QFI PM Model Solutions
Spring 2024

1. Learning Objectives:

3. The candidate will understand the variety and assess the role of equities in investment portfolios. The candidate will demonstrate an understanding of the distinguishing investment characteristics and potential contributions to investment portfolios of the following major asset groups:
   - Real Estate
   - Public Equity
   - Private Equity
   - Commodities
   - Hedge Funds
   - Distressed debts

Learning Outcomes:

(3a) Demonstrate an understanding of the investment strategies and portfolio roles that are characteristic of various types of equity and alternative investments.

(3b) Use different types of equity and alternative investments available for an investor's growth allocation in portfolio construction, considering portfolio design, risk management, liquidity management, manager selection, and implementation.

Sources:

Anson, M, Handbook of Alternative Assets, 2nd Edition, Chapter 12

Commentary on Question:

This question tests the understanding of commodity-linked notes, the advantages of investing in these securities for getting exposure to commodities, how to calculate their payoff, and how to identify arbitrage opportunities associated with these securities.

Solution:

(a) An actuarial associate suggests that the best way for YKF to increase its exposure to crude oil is by investing in the stocks of oil companies.

Explain the limitations of this strategy.

Commentary on Question:

Candidates performed above average on this question. Most candidates were able to identify that stock prices are affected by market risk.

1. Continued

First, stock prices of oil companies are much more dependent upon the movement of the stock market than they are by the movement of crude oil prices. Therefore, investing in an oil company as a "pure play" on crude oil prices provides an investor with significant stock market exposure and very little crude oil exposure.

Second, when an investor invests with an oil company, the investor assumes all of the idiosyncratic risks associated with that company, such as bankruptcy risk, which has nothing to do with the price of oil.

Third, there are other operating risks associated with an investment in oil companies (or any company). For example, a company's financing policies affect the price of its stock.

Finally, even if all of the other risks associated with an investment in an oil company are accepted, the investor might find that the oil company has hedged away its oil exposure.

(b) Describe the advantages commodity-linked notes have over investing directly in oil or oil futures.

Commentary on Question:
Candidates performed below average on this question. Many candidates were not able to identify that the notes were debt instruments or they were free of tracking error.

First, the investor does not have to worry about the rolling of the underlying futures contracts.

Second, the note is, in fact, a debt instrument. Many investors may have restrictions on investing in the commodities markets. However, they can have access to commodity exposure through a debt instrument.

Last, the holder of the note does not have to worry about any tracking error issues with respect to the price of a single commodity or basket of commodities.

(c) Calculate the payout of each of these two notes at maturity if the crude oil price is $85 at that time.

1. Continued

Commentary on Question:
Candidates performed below average on this question. Many candidates incorrectly applied the coupon payments to the final principal repayment of the notes, rather than the face value. For Note 1, many candidates incorrectly used the initial price, rather than the strike price, in the denominator when calculating the total payment. Those candidates that applied the appropriate formulas correctly received full credit.

The total payment of Note 1 at maturity is:
$[1 + \max\{(CP(T) - CP(x))/(CP(x)),0\}](\$2,000,000) + (0.03)(\$2,000,000)$.
CP(T) is the price of the crude oil at maturity of the note, and CP(x) is the strike price.

The total payment of Note 2 at maturity is:
$[1 + (CP(T) - CP(0))/(CP(0))](\$2,000,000) + (0.06)(\$2,000,000)$.
CP(0) is the value of the crude oil at the purchase date of the note.

With CP(T) = 85, the total payment of Note 1 is:
$[1 + (85-77)/77](\$2,000,000) + (0.03)(\$2,000,000) = \$2,267,792$
The total payment of Note 2 is:
$[1 + (85-70)/70](\$2,000,000) + (0.06)(\$2,000,000) = \$2,548,571$

(d) Another associate suggests that commodity futures is another appealing asset class to consider. She has provided the following information regarding an oil futures contract:

- Maturity time: 6 months
- Price of the contract: $75
- Spot price: $70
- Expected annual growth of oil price: 10%
- Storage cost of oil: 2%, continuously compounded
- Risk-free interest rate: 5%, continuously compounded

Construct an arbitrage strategy with this contract.

