APMV Complete Illustrative Solutions
Spring 2009

1.

Learning Objectives:

2 – a. Describe and compare specialized financial instruments that can be used in the construction of an asset portfolio supporting financial institutions and pension plan liabilities

Solution:

(a)

- Collateral of non-agency MBS usually generated from loans that are not conforming to agencies (GSEs), loan size usually > $360,000 (loan limits, documentation)
- Underlying collateral is residential mortgages
- Collateral that support non-agency CMOs include:
    - Home equity loan (include other home loans)
    - Hybrid adjustable-rate mortgages (ARMs) (usually have fixed rate in the first year, then mortgage rate become adjustable – Have 'teaser rate' in early years
    - Alt-A mortgage (borrower's income is not verified – such as when borrower is self employed)
    - Jumbo loan (loan size is not conforming to agencies)
    - Subprime mortgages
    - Compensating interest (borrowers can repay the mortgages during any day of the month, but agencies guarantee and pay interest as if all prepayments occur at the end of the month. So investors get a full month's worth of interest)
    - Weighted-average coupon dispersion (the standard pooling for whole loan is looser, so higher dispersion of coupon mortgage and maturity)
    - Clean-up call provision (issuers usually have the option to pay-off outstanding debt to avoid high fixed servicing cost. Investors need to be aware of this as it will shorten the life of back-end tranches)
- Usually have credit enhancements to mitigate its credit risk:
    - External (corporate guarantee, letters of credit, bond insurance, pool insurance)
    - Internal (reserve fund, excess spread account, senior/subordinated structure)
- Subordinate classes are 'shifting' interest to cover defaults move money to senior tranches earlier

1.   continued

(b)
- Agency CMOs usually backed by government-sponsored enterprise (GSEs) such as Freddie Mac, Ginnie-Mae, Fannie Mae
- Different from agency CMOs, non-agency is not backed by full faith of US government
- Agency CMO uses a general prepayment model while non-agency CMO uses a specialized prepayment model to capture the unique characteristics of prepayment of the collateral
- The collateral is usually non-conforming loans

(c)

The effective duration of liabilities is 13 but effective duration of the assets is 7.5. Dollar duration is the effective duration times the book value. Therefore, the dollar duration of the liabilities is much higher than the dollar duration of the assets. Assuming the non-agency CMOs have the same effective duration as the CMOs currently backing the Traditional line of business, increasing the exposure to non-agency CMOs would lower the dollar duration of the assets since the effective duration of the CMOs is 4.5.

This new investment is not appropriate since it lowers the dollar duration of the assets. Instead of lowering the dollar duration of the assets, LifeCo should increase the dollar duration of the assets.

A better strategy would be to increase the exposure to Government securities or investment Grade public corporate bonds.
- Agency have less prepayment risk and have virtually no credit risk
- Non-agency CMOs have more prepayment risk and credit risk
- Investing in non-agency CMOs is not appropriate for the traditional line. First, CMOs are subject to prepayment risk so duration is uncertain. Non-agency CMOs are also subject to high credit risk due to subprime mortgages, so it poses high risks for not meeting the obligations
- Life Co would also like to reduce credit risk as the current portfolio already has higher low grade bonds than the target, but investing in non-agency CMOs will add credit risk
- Risk: prepayment risk, extension risk, default risk
- Main risk is prepayment risk. As interest rates decrease, many prepayments may occur to refinance
- CMOs are not a good idea – will result in interest rate risk, reinvestment risk, and if non-agency, have credit risk
- If the CMOs prepay, it will happen when rates are low and reinvestment will be at low rates causing spread compress
- Non-agency CMOs have servicer bankruptcy risk

1. **continued**

(d)

- From the Assets and Liabilities Income sheet on p. 11, CMOs have duration of 4.5. This will not decrease the duration Gap, unless the new CMOs have a higher duration
- They also have a negative convexity
- The strategy would not comply with the policy as they are not listed. They are not a good source of guaranteed return.
- Traditional life has mismatching of D (A) – D (L). D (A) is 7.6 which is shorter than D (L) = 13.0. However non-agency CMOs have prepayment risk. Once interest rates fall, non-agency CMO may refinance depending on credit quality, loan rate, economy situation, balance size, seasonal effect.
- Usually non-agency CMO has low credit quality. Therefore, they have high loan rate. If their incentive to refinance has been increased and they have alternatives to refinance, prepayment risk exists. It reduces duration of assets even further. Asset liability mismatch gets serious.
- Life Co's investment policy has ALM guidelines. It has guidelines for asset quality. Credit risk exposure should be diversified and monitored. Non-agency CMOs have a problem on credit risk unless they have extra enhancements.
- Also, Traditional Life has guidelines for duration and scenario tests to comply with the guidelines. Non-agency CMOs have volatile cash flows. To sum, non-agency CMO usually in conflict with current investment policy.
- Life Co would like to minimize the duration mismatch of traditional line. According to the current portfolio, CMO only have a duration of 4.5, so it cannot correct the mismatch problem unless it is invested in very long tranches.

2.

Learning Objectives:

The three syllabus materials discuss application of benchmarks to fixed income portfolios. This question would have three parts. First, would ask for a general description of the benchmarking process as it is applied to fixed income portfolios. Second, would be to analyze and recommend a customized benchmark for Life Co's accumulation annuity portfolio. Third, would be to discuss the issues/challenges in selecting fixed-income benchmarks.

Solution:

(a)

- Formulate an investment policy in terms of limits to
  - Diversification and liquidity requirements
  - Duration targets

- Select a benchmark
  - A standard benchmark
  - Or a customized benchmark

- Analyze a portfolio relative to the benchmark along multiple risk dimensions to identify exposures

- Quantify risk exposures based on historical volatilities and correlations

- Compare projected portfolio performance versus its benchmark under a set of scenarios

- Establish a methodology for replicating the benchmark return in absence of a market view and creating proxy portfolios

- Optimize the portfolio subject to constraints on deviation from the benchmark

- Attribute achieved return to risk exposures taken

(b)

Dollar Duration of Index Assets	$1,500 \times 6.5 =$	9,765
Dollar Duration of Liabilities	$1,500 \times 4.7 =$	7,050
Dollar Duration of Index Assets less Liabilities		2,715
	Required DD of $1,500 \times 0.3$	450

Dollar duration of XYZ Index is greater than the ALM guidelines

2. **continued**

(c)

(i)

