0.57%
IR = 48.48%

14. Continued

(c) Explain why it may be misleading to compare managers using only Information Ratios.

Choosing any outperforming sector is an easier task than choosing the best.

A manager who is capable of choosing the best sector with 40% skill is likely to have higher skill than a manager who has 40% skill at choosing any winning sector.

Other factors should be taken into account:

- investment style
- reputation
- assets under management
- personnel turnover
- fees

15. Learning Objectives:

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

Learning Outcomes:

(5j) Recommend a credit risk management strategy for a given situation.

Sources:

V-C183-10: JP Morgan, "Bond-CDS Basis Handbook," February 2009, Pages 3-48

Commentary on Question:

Commentary listed underneath each question component.

Solution:

(a) Describe and compare the following credit spread measures:

(i) Z-spread

- The Z-spread is the parallel shift applied to the zero curve in order to equate the bond price to the present value of the cash flows.
- The Z-spread is measured in relation to a risk-free rate, such as LIBOR/Swap zero rate or government zero-coupon bond rates.
- Calculation does not explicitly account for expected recovery rates or the term structure of default probabilities (or credit term structure).
- Accounts for the term structure of interest rates, but assumes a flat term structure of credit spreads (assuming credit is the only additional risk priced in by the bond).
- Z-spreads are not traded in the market, while par asset swap spreads are traded.

(ii) Par asset swap spread

- The par asset swap spread is a spread above swaps and is equal to the difference between the present value of the cash flows (coupon payments + principal payments) of a bond and its price, divided by the present value of an annuity of 1 basis point using the risk-free discount curve.
- Calculation does not explicitly take into account either the expected recovery rate or the term structure of default probabilities, like for the Z-spread.
- Like for the Z-spread, the par asset swap spread represents a "flat" credit spread measure.
- Spread = [PV(Coupon+Principal)-Bond Price]/Annuity of 1

15. Continued

(iii) Par equivalent CDS spread

- The PECS is the Credit Default Swap (CDS) spread which would match the bond market price, taking into account the recovery rate and the term structure of default probabilities that are implied by the CDS market
- The PECS uses the market price of a bond to calculate a spread based on implied default probabilities.

(b) Using the Z-spread measure, calculate the Bond-CDS basis given the following information

Price = PV Cash Flows @ risk free rate + Z-spread
96.7 = PV (100 + 2.5) @ (5% + Z-spread)
96.7 = 102.5 / (1+.05+Z-spread)
96.7 * (1.05) + 96.7 * (Z-spread) = 102.5
102.5 – 101.535 = 96.7 * (Z-spread)
.965 = 96.7 * (Z-spread)
Z- Spread = 0.009979
CDS spread(S) : S = PD x (1 – R)
CDS spread = .165%*(1-.833%) = 0.027555
Bond-CDS spread = CDS spread – Bond spread
= 0.027555 – 0.009979 = 0.017576

(c) Describe two of the main drivers of the Bond-CDS basis.

Commentary on Question:
On this question it was not clear to most students to indicate whether the case had a positive effect or negative – ½ marks were awarded for naming of the driver and the other ½ when the direction was correct.

Positive:
- Bond covenants protecting bondholders
- Cheapest-to-deliver option
- Higher CDS relative liquidity (widening spreads)
- Soft credit events
- Unwind of synthetic structured products

15. Continued

Negative:

- Bond issuance (in illiquid and deteriorating credit conditions)
- Bond issuer call options
- Bond repo costs
- Funding costs
- Higher CDS relative liquidity (tightening spreads)
- Issuance of synthetic structured products
- Risk on non-deliverables

(d) Demonstrate the trade you would do to take advantage of the pricing discrepancy.

Commentary on Question:
Full marks were given as long as the answer to this part was correct, even if the candidate did not relate specifically to results of (b).

If the basis is negative (positive), you could buy (borrow and short) the bond and buy (sell) CDS protection with the same maturity as the bond.

16. Learning Objectives:

6. The candidate will understand and apply portfolio management Quantitative Techniques.

Learning Outcomes:

(6c) Describe, contrast and assess credit risk measurement techniques and models.

Sources:

V-C181-10: McNeil, Frey and Embrechts, "Quantitative Risk Mangement," 2005

- Chapter 9 Dynamic Credit Risk Models and Credit Derivatives, Pages 400-408

Commentary on Question:

This question tested the candidate's understanding of risk neutral pricing methods. Candidates generally did well on the calculations in part (b), but many struggled to explain the limitations of risk neutral pricing for credit derivatives in part (a). Many candidates discussed limitations to risk neutral pricing in general.

Solution:

(a) Describe the theoretical and practical limitations of using risk-neutral pricing methods for credit derivatives. List the situations where it may not be appropriate to use a Risk Neutral pricing method for a credit derivative.

The risk neutral approach is based on the notions of the absence of arbitrage and being able to dynamically hedge to create a replicating portfolio of assets that match the derivatives payoff. Therefore to the extent these conditions may be violated, the risk neutral approach will not be appropriate to use.

(b) Consider a credit risky zero coupon bond of 1 year term with a maturity value of 100. In the event of a default, the recovery value of the bond is 65. The physical (real world) default probability is 10%. The bond is currently trading at 91. The risk-free interest rate is 5%.

(i) Calculate the implied discount rate under the physical (real world) default probabilities.

Price0 = [(Price1 | No Default) x P(No Default) + (Price1 | Default) x P (Default)] /(1+i)

91 = (100 x 0.9 + 65 x 0.1)/(1+i)

i = 6.04%

16. Continued

(ii) Calculate the risk-neutral default probability.