Commentary on Question:
Candidates performed below average on this question. Many candidates were not able to obtain the correct fair price of the futures contract and the risk-free profit from the arbitrage strategy. Many candidates received partial credit for providing the appropriate high-level strategy.

1. Continued

The fair price of the future contract should be:
F=Se^((r+c)T)=$70e^((0.05+0.02)(0.5))=$72.49338.

The actual price is higher than the fair price, so an arbitrage opportunity exists.

You can borrow $70 to purchase oil and selling the futures contract with price $75.

At maturity, you earn $75 dollars from the futures contract, and need to pay back the borrowing plus interest and storage costs, which is $70e^((0.05+0.02)(0.5))=$72.49338. Therefore, you earn a risk-free profit of $2.50662.

2. Learning Objectives:

3. The candidate will understand the variety and assess the role of equities in investment portfolios. The candidate will demonstrate an understanding of the distinguishing investment characteristics and potential contributions to investment portfolios of the following major asset groups:
   - Real Estate
   - Public Equity
   - Private Equity
   - Commodities
   - Hedge Funds
   - Distressed debts

Learning Outcomes:

(3a) Demonstrate an understanding of the investment strategies and portfolio roles that are characteristic of various types of equity and alternative investments.

(3b) Use different types of equity and alternative investments available for an investor's growth allocation in portfolio construction, considering portfolio design, risk management, liquidity management, manager selection, and implementation.

(3d) Recommend and justify an optimal portfolio allocation in a risk-return framework.

Sources:

Maginn & Tuttle, *Managing Investment Portfolios: A Dynamic Approach*, 3rd Edition, Chapter 7

Commentary on Question:

This question was designed to test candidates' ability to perform traditional return calculations based on index weighting methods, as well as analyze aspects of those methods that would affect their application in practice, including biases and appropriateness in a hypothetical context.

Solution:

(c) Calculate the returns of the QXYZ index using:

(i) Value-weighted method

(ii) Equal-weighted method

Commentary on Question:

Candidates performed above average on this section. Most candidates received full credit for their responses. A common error was incorrectly developing the value-weighted calculation development.

2. Continued

Value-weighted return:
(Sum of 12/31/2025 MV/Sum of 12/31/2024 MV) – 1 = 30.29%

Equal-weighted return = Average of Price Changes = 22.35%

(d) Describe a key bias in the performance measurement for each of the two index weighting methods.

Commentary on Question:
Candidates performed above average for this section. Most candidates received full credit for correctly recognizing that the value-weighted method would overweight the returns of companies with the largest market caps, while the equal-weighted method would overweight the returns of smaller firms.

Value-weighted: The performance of a value-weighted index will be biased toward the shares of companies with the largest market capitalizations. This will create a general problematic bias toward larger more mature companies as well as a possibility of weighting toward overvalued companies with the most significant increases in share price.

Equal-weighted: The performance of an equal-weighted index will be biased toward smaller companies, which will be weighted the same as very large companies. This requires maintaining ongoing rebalancing and associated transaction costs.

(c) Explain why the return on an index fund constructed using the full replication method may be less than the return of the underlying index.

Commentary on Question:
Candidates performed below average on this section. Most candidates received partial credit for recognizing the impact of transaction costs. Candidates that also commented on the effects of management and administration costs and recognized the drag of cash positions received full credit.

The index fund return may be less than the underlying index due to:

- Management and administration costs.
- Transaction costs for portfolio adjustments required to maintain consistency with the index.
- Transaction costs from investing and disinvesting cash flows.
- Performance drag from cash positions of uptrending markets.

2. Continued

(d) Describe the stratified sampling method.

Commentary on Question:
Candidates performed as expected on this section. Candidates that effectively defined the method from inception received full credit. The most common error was not providing sufficient detail beyond broadly stating the method description.

Process Definition:
Using stratified sampling, a portfolio manager divides the index along a number of dimensions (e.g., market capitalization, industry, value, and growth), creating multidimensional cells. Each index stock is placed into the cell that best describes it.

OR

Specific Context Example: For instance, a simple cell structure could focus on market cap and industry. A manager trying to build a portfolio mimicking the TOPIX index would then place a stock such as Toyota into a cell that is defined by automobile stocks with market cap greater than ¥5 trillion. Next, she would characterize all stocks in the index in this way and determine the weight of each cell in the index by totaling the market cap for all stocks in that cell. The manager would then build a portfolio by selecting a random sample of stocks from each cell and ensuring that the sum of the weights of the stocks purchased from each cell corresponds to the cell's weight in the index.