Current Assets	Book Value	% of Total
Government	59	4%
Total Investment Grade Corporate	728	49%
Total Below Investment Grade Corporate	258	17%
Mortgage Products	369	25%
Equity	19	1%
Cash	30	2%
Other	38	2%
Total	1,500	100%

- Total Investment Grade for XYZ Index is 47% (32% + 15%) versus 49% for current assets, which fits well
- Total Below Investment Grade for XYZ Index is 8% (5% + 3%) versus 17% for current assets, which does not match well
- Total Mortgage Products for XYZ Index is 25% versus 25% for current assets, which fits well
- Total Equity for XYZ Index is 20% versus 1% for current assets, which does not match well
- XYZ Index does not have any allocation to Government and Cash positions which does not match well

(ii)
- An appropriate benchmark should match the desired or required strategic allocation of portfolio assets so that the portfolio manager is able to "buy the benchmark" when and if he so desires
  - The standard weighting for XYZ Index is not appropriate for the current assets
- Goal should be to keep the benchmark as broad based and well-diversified as possible while still meeting all the requirements of the investment policy
  - XYX Index is broad based and well-diversified
- Even with customized weights, the objectivity of the benchmark should be preserved in order to allow for historical analysis

(d)

Duration Problem
  The duration problem is the fact that the duration of the benchmark comes from issuer preferences and is not necessarily the duration that a given investor should hold

"Bums" Problem
  The bums problem is that the biggest debtors have the largest weights in the benchmarks

3.

Learning Objectives:

Explain how an investment policy and an investment strategy can help manage risk and create value

*This question asks candidates to demonstrate mastery of investment policy statements, and practical concerns in selecting a new or existing portfolio in which to place a new line of business. The best sources for answering the question can be found in the CIA guidance note: **An Overview of an Investment Policy Statement in an Asset/Liability Management Context**, p. 3-7 and V-C137-09, FET 125-07; **Introduction to the Formation of Investment Strategy for Life Insurance Companies and Pension Plans**, section 4.0: Investment Strategy Considerations.*

Solution:

(a)

Objective of the Business
- The LTC product is an insurance product that takes in a large amount of premium at the initial durations in relation to claims and pays out much more in benefits at later durations in relation to premiums.
- Because of the long term nature of the risk, it is essential to invest the early excess premiums in order to support the long term expected claims. The pricing interest rate needs to be set in conjunction with the investment team – can we meet or beat it?

Description of Liabilities
- Long term as stated above but sensitive to interest rates if product is fully guaranteed and interest rates rise; could see higher lapses; also have to be careful about increasing life expectancy – if people require care longer than expected, benefit payments may be needed longer than invested for

Risk Tolerance

Marketability / Liquidity
- Key risk on LTC is having to pay benefits earlier than expected or for more than expected.

Accounting / Regulatory Tax

Asset Mix Target / Portfolio Management
- Risk and diversification constraints; horizon is the most important consideration

Performance

Procedures / Authorities

3.   continued

(b)

Closed block of traditional life
- Duration of liabilities is very long and it is difficult to find long assets to back this line of business, similar to LTC
- Some benefit in combining, best of all 3 options presented

UL Block:
- Not a good idea to combine with this segment, since the duration of the UL block is much shorter – it is interest rate sensitive because of crediting rate strategy
- Not a good idea to combine the two for investment purposes

Accumulation annuities
- Deferred annuities are often rate sensitive (crediting rates of 1-5 years typical) similar to UL so not a good match with LTC (30+ years)
- Accumulation stage of these annuities has similar cashflow profile to LTC, very large inflows followed by large outflows down the road
- Could still combine but just manage independently but similar investment strategy – could use shorter term bonds plus equities on annuities and long term bonds plus equities on LTC

(c)

Economic outlook
- Key message here is that the policy needs to be flexible enough to allow the fund manager to wait to execute if current conditions are not optimal; better to invest in cash and wait then to invest for such a long term and destroy value

Asset Mix and Expected Returns
- Asset mix is more important than individual security selection so need to be careful to make the best choices for asset mix (weighting and type) given long term needs

Liability Characteristics
- Important to have good liability cashflow models available; cashflow forecasting is crucial to making best investment decisions and also ability to update the forecasts and provide a reconciliation, forecasts should start from current period (less than 1 year) and go to the last significant outflow, which can be more than 30 years out

Liquidity
- Needs are next to 0 in the first 10 years or so, then becomes more, then great at 20-30 years+

3.   continued

Taxes
- Risk tolerance is the same for other segments – only difference here is that this line will require longer term assets and likely derivatives, so be sure competence exists, if not, could outsource, seek assistance, ensure proper controls in place
- If derivatives used to forward invest early positive cashflows, ensure there is a monitoring system in place, want to ensure there is effective hedging in place so that there are no surprises (either economic or tax / regulatory)

4.

Learning Objectives:

1 – b. Identify the obligations of a fiduciary in managing investment portfolios and show how they apply in a given situation.

Solution:

(a)

Reference: Managing your Advisor – V-C138-09 p. 22-23 – Items 1-6 as relevant

Accountability
- ALM committee review type and amount of purchase; inv dept executes trade; finance is responsible for accounting reporting.

Permitted Uses
- Hedging only for improving risk management
- Investment risk reduction – same idea as above; could buy a Corp A bond and protect against 1 downgrade or 2 or whatever mgmt is comfortable with
- Replication – could be an option here since could write the CDS and hold governments, which means you are holding a lower rated security

Type of derivatives allowed
- CDS are on approved list

Counterparty restriction
- Need to have exposure limits to names, especially important on CDS's

Derivative Portfolio exposure limits
- Should establish a limit in the portfolio and for the company (via the surplus segment) – should be tied to maximum tolerance for loss (say no more than 5% of segment and/or 5-10% of surplus but this will depend on actual level of surplus versus required) – could look at VAR analysis

Internal Controls
- Ensure they are appropriate and consistent with other derivative policies – key point here is monitoring external environment and terminate program if conditions deteriorate, ensure diversification and do not over expose to one issuer or sector
- FAS 133

4.   continued

(b)

Reference: LifeCo case study – p. 12, 30, 32 Non-Trad segment

- Sell protection to a protection buyer
- LifeCo receives a fee (130 bps of notional)
- LifeCo will pay in the event the mortgage defaulted up to the notional amount
- Must specify in the contract what constitutes default
- Could invest more heavily in MBS and offset risk by purchasing CDS, payout 130 bps fee, but are covered in case of a default, this effectively rises the credit standing of the MBS

(c)