$91 = (100 \times (1-d) + 65 \times d)/(1+0.05)$

$d = 0.1271$

(iii) Compare the risk-neutral probability to the real world physical probability and describe why they differ.

The risk neutral default probability of 12.71% is higher than the 10% estimated physical default probability.

Risk neutral default probabilities tend to be higher because investors demand a premium for bearing the default risk.

The risk neutral default probability being higher than the real world default probability implies that the actual observed market price is lower than the real world expected price.

Interest income on corporates tends to be taxed at a higher rate than risk-free bonds (e.g. treasuries), which gives the impression that a credit risky bond is being more expensive than the default rate would suggest.

Credit risky bonds tend to be less liquid than risk free bonds (treasuries).

17. 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:

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

(8c) Identify and apply the concepts of behavioral finance with respect to investors, option holders and policyholders, including optimal behavior, real behavior, model behavior and empirical studies.

Sources:

V-C124-07: Siegel, J. Stocks for the Long Run, Chapter 7 The Great Bull Market, The New Economy, The Age Wave, and Future Stock Returns

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

V-C120-07: "The Efficient Market Hypothesis and Its Critics" by B. Malkiel, Journal of Economic Perspectives, Winter 2003

Commentary on Question:

Most candidates did well on this question with the exception of part (b). Many candidates did not mention that corporate profit growth is capped at GDP growth in the long term. Several candidates attempted to answer part (b) instead by analyzing historical trends and making subjective commentary.

Solution:

(a) Assess if the increase in the P/E ratio of N40 is likely to be anomalous or not.

The P/E ratio is not anomalous for the following reasons:

- Volatility is down, implying a more stable economy
- Unemployment is down
- Lower bid-ask spreads implies transaction costs are down
- Lower tax rates
- Reduced dividend payouts
- Lower real interest rates put upward pressure on stock prices as bonds compete less effectively for investor's dollars

17. Continued

(b) Assess your economist's predictions and their implications for growth in the N40 index.

Corporate profit growth should be capped at GDP growth. Otherwise, owners of capital are receiving a greater portion of the economic pie and labor is receiving a smaller portion. This would result in social unrest. Hence the economist's predictions are incompatible.

(c) Describe how Robert Shiller's feedback model may explain the rapid growth of the P/E ratio of N40.

When asset prices go up, creating success for some investors, this may attract the attention of the public, leading more people to want to buy the asset hoping the recent price increases will be repeated. The increased demand causes further price increases.

Eventually, the bubble bursts, and prices fall as the expectations of further price increases disappear.

The same feedback can also produce a negative bubble as downward movements propel further downward movements, promoting word of mouth pessimism.

(d) Explain what might prevent rational investors from implementing arbitrage to correct feedback bubbles.

Arbitragers who attempt to short an overvalued stock have no guarantee that irrational investors will not continue to buy into rising markets.

Limited time horizons: they also normally face short time horizons because even temporary losses may induce their clients to withdraw their money.

Unlimited potential losses: since a short position can lose an unlimited amount – the stock shorted can increase in value indefinitely – arbitragers face unlimited risk.

18. Learning Objectives:

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

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

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.

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

(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:

Formation of Investment Strategy for Insurance Companies and Pension Plans

HFIS, Chapter 20, Emerging Market Debt

HFIS, Chapter 48, Dedicated Bond Portfolios

CFA Textbook Chapter 1

Commentary on Question:

Most candidates did well describing the considerations of an investment policy in (a) and describing the strategies given in part (b). Many struggled to describe characteristics of emerging market debt in part (c).

Solution:

(a) Describe briefly how this liability schedule will impact considerations of an investment policy.

Considerations for the investment policy:
- Liability characteristics: cash flows are higher in the early years, meaning short duration investments may be appropriate.
- Liquidity: the state will need sufficient liquidity to make payments when they are due.

18. Continued

- Risk tolerance: the investment should be low risk, as the state must avoid losses and shortfalls.
- Return objective: the investment must provide sufficient returns to cover all future payments.
- Legal and regulatory factors: the agency is tax exempt so taxes are not a factor in the strategy.

(b) For each of these two strategies:

(i) Describe the strategy.

Dedicated Bond Portfolio:
- Portfolio assets cover liability cash flows for each time period

Active Immunization:
- Duration of asset portfolio is matched to liability portfolio

(ii) Describe the advantages and disadvantages of using the strategy to fund this particular liability stream.

Dedicated Bond Portfolio:
Advantage: Locks in price with very little risk
Disadvantage: Larger time and effort to execute

Active Immunization:
Advantage: Allows active management of portfolio
Disadvantage: Requires ongoing resources to maintain

(c) In response to part (b) above, a dedicated bond portfolio was developed. The cost of the portfolio was 180 MM. As an alternative to the dedicated bond portfolio approach, which would require an additional 5 MM, the prior advisor had suggested that a portion of the proceeds from the maturing bonds be invested in emerging market debt,

(i) Describe the characteristics and risks of emerging market debt.

Characteristics of emerging market debt:
- Less liquid
- Varied practice by country
- Most debt issued by Asian or Latin American countries
- Ratings have improved, wide range of credit quality available

18. Continued

Risks:

- More volatile asset class
- Other risks – currency, political, default, etc.

(ii) Describe the advantages and disadvantages of using this investment type to fund this liability stream.

Advantages

- Higher yield to cover the shortfall
- Could select bonds from different countries that may not be positively correlated, which in turn would enhance diversification

Disadvantages

- Cash flows may be volatile, and may not coincide with the liability stream