(e) Recommend the most appropriate method for constructing the G3000 index fund.

Commentary on Question:
Candidates performed above average on this question. Those candidates that recognized that the stratified sampling was preferable to full replication and commented on the transaction cost issue and the availability of securities received full credit. A common error was introducing methods other than the two available to be selected in the question context.

The preferred method depends on portfolio size and the availability of active trading in an index basket by means of portfolio trades. Stratified sampling is preferred when a portfolio manager wishes to track an index containing a large number of stocks, particularly stocks that are more difficult and costly to trade. Replication may not be the most cost effective choice given the costs of transacting in small-cap issues.

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Learning Outcomes:

(3a) Demonstrate an understanding of the investment strategies and portfolio roles that are characteristic of various types of equity and alternative investments.

(3c) Explain the basic active equity selection strategies including value, growth and combination approaches, and compare techniques for characterizing investment style of an asset manager.

Sources:

Handbook of Alternative Assets, Mark Anson, 2nd Edition, 2006 Ch. 6: Risk Management Part I: Hedge Funds Return Distribution
Handbook of Alternative Assets, Mark Anson, 2nd Edition, 2006 Ch. 7: Risk Management Part II: Additional Hedge Funds risks
Handbook of Alternative Assets, Mark Anson, 2nd Edition, 2006 Ch. 3: Introduction to Hedge Fund, Mark Anson, 2nd Edition, 2006

Commentary on Question:

This question tests the candidates' understanding of the distributions and risks of hedge fund strategies.

Solution:

(e) Your students made the following comments about the risks faced by hedge funds.

1. Process risk is a type of fundamental risk due to the general lack of transparency associated with it.
2. Beta expansion risk occurs when hedge fund managers short the same securities.
3. Off-balance sheet risk can be due to short volatility risk, fund manager skill risk, and mapping risk.

Critique each statement.

3. Continued

Commentary on Question:
Candidates did below average on this part of the question. Many candidates received partial credit for recognizing that the lack of transparency is associated with process risk and for identifying that beta expansion risk occurs when a crowded shorts situation is present, A few candidates received additional partial credit for pointing out that process risk is a type of idiosyncratic risk and for noting that mapping risk refers to differences in reporting standards.

FALSE: Process risk is NOT a type of fundamental risk, but is a type of idiosyncratic risk. However, there is a general lack of transparency associated with process risk.
TRUE: Beta expansion risk occurs when hedge fund managers short the same securities.
TRUE: Off-balance sheet risk can be due to short volatility risk
TRUE or PARTLY TRUE: Off-balance sheet risk can be due to fund manager skill risk, since this is hard to quantify and report.
Reported returns can be compared only if they are similar in time period, objective, risk, etc.
FALSE: Off-balance sheet risk is unrelated to mapping risk.
Mapping risk refers to differences in reporting standards, vs. lack of reporting.

(f) Based on research work on public companies A and B, your student team proposed a stub trading strategy on companies A and B. Company's A ownership in Company B contributes to 25% of Company's A's consolidated operating income. The relevant information is given below:

	On the date the trading strategy began	On the date the trading strategy ended
Company A's share price	$50	$56
Company B's share price	$40	$44
Based on the student team's research work, the share price of Company A's own operation (i.e., when excluding A's ownership in B)	$42	$45
Neither A nor B pays dividends; Transaction cost = $0; A and B have issued the exact same number of shares.		

Construct this strategy.

3. Continued

Commentary on Question:
Candidates did poorly on this part of the question. Some candidates received partial credit for identifying the correct hedge positions for companies A and B, but only a few candidates calculated the ratio correctly.

The fair value of A's share price = $42 + $40*25%. But actual price = $50, so A is undervalued. Therefore, we should be long on A and short on B. Since B contributes 25% to A's operation, the correct hedge ratio is to buy 3 shares of A and short 1 share of B.

4. Learning Objectives:

3. The candidate will understand the variety and assess the role of equities in investment portfolios. The candidate will demonstrate an understanding of the distinguishing investment characteristics and potential contributions to investment portfolios of the following major asset groups:
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   - Private Equity
   - Commodities
   - Hedge Funds
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Learning Outcomes:

(3a) Demonstrate an understanding of the investment strategies and portfolio roles that are characteristic of various types of equity and alternative investments.