Reference: LifeCo cast study – p. 12, 30, 32 Non-Trad segment

- Current yield = 7.17%
- Current exposure = 400 million
- Target yield = 7.25%
- Need yield $(7.25\% - 7.17\%) \times 400 = 0.32M$

- Need to sell $= \dfrac{0.32}{1.3\%} = 24.6$ notional amount of CDS

(d)

Reference: Maximum loss determined by reviewing Term Sheet from Case Study p. 32

- If recent downgrades indicate an expected increase in defaults, then LifeCo may need to pay out claims on its CDS contracts
- Losses are capped at 24.6 million notional
- Losses aren't likely to reach 24.6 million because of recoveries in the mortgages
- Pay outs are commonly (Notional – Market value of mortgage) if the credit event is triggered

(e)

Reference: Fiduciary study note FET-128-07 p. 5, 8, 10

Fiduciary obligations
- Loyal
- Make property productive
- Diversify
- Delegate appropriately
- Act in accordance with trust
- Fiduciary obligation is not to take excessive risk w/ principal
- This strategy has big downside risk
- Is consistent with LifeCo fiduciary obligations

5.

6 – a. Define and evaluate credit risk as related to fixed income securities, derivatives, and reinsurance ceded.

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

This is a computation and analysis question asking candidates to assess credit risk of fixed income securities issued by a particular company and a fixed income portfolio of an investor by using different credit risk measurements. Then the candidates are asked to evaluate the advantage and disadvantage of these credit risk measurements. The expected answers are based on the content of chapter 9 and chapter 10 of Michel Crouhy, Robert Mark, Dan Galai, "Risk Management," 2001. Credit is given to those answers that could correctly calculate the credit risk under each credit risk measurement and could correctly assess the advantage and disadvantage of each credit risk measurement.

Solution:

(a)

KMV approach: (Risk-neutral)

Asset value $V_0 = 120,000$

Face value $F = 120,000$

Risk free rate $r = 4\%$

Volatility $\sigma = 30\%$

Time to maturity $T = 1$

$$d_1 = \frac{\ln\left(\frac{120}{120}\right) + \left(0.04 + \frac{1}{2} \times 0.3^2\right)1}{0.3} = 0.28\overline{3}$$

$$d_2 = 0.28\overline{3} - 0.3\sqrt{1} = -0.017$$

$$N\left(-d_2\right) = \text{Risk-Neutral Default Prob} = N\left(0.017\right) = 0.5080$$

(Real World)

Use the expected return $\mu = 15\%$

5. **continued**

$$DD = \frac{\ln\frac{V_0}{F} + \left(\mu - \frac{1}{2}\delta^2\right)T}{\delta\sqrt{T}}$$

$$= \frac{\ln\left(\frac{120}{120}\right) + \left(0.15 - \frac{1}{2}(0.3)^2\right)1}{0.3\left(\sqrt{1}\right)}$$

$$= 0.35$$

Real World Default Prob $N(-DD) = N(-0.35) = 0.3632$

(b)

Expected recovery discounted to time 0

$$= \frac{N(-d_1)}{N(-d_2)}V_0$$

$$= \frac{N(-0.28)}{N(0.02)} \times 120,000$$

$$= \frac{0.3897}{0.5080} \times 120,000$$

$$= 92,055$$

Expected recovery at time 1

$$= 92,055 \times e^{0.04\times1}$$

$$= 95,812$$

Loss given default discounted to time 0

$$= 120,000e^{-0.04\times1} - 92,055$$

$$= 23,239.7$$

Loss given default at time 1

$$= 23,239.7 \times e^{0.04\times1}$$

$$= 24,188.1$$

5. **continued**

(c)

Band	Expected Loss
1	$\sum LGD_A P_A = \sum \text{Exposure}_A(1-\text{Recovery})(P_A) = 120,000(1-0)(0.012) = 1440$
3	$250,000(1-0)(0.0002) + 323,000(1-0)(0.005) = 1665$
6	$1322.7 = \left[620(0.0012) + 643(0.0009)\right](1000)$

Number of defaults in band 6 $= \bar{n} = \dfrac{EL_6}{L_6} = \dfrac{1322.7}{600,000} = 0.0022 = 0.22\%$

(d)

KMV Approach (Contingent Claim Approach):

Uses Merton:

Assumes assets $= V_0$ equal equities (E_0) plus a bond with face value F

and market value B_6.

Credit event: downgrades / default
Risk Definition: Default Loss
Analysis Type: Simulation / Analytic

Disadvantages of KMV:
Constant interest rate
Assume all debt is zero coupon debt, so it does not consider the case when default occurs due to missed coupon payments
Asset volatility and asset correlation are not observed and difficult to estimate
Seniority of debt not considered

Extensions to the model have been made to factor in these disadvantages (Geske, Longstaff, etc.)

Credit Risk+ Model

Only deals with downgrades
Uses Poisson distribution for defaults

$P(\text{\# of defaults} = n) = \dfrac{\bar{n}^n e^{-\bar{n}}}{n!}$

Exposures calculated through banding technique used in part (c)
Risk Definition: Default Losses
Analysis Type: Analytic

5. continued

Advantages of Credit Risk+:
Easy to Use
Calculates marginal losses by obligor
Does not require a lot of info

Disadvantages:
Does not account for migration risks
Does not consider credit and market risk together
Not good for nonlinear options

6.

Learning Objectives:

> **5 – k**. Demonstrate how to apply funding and portfolio management strategies to control equity and interest rate risk, including key rate risks. Explain the concepts of immunization including modern refinements and practical limitations.

> **Source:** Babbel & Fabozzi, Chapter 31, Pages 433 - 441

Solution:

(a)

Spread Risk
- The risk of widening and narrowing of the Option Adjusted Spread (OAS)
- It is used to compensate for the extra risk inherent in mortgage backed securities
- OAS is calculated by projecting cash flows using a prepayment model
  - Use prepayment model that assigns an expected prepayment implying an expected cash flow – for a given interest-rate path
  - Discount these expected cash flows at U.S. Treasury rates plus OAS to obtain their present value
  - Average the present value of the cash flows across all paths
  - OAS is selected such that the average price is equal to the observed market price of the security
- OAS is very sensitive to the prepayment model structure
- Normally do not hedge this risk

(b)

Interest Rate Risk
- The interest-rate risk of a mortgage backed security corresponds to the interest rate risk of comparable Treasury securities
- This risk can be hedged directly by selling a package of Treasury Notes or interest-rate futures
- Duration is the normal quantification of interest rate risk
- Interest rate curves normally do not move in tandem
- Shorter term rates (2 year) normally move twice as much as longer term rates (30 years)
- Interest rate movement could be explained by two factors or effects: level effect and twist effect

6. continued

(c)

Prepayment Risk

- The risk average lives (or durations) of mortgage backed securities vary as interest rates change due to prepayment behavior
- The average lives extend as interest rates rise and shorten as interest rates fall
- The percentage decline in price declines faster as interest rate rise : negative convexity
- Dynamically hedge using package of Treasury notes or interest-rate futures or options
- By both dynamically hedging and buying options will entail some form of premium. Buying futures – after prices have risen and selling futures after prices fall (buy high, sell low)

(d)

Volatility Risk

- The embedded option of the homeowner's prepayment tends to be more valuable when future interest-rate volatility is expected to be high than when it is expected to be low
- OAS spreads tend to widen when expected volatility increases and narrow when expected volatility declines
- If one believes the implied volatility is overstated as compared to the expected future volatility, then it will be more economical to do dynamic hedge, otherwise the purchase of options will be more economical

(e)

Model Risk

- The risk that the prepayment model is wrong
- Models calibrated to past behavior will understate the impact of innovation
- Cannot be hedged explicitly but could keep portfolio exposure in line with that of the indices

7.

Learning Objectives:

> **6 – a.** Define and evaluate credit risk as related to fixed income securities, derivatives, and reinsurance ceded
>
> **6 – f.** Recommend a credit risk management strategy for a given situation

Solution:

(a)

Rating		Expected Percentage in 12 months
Aaa	$(0.05 \times 0.85) =$	4.25%
Aa	$(0.05 \times 0.10) + (0.10 \times 0.8) =$	8.50%
A	$(0.05 \times 0.05) + (0.10 \times 0.10) + (0.30 \times 0.75) =$	23.75%
Baa	$(0.10 \times 0.05) + (0.30 \times 0.10) + (0.50 \times 0.75) + (0.05 \times 0.05) =$	41.25%
Ba	$(0.10 \times 0.05) + (0.30 \times 0.10) + (0.50 \times 0.10) + (0.05 \times 0.65) =$	11.75%
B	$(0.30 \times 0.05) + (0.50 \times 0.10) + (0.05 \times 0.15) =$	7.25%
Caa – C	$(0.50 \times 0.05) + (0.05 \times 0.10) =$	3.00%
default	$(0.05 \times 0.05) =$	0.25%

(b) Credit default swaps (CDS) can be thought of as insurance against default of some underlying instrument.

A protection buyer (seller of credit risk) makes periodic payments of a negotiated number of basis points times the notional amount of an underlying bond or loan.

The protection seller (buyer of credit risk) makes no payments unless underlying bond or loan defaults.

In the event of default, the protection seller pays to the protection buyer a default payment equal to the notional amount, minus pre-specified recovery factor.

CDS contract will need to clearly define events and typically contains materiality clause requiring that change in credit status be validated by 3rd party evidence.

(c) CDS can be used to protect against downgrades and defaults in economic downturn. Company can either buy single name CDS on holdings they feel are most vulnerable to an economic downturn. They may also consider buying a first to default put based on the economically sensitive exposures in the portfolio.

8.

Learning Objectives:

3 – a. Describe asset allocation strategies that can be used to construct an asset portfolio

This question focuses on the reverse optimization procedure described in William F. Sharpe's paper "Expected Utility Asset Allocation" (SN V-C151-09). This procedure can be used to set realistic inputs for an asset allocation study.

Solution:

(a)

The reverse optimization procedure:
- Collect data on historical returns in each scenario for each security
- Calculate the mean, standard deviation, correlations for the assets
- Collect information on current risk-free rate, market risk premium and relative values for the assets.
- Calculate historical excess return (over risk-free rate) for each asset
- Compute covariance & correlations from assets
- Calculate the beta for each asset
- $\text{Beta}(A) = \dfrac{\text{Cov}(A, \text{Market})}{\text{Var}(\text{Market})}$
- Calculate the expected return for each asset using CAPM
- Expected Return = Risk-less rate + Beta × Market risk premium

(b)

- Better starting point – reverse optimization assumes market is in equilibrium and the market portfolio is consistent with the mean – variance efficient portfolio
- More stable inputs – historical volatility and correlation are relatively stable compared to historical returns, which is very sensitive to the time period used
- Reflect the assumption that major asset classes are informationally efficient and are priced reasonably
- Find the set of expected returns that would give the market portfolio as a solution

8. **continued**

(c)

- Let C = Cash, B = Bonds, S = Stocks, M = Market
- $\text{Cov}(C, M) = 0$
- $\text{Cov}(B, M) = 0.1 \times 0 + 0.4 \times 0.003 + 0.5 \times 0.006 = 0.0042$
- $\text{Cov}(S, M) = 0.4 \times 0.006 + 0.5 \times 0.0031 = 0.0179$
- $\text{Var}(M) = 0.4 \times 0.0042 + 0.5 \times 0.0179 = 0.01063$
- $\text{Beta}(C) = 0$
- $\text{Beta}(B) = \dfrac{0.0042}{0.01063} = 0.3951$
- $\text{Beta}(S) = \dfrac{0.0179}{0.01063} = 1.6839$
- Exp. Return $(C) = 0.03 + 0 \times 0.04 = 0.03$
- Exp. Return $(B) = 0.03 + 0.3951 \times 0.04 = 0.04580$
- Exp. Return $(S) = 0.03 + 1.6839 \times 0.04 = 0.0974$

9.

Learning Objectives:

A – Explain how behavioral characteristics of individuals or firms affect the investment or capital management process.

B – Describe how behavioral finance explains the existence of some market anomalies

C – 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.

Solution:

(a)

Behavioral Biases
- Cognitive Illusions
- Representativeness
- Confirmation Bias
- Anchoring / Extrapolation
- Misconceptions of Randomness
- Mental Accounting
- Regret Aversion

(b)

Social Groups

Crowds
- Diverse Backgrounds
- No Social Cohesion
- Uses wider variety of information sources

Committees
- Homogeneous
- Task Oriented
- Under pressure to conform
- Overconfident in abilities

(c)

Efficient Market Impact/Breakdowns
- Over-reaction or under-reaction to information
- Long run reversals
- Seasonal patterns
- Day of the week patterns
- Size Effect
- Use of dividend yield to predict price

10.

Learning Objectives:

4 – c. Evaluate complex situations associated with the presence of embedded options, hedging strategies, accounting consideration, taxation and capital requirements under a rage of economic environments.