(3b) Use different types of equity and alternative investments available for an investor's growth allocation in portfolio construction, considering portfolio design, risk management, liquidity management, manager selection, and implementation.

(3d) Recommend and justify an optimal portfolio allocation in a risk-return framework.

Sources:

Anson, M, *Handbook of Alternative Assets*, 2nd Edition, Chapter 17

Commentary on Question:

This question tests candidates' understanding of Leveraged Buyouts (LBOs).

Solution:

(a) Explain why LBOs are generally less risky than providing financing for venture capital deals.

Commentary on Question:

The candidates performed above average on this section. Partial credit was awarded for each acceptable explanation, and most candidates provided two or more acceptable explanations.

LBOs are generally less risky because:

- They typically occur on mature companies with products/services developed, whereas with venture capital, products/services are just starting to be developed
- Firms targeted for LBOs typically have proven management teams, so it is easier to assess the key employees

4. Continued

- LBO targets generally have a track record of profitability
- The exit strategy of an IPO in several years is more viable for a buyout firm compared to a startup venture
- LBO targets are generally firms that have undervalued assets
- They are generally more focused on operating efficiencies than developing innovative technologies

(b) Assess whether ABC should pursue a LBO for each company.

Commentary on Question:
The candidates performed brilliantly on this section. Nearly all candidates made the correct assessments for GHI and LMN, respectively, and most candidates earned full credit. Some candidates only received partial credit due to not providing sufficient support for their assessments.

ABC should not pursue GHI because:
- The company has only been in business for 1 year, and it is not yet mature
- The company has a high debt-to-equity ratio
- The company is likely overvalued, as evidenced by its high price-to-book ratio
- The company's net margin is negative, suggesting it is not profitable
- The EV industry is very capital intensive and relies on technological innovation

ABC should pursue LMN because:
- The company has been in business for a long time
- The stock price is likely undervalued, given the 50% decline in the last year coupled with the low price-to-book ratio
- The company has relatively low debt, as evidenced by the debt-to-equity ratio
- The large increase in number of employees suggests there are places to look for efficiencies in operations
- The grocery industry is relatively stable
- The positive net margin suggests the company is profitable

(c) Calculate the minimum amount from a sale of TUV that ABC needs to receive at the end of the investment period in order to meet its annual compound return target.

Commentary on Question:
The candidates performed above average on this section with many candidates receiving full credit. A common mistake made by candidates was adding an extra $300m to the sale price for the initial debt that is to be re-paid prior to the sale of TUV.

4. Continued

- Equity investment = $500 million - $300 million = $200 million
- (Sale price/Equity investment)^(1/Investment Period) – 1 = Target Annual Compound Return
- Minimum sale price = $742.59 million

(d) Describe the risks with this transaction that may cause ABC not to achieve the annual compound return target.

Commentary on Question:
The candidates performed as expected on this section. Partial credit was awarded for each appropriate risk, and many candidates provided two or more appropriate risks.

- The high leverage ratio leaves little margin for error
- The company may not be able to generate enough cash flow to service the interest payments on the debt
- Management's strategy to unlock the intrinsic value from TUV may not be optimal
- The incentive and monitoring schemes put in place by ABC Investment Company to monitor TUV's performance may not be adequate
- ABC may not be able to fulfill its exit strategy on time or may have to sell at a lower price than the minimum price required

5. Learning Objectives:

1. The candidate will understand how to work with the variety of fixed income instruments and evaluate fixed income portfolios.

2. The candidate will understand the credit risk aspects of individual securities, portfolios, and sectors and be able to apply a variety of credit risk theories and models to the investment management process.

Learning Outcomes:

(1a) Demonstrate an understanding of various fixed income investments considering:
- cash flow characteristics,
- markets in which they trade, and
- underlying risks such as interest rate, credit and event risks

(2a) Demonstrate an understanding of credit analysis.

(2b) Demonstrate an understanding of and the ability to apply both the concepts and techniques used in the measurement of default risk of individual securities.