The question related to setting an investment strategy using options. The main source is the text "Investment Management for Insurers" by Babbel & Fabozzi, Ch. 26.

Solution:

(a)

A collar is recommended to hedge concerns. This option strategy can be costless using one long put option and two short call options.

(b)

The payoffs of the option strategy are shown below:

	$S < Kp$	$Kp \leq S \leq Kc$	$S > Kc$
Portfolio	S	S	S
Long Put	$Kp - S$	0	0
2 Short calls	0	0	$-2(S - Kc)$
Total Payoffs	Kp	S	$2Kc - S$

Kp is the strike price of the put
Kc is the strike price of the call
S is the index level when the options are exercised

(c)

The portfolio will experience a maximum loss of 40 if the index level falls below 875.

Alternatively, the portfolio will experience a one for one loss with increases in the level of the M&P 500 above "Index," where:

$$2Kc - Index - 875 < 0$$
$$2 \times 920 - Index - 875 < 0$$
$$Index > 965$$

11.

Learning Objectives:

2 – a. Describe and compare specialized financial instruments that can be used in the construction of an asset portfolio supporting financial institutions and pension plan liabilities

Readings:
SN V-C165-09, SN V-C166-09, SN V-C177-09, Risk Management (Crouhy)

Solution:

(a)
- Diversify risks by pooling assets
- Choose appropriate tranches to reflect an investor's own risk-reward profile
- Enhance yields
- Manage regulatory capital more efficiently
- Originate more loans without funding them
- Generate fee income
- Make illiquid loans more liquid
- Cost less to create SFP with technological advance
- Access to previously unavailable markets

(b)
- Credit ratings have been erroneously perceived to provide a common risk metric for SFP and all fixed-income instruments
- Ratings do not measure the likelihood of intensity of downgrades or mark-to-market losses
- Slow to recognize the deterioration of some of the fundamental inputs to the rating methodology
- Rating agencies may have a conflict of interest when their fees are paid by the issuers
- Ratings methods do not appropriately account for correlation and diversification of the assets in a pool

(c)
- Investors need to understand the risks inherent in investments, not to rely heavily on ratings from the rating agencies, and need to perform own due diligence
- Avoid the incentives for loan originators and aggregators / managers that are not aligned with the incentives for investors
- Do not ignore tail risks when dependency between the individual pool and general economic condition can increase in the worst case
- Through mitigation techniques, reduce exposures to eliminate adverse outcomes from stress scenarios. Develop an exposure limit for each risk
- Create culture to foster long-term risk-reward decisions instead of short-term profit takings

12.

Learning Objectives:

  1 – e. Explain principles of risk-based capital management and their impact upon portfolio management.

  This question on capital is particularly timely given the financial crisis. Capital has been a major concern. The question pushes the candidate to think critically about the difference among several capital bases and understand economic capital, which will likely become more important going forward. See study notes **Specialty Guide on Economic Capital***, Pages 21 – 43 and* **New Insurance Capital Model Embraces Trend in Risk Management***, Pages 1 –2.*

Solution:

(a)

  Regulatory and rating agency capital requirements are motivated fundamentally by solvency concerns.

  Rating agencies are also concerned with the level of financial strength and general credit worthiness of an organization.

  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.

  The motives behind calculating Economic Capital concern "appropriate" allocation of capital to the risks undertaken by the company.

  The level should be sufficient for a going-concern entity and reflect the degree of contribution of risk to the company.

  However, capital levels required by the regulator and rating agencies create an overall constraint as to the amount of capital held by the firm.

(b)

  There are a number of different approaches to calculating EC:
- Full economic scenarios
- Stress test method
- Factor table
- Stochastic models
- Scenario generator
- Statistical methods: Mean-variance-Covariance Model
- Credit risk method: Frequency & severity / recovery models
- Operational risk method: Frequency & severity / recovery models
- Option pricing theory / Black Scholes model
- Adjustments for correlation

12. continued

(c)

Solutions as follows:

Method	Advantage	Disadvantage
Hold in Corporate Line	Simple Insulate product lines from vagaries of required capital formulas	Could lead to over investment in lines of business that tie up excessive required capital
Marginal	Attempt to allocate true cost of face capital for adding given line of business	Complicated
Pro-rata	Simple Allocates face capital to business units	May allocate large amount of face capital to LOB that generated none and vice-versa
Treat each LOB as if monoline	Easier to understand than Marginal approach Neither helps nor hurts a given LOB due to presence of other LOBs	May allocate large amount of face capital to LOB that adds little required capital due to diversification

(d)

CRO's method is inappropriate for two reasons. First, EC should adjust the capital that is included under reserves. Secondly, these three risks are not mutually independent, so a covariance adjustment is needed.

(e)

Risks covered in FPC are financial market risk, credit risk and operational risk. Risks that are not specifically included in these three categories may be analyzed using Standard & Poor's traditional capital modeling and then added to the capital adequacy requirements determined by FPC model.

13.

Learning Objectives:

4 – b. Assess a portfolio position against portfolio management objectives and recommend a strategy to rebalance the portfolio.

Portfolio rebalancing strategies are reviewed in this question based on the material from Ch. 11, of the Maginn & Tuttle textbook.

Solution:

(a)

Rebalancing benefits – the two statements are correct, also with the following
- Maintain desired systematic risk exposure
- Reduce present value of expected losses from not tracking optimal strategic asset allocation
- Disciplined rebalancing tends to reduce risk while adding value, historical data suggests

(b)

Percentage-of-portfolio rebalancing – correct
- Rebalancing corridors are set as a % of portfolio value
- Rebalancing can occur any calendar date
- Tighter control since rebalancing is related to market result

(c)

Percentage-of-portfolio monitoring frequency – incorrect
- The more frequent monitoring, the greater precise the rebalancing
- Required monitoring at an agreed-upon frequency

(d)

Transaction costs – incorrect
- Illiquid investments, e.g. private equity and real estate, have a higher transaction costs
- Liquid assets also have transaction costs
  - Observable costs, e.g. commissions
  - Bid-ask spread
  - Market impact
    - Difference between realized price and the price that would have been in absence of the order
  - Opportunity cost
    - The cost of the trades one seeks but fails to execute
  - Tax costs

13. continued

(e)

Tax costs are not important – incorrect
- This rebalancing is buying appreciated assets – incorrect
    - This is selling appreciated assets and buying depreciated ones, opposite to what statement says
- Sales of appreciated assets may trigger a tax liability for taxable investors
- Tax rates may be different for gains between short term investments and long term ones
- Rebalancing can be costly if incurs capital gains

(f)

The corridor – incorrect
- Should be based on the following five factors
    - Transaction cost
        - The higher the transaction cost, the wider the corridor
        - Not worth rebalancing if costs > benefits
    - Risk tolerance
        - The higher the risk tolerance, the wider the corridor
        - Clients less sensitive to straying from desired mix
    - Correlation with other asset classes
        - The higher this correlation, the wider the corridor
        - The mix is less likely to diverge
    - Volatility
        - The higher the volatility, the narrower the corridor
        - Further divergence is likely

(g)

The corridor for equity – incorrect
- The corridor should be set narrower for asset classes with higher volatility
- Corridor of Corporate Bonds $= \dfrac{5\%}{50\%} = 10\%$
- Corridor of Mortgages $= \dfrac{4\%}{40\%} = 10\%$
- Corridor of Equities $= \dfrac{2\%}{10\%} = 20\%$
- The recommended corridor for equities should be less than 10% because equity's volatility is considered higher

14.

Learning Objectives:

4 – e. Recommend an investment strategy for a given situation.

This question touches on the material from Chapter 26 of Litterman's <u>Modern Investment Management: An Equilibrium Approach</u>, as well as Chapter 8 of Maginn & Tuttle's <u>Managing Investment Portfolios</u> dealing with hedge funds. The candidate is expected to demonstrate understanding of issues relating to the measurement and evaluation of hedge funds, as well as the process of developing a hedge fund allocation.

Solution:

(a)

Survivorship bias
- Hedge fund managers are dropped from an index if they stop reporting performances to the index providers

Backfill bias
- Hedge funds don't report to index until after a few good years

Invest-ability
- Hedge funds may not be open to new investors. Some of the hedge funds no longer accept new assets

Transparency
- Some index providers don't disclose names of hedge fund managers

Incorrect fund categorization
- Hedge fund managers self report style, category, which they do not manage capital

Frequency of reporting
- Report only monthly, not enough to see all peaks. Understate a fund's true peak to trough losses

Leverage measurement
- Funds use different leverage amounts, difficult to calculate leverage

Constituent weightings
- Some indexes equal weight, giving too much weight to small funds

Completeness
- Some of the best managers do not report to an index

14. continued

(b)

The returns achieved
- May be affected by reporting and compounding frequency
- Could look at the rolling return

Volatility
- Standard deviation
  - Might not correctly represent the actual risk of hedge fund's strategies
- Downside volatility
  - Does not penalize high positive returns
- Drawdown

Performance appraisal measures
- Sharpe Ratio
  - Has a number of limitations and can be gamed
- Sortino Ratio
  - Replaces standard deviation with downside deviation
- Gain-to-loss measure
  - Measures the ratio of positive returns to negative returns over the period of time

Correlations
- Correlations provide information on diversification benefit in a portfolio context
- Most meaningful when returns are normally distributed

Skewness and kurtosis
- Affect risk profile

Consistency
- Most relevant when comparing fund of the same style or strategy

(c)

Calculate downside deviation

$$\text{Downside deviation} = \sqrt{\frac{\sum_{i-1}^{n}\left[\min\left(r_2 - r^s, 0\right)\right]^2}{n-1}}$$

Use the risk-free rate as the threshold rate

$$\text{Yr1 } \min\left(0.11 - 0.3, 0\right)^2 = 0$$

$$\text{Yr2 } \min\left(-0.10 - 0.04, 0\right)^2 = 0.0196$$

$$\text{Yr3 } \min\left(0.02 - 0.02, 0\right)^2 = 0$$

$$\text{Yr4 } \min\left(0.10 - 0.01, 0\right)^2 = 0$$

$$\sqrt{\frac{0 + 0.0196 + 0 + 0}{2}} = 8.08\%$$

14. continued

Calculate maximum drawdown

- Maximum drawdown is the largest difference between a high-water point and a subsequent low

High-water after year 1 $111

Subsequent low: $99.9

$$MD = 111 - 99.9 = 11.1$$

Calculate Sharpe ratio

$$SR = \frac{\text{return} - \text{risk-free rate}}{\text{standard deviation}}$$

Average return = 0.0289

Average risk-free rate = 0.0249

Standard deviation = 0.097

$$SR = \frac{0.0289 - 0.0249}{0.097} = 0.0412$$

(d)

Investing in Hedge-It-All is appropriate if

- The investor is a high net worth individual seeking alpha, high absolute returns and portfolio diversification benefits
- The investor understands risk associated with investing in hedge funds
- Diversification benefits offered by the fund are attractive in the context of the portfolio
- Downside deviation value is not higher than investor's tolerance
- Sharpe ratio for the entire portfolio plus the hedge fund is sufficiently higher than without
- Investor has done the due diligence on other aspects of the fund, such as administration, etc.

(e)

Allocation to HF

- First identify a potential hedge fund portfolio structure and then assess the volatility of this structure and its correlation with other asset classes
- Ideally, the hedge fund portfolio would be structured so that the allocation of risk across fund strategies would be consistent with an investor's views about expected returns
- We would like to know how the overall portfolio volatility is distributed across the various asset classes
- We would like to understand the impact on portfolio risk and return of allocation a portion of the portfolio away from each of the asset classes and into hedge funds
- An analyst uses historical time series data to estimate the expected return, volatility, and correlation of returns for various asset classes.

14. continued

However
- Optional portfolio weights are incredibly sensitive to small changes in expected return assumptions
- Instead of asking what the portfolio weights should be on the basis of specific expected return assumptions, we instead ask what return can justify a specific allocation
- We call the returns the implied hurdle rates

15.

Learning Objectives:

7 – c. Describe and assess performance measurement methodologies for investment portfolios

This material looks at the process and application of RAROC (risk-adjusted return on capital). Tthere are various approaches to develop measurements for Credit Risk, Market Risk, and Operational Risk.