(2c) Understand and apply various approaches for managing credit risk in a portfolio setting, including the use of Credit Default Swaps

Sources:

Commercial Real Estate Analysis and Investments, Miller & Geltner, 2014, Third Edition, OnCourse Learning Publishing, Chapters 16, 20

Handbook of Credit Risk Management, Bouteillé & Craig-Pushner, Chapter 20

Commentary on Question:

This question is intended to test the candidate's understanding of the hierarchy of CMBS payments, the interaction of prepayments with this hierarchy, the concepts underpinning the underlying loans backing the CMBS, and hedging strategies.

Solution:

(a) Compare and contrast residential mortgages and commercial mortgages on the basis of:

(i) volume in the market

(ii) loan size

(iii) income generation of the underlying property

(iv) characteristics of the borrower

5. Continued

Commentary on Question:
Candidates performed above average on this section. A common error was mistaking the number (volume) of loans for the size of the loans.

- Individual residential loans are much more numerous in the market than commercial loans
- Individual residential loans are much smaller on average than commercial loans
- Commercial properties generate income (e.g., rental payments), whereas Residential owner-occupied properties do not (meaning the lender must depend on the individual borrower's income to service the loan)
- Residential borrowers are usually not financial or business professionals and are typically in the market only occasionally (on average about once in every 5-10 years), whereas commercial borrowers tend to be commercial or financial entities staffed by business professionals with much greater financial expertise than the typical homeowner.

(b) Your co-worker makes the statement, "Tranche B is very attractive given that the risk is not all that different from Tranche A".

Critique the statement.

Commentary on Question:
Candidates performed as expected on this section. Candidates generally did well at identifying that Tranche B is riskier. The most successful candidates were able to articulate that Tranche B is the first to absorb losses, while also commenting that it needed to have remaining par value in order for this mechanism to have an impact on the risk profile.

- The statement is incorrect – Tranche B has considerably more risk
- Tranche B is the loss-absorbing (first-loss) tranche in this simple structure.
- Credit losses due to defaults in any of the mortgages are first assigned to Tranche B as long as tranche B still has par value that could be written down.
- Tranche B may have the same default probability, but has much greater conditional loss severity in case of default.

(c) Calculate the amount outstanding in Tranche A and Tranche B after the prepayments.

5. Continued

Commentary on Question:
Candidates performed above average on this section. Candidates were generally able to identify that Tranche B's outstanding par value does not change given the structure of the CMBS in question. Candidates received full credit for articulating this while also showing their work on calculations for the new par value of Tranche A. A common error was not properly calculating the amount of par value prepaid.

Tranche A: All of the repaid cash flows pay down its par value. Its original Par Value prior to any prepayment was \$0.5 million * 100 * 75% = \$37.5 million. Since a total prepayment of \$18.75 million (25*\$0.5 million + 25*\$0.25 million) occurred, all of it would have drawn down Tranche A's par value, giving it a new par value of \$18.75 million.

Tranche B: As all of the prepayments were allocated to Tranche A, none of the original face amount of Tranche B has been paid down. So that amount remains at \$12.5 million.

(d) Recommend a strategy that balances your CFO's desire to increase shareholder returns with your concern of downside risk.

Commentary on Question:
Candidates performed as expected on this section. Candidates received full credit for providing a clear recommendation of a strategy, while clearly outlining how it balances both of the concerns related to shareholder returns and downside risk. A common error was failing to address each of these considerations or failing to justify how their recommended strategy addresses the relevant points.

One possible strategy would be to purchase a Credit Default Swap (CDS) on a portion of the underlying loans in the pool. In the event that the underlying mortgage loans default, given that Tranche B would absorb the losses, a CDS could reimburse a portion of the credit-related losses. This would balance the CFO's desire to chase a higher financial return (by providing exposure to the tranche bearing the higher potential rate of return) with your concern of potential large losses in the event of a default of the underlying pool of mortgages.

Alternatively, could reduce risk by putting limit on how much is invested in Tranche B so as to reduce the potential amount at risk, or other answers in a similar vein.

6. Learning Objectives:

5. The candidate will understand:
   - The design and management of asset portfolios in alignment with investment objectives and strategies, including investments in fixed income, equity and alternative assets.
   - The theory and techniques of portfolio asset allocation.

Learning Outcomes:

(5d) Develop asset allocation strategies in alignment with investment risk and return objectives.

(5e) Demonstrate an understanding of asset allocation approaches and techniques, including the concept of risk factor investing.

(5f) Demonstrate an understanding of the role and the importance of strategic and tactical asset allocation in relation to systematic risk.

Sources:

Managing Investment Portfolios: A Dynamic Process, Maginn & Tuttle, 3rd Edition, 2007, Chapter 5 (P.230 to 327)

QFIP-155-21: Fundamentals of Efficient Factor Investing, by Roger Clarke, Harindra de Silva & Steven Thorley (P.9 to 26)

Commentary on Question:

This question tested the candidates' understanding of how tactical asset allocation and efficient factor investing may be applied for a life insurance company.

Overall, candidates performed slightly below average in this question. Only a few candidates received most of the points for this question.

Solution:

(a)

(i) Explain principle 1) above

Commentary on Question:

Most candidates did as expected and mentioned enough of the principle to earn credit by at least making a reference to use historical and/or market information to project potential returns. Candidates who received less than full credit either left the answer blank or didn't provide enough related content in their answers.

6. Continued

Market prices tell explicitly what returns are available. Cash yields reveal the immediate nominal return accorded short-term investors. Thus, at least for this and similar pure discount instruments, investors have objective knowledge of prospective returns.

Although prices yield less direct information about prospective return for other asset classes, we can at least make educated estimates. For example, we could use dividend yield plus growth rate to estimate the return to equities. Inevitably, reality will not quite match these expectations. Nevertheless, history suggests that simple objective measures provide a useful, objective guide to future rewards.

(ii) Explain how principle 1) can help derive the long-term return expectations for Public Common Stocks.

Commentary on Question:
Candidates did poorly for this portion. Some candidates earned credit if the answer mentioned dividend yields, growth, and/or change in valuation. However, the majority of candidates misunderstood, and instead of defining the principle and applying it to long term returns of public stocks, their answer referred to the overweighted or underweighted allocation based on the two-year performance.

Public common stock asset class has three components to return: income (dividend yield), growth in income (growth in real dividend), and changing in valuation levels (changes in the values that the market assigns to each dollar of income).

(b) Describe how principles 2) and 3) above may affect the tactical allocation of the Public Common Stocks and Investment Grade Public Bonds respectively.

Commentary on Question:
Candidates did as expected on this section. Most candidates understood the concepts of relative expected return reflecting risk perceptions as well as the idea that the market is rational and mean reverting. The candidates that received lower credit failed to correctly predict the overweighting of both stocks and bonds for future allocations.

When investors perceive more risk, they demand payment for assuming it. If expected equity returns are particularly high compared with bond expected returns, the market is clearly applying a substantial risk premium to stocks.

In the long term, the equity volatility ratio and equity premium measures tend to track one another. In the short term, they provide information when they diverge.

6. Continued

We are given that the equity volatility ratio has been rising faster than the equity risk premium for 2 years. It means we have a bullish indicator for the equity (increase equity holding) because investors expect to be compensated for higher risk.

If the TAA manager can identify departures from equilibrium in the relative pricing of asset classes, the manager may try to exploit them with knowledge that departures from equilibrium compress a proverbial spring that drives the system back towards balance.

We are given that Public Bonds' (Investment Grade) total return has been 1% over the past 5 years, which is below the long-term return of 4%. A reversion to the mean would indicate that we expect the Public Bonds to outperform the recent 5-year experience of 1%.

(c)

(i) Calculate the Maximum possible factor Sharpe ratio for a portfolio composed of the above factors and the market portfolio.

Commentary on Question:
Candidates did above average on this portion. Most candidates calculated the Maximum Possible Sharpe ratio using the assumption of no correlation as a proxy, and some earned full credit if they used the full formula using the correlation factor. Only a few candidates received lower credit because they didn't complete the equation or left it blank.

The Sharpe ratio of the Market is 6% / 15% = 0.4 = Market return over the risk free rate / active risk for Information risks below

IR (A) = 0/.04 = 0.0 = Return in excess of market/ active risk of factor portfolio A
IR (B) = .01 / .025 = 0.4 = Return in excess of market/ active risk of factor portfolio B

The Treynor–Black rule is that the maximum possible unconstrained (i.e., long–short portfolio) Sharpe ratio squared = market portfolio Sharpe ratio squared + (information ratio A squared + information ratio B squared) /(1 + correlation of A and B):

Using Equation (12) from the reference, the maximum possible factor Sharpe ratio
= (0.4 ^2 + (0.0^2 +0.4^2)/(1+(-0.2)))^(1/2) = 0.6

6. Continued

(ii) Calculate the excess return over the risk-free rate of the maximum possible factor Sharpe Ratio portfolio.