Solution:

(a)

RAROC is set to provide a cushion against unexpected losses
- Cushion based on a desired confidence level, usually corresponds to the targeted credit ratings
- e.g. AA rating corresponds to a confidence level of 99.96%

Component of RAROC
Credit Risk
- Risk of a loss due to a change in credit quality of an asset
- Probability of default function of risk rating or some structured algorithm
- Capital charge is for credit risk is capital factor time market value of position
- Capital factors can be obtained from rating agencies, external models or internal models

Market risk
- Risk of losses due to a change in interest rate and any price factors
- Capital allocation is based on Value at Risk (VaR)
- There is charge for unused capital and penalties for exceeding limits

Operational Risk
- The risk of daily business operation, mismanagement, computer failure, inefficiency, poor documentation
- Difficult to quantify
- Needs to rely on judgment

15. continued

(b)

Market Risk

$$= F1 \times \text{VaR} + F2 \times \left(\text{VaR limit} - \text{VaR}\right)$$

$$= \left(10,000,000 \times 2\right) + 0.15 \times \left(12,000,000 - 5,000,000\right)$$

$$= 11,050,000$$

Credit Risk

$= \text{Market Value of loan} \times \text{Credit factor}$

$= 970,000,000 \times 1.89\%$

$$= 18,333,000$$

Operational risk

$= \text{Operational VaR}$

$= 1,000,000$

Total RAROC capital

$= \text{Market Risk Capital} + \text{Credit Risk Capital} + \text{Operational Risk Capital}$

$= 30,383,000$

(c)

$$= \frac{\left(\begin{array}{l}\text{Earned} - \text{Credited} - \text{Inv Expenses} - \text{operating costs} - \\ \text{expected losses} + \text{Earned on Economic Capital}\end{array}\right)}{\text{Economic Capital}}$$

$$= \frac{\left(1,000,000,000 \times \left(6.8\% - 4\% - 0.1\% - 1.5\% - 1.0\%\right) + 30,383,000 \times 6\%\right)}{30,383,000}$$

$$= 12.6\%$$

(d)

- RAROC rate of 12.6^ is below hurdle rate of 15%, so I do not recommend that investment.
- Economic value would decrease by $734,470
  $$\left(= 30,383,000 \times \left(12.6\% - 15\%\right)\right)$$

16.

Learning Objectives:

5 – a. Explain the rationale for managing risk and for the selection of the appropriate hedging level.

5 – b. Identify and describe financial and non-financial risks faced by an entity, including but not limited to currency risk, credit risk, spread risk, liquidity risk, interest risk, equity risk, product risk, operational risk, legal risk, and political risk.

5 – c. Assess the overall corporate risk exposure arising from financial and non-financial risks

5 – d. Define risk metrics to quantify major types of risk exposure in the context of an integrated risk management process

5 – e. Explain the limitations of risk metrics

5 – f. Describe risk management techniques that can be used to deal with financial and non-financial risks listed in 5-b.

Solution:

(a)

There are risks beyond those that have been modeled.
These include Legal, Regulatory, Reputational, Operational and Environmental.
The model's assumptions may not have picked up something that is currently unknown.

(b)

Description
- Simple single factor yield to maturing approach
- All points on the yield curve are shifted up or down by the same amount
- If change is small then good for duration analysis

Appraisal
- Not realistic. Interest rate curves rarely move in a parallel fashion
- Should consider other changes such as butterfly, twists, shifts and steepening

(c)

Reasons for credit spread change
- Change in yield curve
- Change in credit rating of debt issuer
- Extraneous events (economy, inflation)

Strategy to hedge risk
- Interest rate swaps
- Credit default swap

16. continued

(d)

To mitigate liquidity risk:
- Maintain a cash or highly liquid position at all times
- Maintain durable lines of credit
- Have sequential cash inflows from assets matching liability cash outflows
- Have product features such as surrender charges or market value adjustments upon withdrawal

(e)

- The main risk is interest rate disintermediation
- Good metrics to measure this are duration or convexity
- A duration or convexity mismatch between assets and liabilities could indicate a problem
- Can also consider stochastic modeling
- A negative outcome when using stochastic modeling could forewarn of a problem

17.

Learning Objectives:

6 – b. Define and evaluate spread risk as related to fixed income securities and derivatives.

This question covers synthetic CDOs. The candidate is expected to demonstrate understanding of related risk measures, risk management challenges and the effect of default correlation. In addition, the candidate is asked to calculate the par spread of a given tranche.

Solution:

(a)

A synthetic CDO is a transaction that transfers the credit risk on a reference portfolio of assets. The reference portfolio is made up of credit default swaps. Typically credit risk is split into equity, mezz, and senior tranches with predetermined attachment and detachment points. Tranches in lower portion of capital structure are significantly leveraged exposures. Often 80% of the capital structure is in AAA rated super senior tranche.

(b)

- The sensitivity of the tranche's value to a change in credit spreads on the names in the reference portfolio. This is computed by reducing all the credit spreads on the reference credits by 10 bps, re-computing the default probability distribution, then computing the increase in each tranche's mark-to-market value.
- The tranche's expected loss from defaults in the reference portfolio occurring up to the maturity of the CDO. *EL* on tranche i is:

$$EL_i = \sum_{\ell=0}^{N} p(\ell, T_i) \max\left(\min\left(\ell A(1-R), H\right) - L, 0\right)$$

Where T_i is the final maturity date, $p(l,t)$ is the default probability distribution, L and H are attachment points and the loss from any default is $A(1-R)$

- A level of loss due to default that is one standard deviation above the tranche's expected loss (one measure of unexpected loss)

$$SD_i = \left(\sum_{l=0}^{N} p(l, T_i)\left[\max\left(\min\left(lA(1-R), H\right) - L, 0\right) - EL_i\right]^2\right)^{\frac{1}{2}}$$

and unexpected loss is $= UL_i = EL_i + SD_i$

Unexpected Loss is not helpful for senior tranches given skewed loss distribution – mean variance approaches potentially misleading here

17. continued

(c)

A higher correlation of defaults has two effects:
- Greater likelihood that losses will wipe out the equity and mezzanine tranches and inflict losses on the senior tranches
- Greater likelihood that there are very few defaults

Thus
- The value of the senior tranche falls as correlation rises
- The value of the equity tranche rises as correlation rises
- The value of the mezzanine is less sensitive to correlation (subject to both effects which can broadly cancel each other)

(d)

- Need to establish delta hedges for all CDS in reference pool, but deltas are model-dependent
- Lack of liquidity may make it prohibitively expensive to enter and unwind CDS positives every time the hedge changes
- Hard to simultaneously hedge small spread changes and "jump to default" risk
- Delta hedge still leaves significant residual exposure to correlation risk which is often more significant than spread risk, especially for senior tranches. Might need to hedge times with tranches

(e)

$$S_{Par} = \frac{Contingent}{\sum_{i=1}^{n} D_i \Delta_i \left\{ (H - L) - EL_i \right\}}$$

The discount rates $D_k = 1.05^{-k}$

$k = 1: \quad 0.9524$

$k = 2: \quad 0.9070$

$k = 3: \quad 0.8638$

The expected payments (that the trance investor must make when defaults affect the tranche) is calculated as $EL_k - EL_{k-1}$:

$k = 1: \quad \$3$ million

$k = 2: \quad \$3.5$ million

$k = 3: \quad \$4$ million

Contingent = PV (expected payments) = 9.5

17. continued

The expected tranche principal outstanding on payment date T_k is calculated as $(H - L) - EL_k$:

$$L = \$50\text{million}$$
$$H = \$150\text{million}$$
$$k = 1: \quad \$97 \text{ million}$$
$$k = 2: \quad \$93.5 \text{ million}$$
$$k = 3: \quad \$89.5 \text{ million}$$

The accrual factor for payment date $= 1$

The denominator of the formula $= 254.5$

The spread $= 9.5 / 254.5 = 3.73\%$

18.