Commentary on Question:
Candidates did poorly on this portion. Candidates who earned higher credit used the full formula including the correlation factor. However, many earned a low mark because they didn't apply the formula, only wrote the concept of weights without a full understanding of the concept, or left it blank.

First calculate the weights of the portfolio:
Weight of a factor A is = Standard deviation of Market / (Sharpe ratio of Market * (1- correlation of portfolios A and B ^2)) * ((Information ratio A/Active risk A)-correlation AB *(Information ratio B/Active Risk B))

Weight A = .15/(.4 * (1- (-.2)^2))* ((0/.04)-(-.2)*.4/.025)) = 1.25
Weight B =.15/(.4 * (1- (-.2)^2))* ((.4/.025)-(-.2)*.0/.04)) = 6.25
Weight Market portfolio = 1 – 1.25 – 6.25 = -6.5

Portfolio return = weight market portfolio * market return over risk free + weight portfolio A * market return over risk free + weight portfolio B * market return over risk free

Market return portfolio A = market return over risk free + portfolio A return over market = 0.06 + 0.0 =.06
Market return portfolio B = market return over risk free + portfolio B return over market = 0.06 + 0.01 = .07

Total excess return of maximum possible factor Sharpe Ratio portfolio=-6.5*.06+1.5*.06+6.5*.07 = 12.25%

7. Learning Objectives:

5. The candidate will understand:
   - The design and management of asset portfolios in alignment with investment objectives and strategies, including investments in fixed income, equity and alternative assets.
   - The theory and techniques of portfolio asset allocation.

Learning Outcomes:

(5c) Construct and manage portfolios of equity and alternative investments under various strategies, including active, passive and style management.

(5g) Explain the manager selection process.

Sources:

Maginn & Tuttle Ch 7.

Commentary on Question:

This question is intended to test the candidate's understanding on constructing and managing portfolios of equity and alternative investments under various strategies, including active, passive and style management and explaining the manager selection process.

Overall, candidates performed below average on this question, especially on parts (b) and (e).

Solution:

(a) Assess whether the stock selection above is consistent with a Growth Style.

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to identify some of the stock selection that's consistent or inconsistent with the Growth Style but not all of them, hence only got partial credit. Full credit was only given to candidates who correctly accessed all 8 areas of the stock selection. No credits were given for assessing the number of stocks or market cap as they are not associated with growth stocks.

- A growth-oriented portfolio has lower dividend payout ratios – consistent.
- A growth-oriented portfolio very clear bias toward higher P/Es, relative to the market – consistent.
- A growth-oriented portfolio has a higher EPS growth rate – inconsistent.
- A growth-oriented portfolio has a lower Earnings Variability – consistent.
- A growth-oriented portfolio has a lower weight to Finance -consistent.
- A growth-oriented portfolio has a higher weight to Health Care -inconsistent.
- A growth-oriented portfolio has a higher weight to Information Technology - consistent.
- A growth-oriented portfolio has a lower weight to Utilities -inconsistent.

7. Continued

(b) Explain two reasons why short selling stocks may be a strategy to consider.

Commentary on Question:
The candidates performed below average on this section. Some candidates were able to identify one reason, hence only got partial credits. Full credits were only given to candidates who correctly explained two reasons [out of four].

- Many investors look only for undervalued stocks, but because of impediments to short selling, relatively few search for overvalued stocks. These impediments prevent investor pessimism from being fully expressed.
- Opportunities to short a stock may arise because of management fraud, ‘‘window dressing’’ of accounts, or negligence. Few parallel opportunities exist on the long side because of the underlying assumption that management is honest and that the accounts are accurate. Rarely do corporate managers deliberately understate profits.
- Sell-side analysts issue many more reports with buy recommendations than with sell recommendations. One explanation for this phenomenon is related to commissions that a recommendation may generate: Although most customers may be potential buyers of a stock, only those who already own shares or who are short sellers—usually a smaller group—can sell it.
- Sell-side analysts may be reluctant to issue negative opinions on companies’ stocks for reasons other than generic ones such as that a stock has become relatively expensive. Most companies’ managements have a vested interest in seeing their share price rise because of personal shareholdings and stock options. After an analyst issues a sell recommendation, therefore, he can find himself suddenly cut off from communicating with management and threatened with libel suits.