Learning Objectives:

5 – b. Identify and describe financial and non-financial risks faced by an entity, including but not limited to currency risk, credit risk, spread risk, liquidity risk, interest risk, equity risk, product risk, operational risk, legal risk, and political risk.

5 – c. Assess the overall corporate risk exposure arising from financial and non-financial risks.

Solution:

(a)

Market Risk
- Risk from adverse movements in interest rates
- Risk that liabilities and assets will change by different amounts when interest rates move

Liquidity Risk
- Risk that asset cash flows do not coincide with liability cash flows
- Risk that insurance company would not be able to meet its obligations due to inability to liquidate assets

(b)

Single Premium Endowment Policy
- Risk that assets do not earn sufficient rate to meet required return
- Risk of changing interest rates due to long duration of liabilities

Universal Life Policy
- Risk of large amounts of withdrawals or loans
- Book value surrenders
- Risk of insufficient asset returns to fund credited rates or minimum interest rate guarantees

(c)

Single Premium Endowment Policy
- Duration matching (ensure that the duration of assets and liabilities are equal)
- Cash flow matching – for example, buy a zero-coupon bond that matures at the time of endowment

18. continued

Universal Life
- Duration matching (ensure that the duration of assets and liabilities are equal)
- Use effective duration (consider the impact of interest rates on liability cash flows)
- Ensure that policy loan interest rates match market interest rates
- Impose surrender charges in early policy years
- Ensure that credited rates track market rates

Mortgage backed securities
- Consider using prepayment derivatives or any other derivatives to mitigate the prepayment risk

19.

Learning Objectives:

4 – b. Assess a portfolio position against portfolio management objectives and recommend a strategy to rebalance the portfolio

*This is a recall and evaluate question asking candidates to review results of an active equity investment analysis. The correct answers are expected to be based on the content in Section 5 **Active Equity Investing** in Ch. 7 "Monitoring and Rebalancing" of Maginn's book. Credit is given for answers that provide correct investment style differences, explain stated style analyses, and infer reasonably the style of the portfolio.*

Solution:

(a)

Value style
- Low P/E
  - Look for stocks selling at low prices to current or normal earnings
  - In industries categorized as defensive, cyclical, or out-of-favor
  - Expect their P/E to rise as they recover
- Contrarian
  - Look for stocks selling at low P/B
  - In depressed industries
- High yield
  - Look for stocks with high and stable dividend prospects

Growth style
- Focus on earnings
- Pay above-market earnings multiples for companies that have superior growth rates
- Invest in growing industries, i.e. high sales growth, high P/Es P/Bs
- Consistent growth: long history of sales growth, high profitability, predictable earnings
- Earnings momentum: have higher EPS growth, but such growth is less sustainable
- Buy stocks at a premium and count on market to continue paying it for earnings growth

19. continued

(b)

Returns-based style
- Relies on portfolio return to understand the characteristics of portfolios
- Regresses portfolio returns on the return series of securities indices
- Analyzes historical returns of the portfolio
- Characterizes entire portfolio
- Facilitates comparisons of portfolios
- Aggregates effect of investment process
- Different models give consistent results
- Clear theoretical basis
- Quick and cost effective

Holding-based style
- Categorizes individual securities by their characteristics; and
- Aggregates results to understand overall style of the portfolio
- At a given point of time
- Characterizes each position
- Facilitates comparisons of individual positions
- Captures changes quicker than returns-based
- More data intensive

(c)

Returns-based
- Need to properly select indices, that are mutually exclusive
- Error in specifying indices may lead to inaccurate conclusions
- May be ineffective in characterizing current style

Holdings-based
- Need to properly select possible variables, EPS, P/E, sector ...
- May not reflect the way managers approach security selection
- Different spec may give different results

(d)

Holdings-based analysis
- Lower P/E – value
- Lower P/B – value
- Higher EPS growth – growth
- Higher dividend yield – value
- Higher weights in Finance – value
- Lower weight in utilities – growth
- Lower weightings in IT – value
- A value style portfolio

19. continued

Returns-based analysis
- More on small to mid-cap – 80% of the portfolio
- An active management since selection is 2.2%
- Style fit of 97.8% is high
- Information ratio $= \dfrac{0.3\%}{6\%} = 5\%$
- A growth bias – 85% in growth style

Conclusion: Analyses give contradicting results
Possible explanation – style drift

20.

Learning Objectives:

2 – a. Describe and compare specialized financial instruments that can be used in the construction of an asset portfolio supporting financial institutions and pension plan liabilities.

Solution:

(a)

Own actual commodities, but then need to manage warehouse
Owning the shares or equity of commodity producers
Return affected by factors not related to commodity
Return on stocks of commodities are not as highly correlated with returns on commodity as they are to return to stock market as whole

Futures Market
Liquid
Use of Swaps
Low fees

Invest in commodities index
Structured commodity products
Fee charged

(b)

T Bill Return
Represent return earned on collateral

Risk Premium

Rebalancing

Convenience Yield
Processor of commodity bid up price of near contract compared to distant contract to ensure supply / roll return
Investor makes money even though spot price not changed

Expectational Variance
Unexpected occurrences

20. continued

(c)

Level of Diversification
How much
Risk/Return desires
Pick the index
Components of index
Choice of collateral
Passive approach or active overlay
Co-mingled or separate account
Liquidity Requirements
Direct or Indirect

(d)

With positive correlation of commodity prices to inflation, investment in commodities can act as a hedge against the rise in claim costs over time for the LTC block.
May not move with medical inflation though.
Investment in a commodities index