(c)

(i) Calculate the number of annual independent trades per year necessary for Fund A to have the same Information Ratio as Fund C.

(ii) Explain why Portfolio B should require a higher number of annual trades in order to achieve the same Information Ratio.

Commentary on Question:
The candidates performed as expected on this section. For (i), most candidates were able to identify the formula for the Information Ratio. Partial credits were given to candidates who correctly calculated the Information Ratio for Fund C, but did not correctly calculate the number of annual independent trades per year for Fund A to get the full credits.
For (ii), partial credits were given to candidates who identified that Fund B has a lower IC. Only a few candidates who mentioned about insight into fund and acquiring information got the full credits.

7. Continued

(i) Determine Information ratio for Fund C (Use formula 7-1),
IR ≈ IC√Breadth
Breadth = active investment decisions each year.
IC = Information Coefficient = The information coefficient is more formally defined as the correlation between forecast return and actual return.
IRc = 0.05√100 = .5
IRa = 0.03√X = .5
X = 278

(ii) As portfolio B has less insight through a lower IC, it would need to acquire more information via more active investment decisions to generate a similar knowledge about the fund.

(d) Calculate Z so that the total fees under either approach are equal.

Commentary on Question:
The candidates performed as expected on this section. Full credits were only given to candidates who derived Z through correct formulas for total fees under both approaches.

Fees under Ad Valorem approach
200 * .005 + (500-200)*.004 = 2.2m
Expected Alpha = excess of the benchmark return
Fees under performance based approach
500 * Z + .1*.02*500 = 2.2
Z = 24bps

(e) Explain two additional features that could be added to the performance-based fee formula to better align the fund managers incentives with the your company's interests.

Commentary on Question:
The candidates performed below average on this section. Full credits were given to only a few candidates who correctly identified any two out of the three listed features and explained on why they better align with the goals.

- **Fee cap** limits the total fee paid regardless of performance and is frequently put in place to limit the portfolio manager's incentive to aim for very high returns by taking a high level of risk.

7. Continued

- **High water mark** is a provision requiring the portfolio manager to have cumulatively generated outperformance since the last performance-based fee was paid. This will force managers to cumulatively outperform the benchmark rather than year to year to get the excess fee which is more in line with the expectations.

- **Symmetric incentive fees** that reduce as well as increase compensation—may align the plan sponsor's interests with those of the portfolio manager by spurring the manager to greater effort.

8. Learning Objectives:

7. The candidate will understand the need for and goals of assessing the performance of a portfolio, and the methods and limitations of performance attribution.

Learning Outcomes:

(7a) Explain the use of segmented asset portfolios for supporting different investment objectives.

(7b) Apply performance measurement methodologies to various asset portfolios.

(7d) Assess and interpret performance attribution metrics for a given asset or portfolio.

Sources:

Managing Investment Portfolios: A Dynamic Process, Maginn & Tuttle, 3rd Edition, Ch 12

QFIP-145-19: Determinants of Portfolio Performance

Commentary on Question:

This question tests performance attribution and selecting performance measures.

Solution:

(a)

(i) Compare the time-weighted rate of return and the money-weighted rate of return.

(ii) Explain which measure you would use when reporting to your client.

Commentary on Question:

The candidates performed brilliantly on this section. Most were able to identify differences between the two measures and recommend a measure with support.

(i)

Compare and contrast

Time-Weighted Rate of Return (TWR)	Money-Weighted Rate of Return (MWR)
• Growth of single unit of money invested in the account • Not affected by external cashflows • Require account valuations on every date of external cash flow	• Average growth rate of all money invested in an account • Sensitive to size and timing of external cashflows • Useful if the manager maintains control over the timing and amount of cash flows

8. Continued

(ii)
Possible Recommendations that would earn full credit:

- Recommend TWR: The measure is not affected by external cash flows. The client's account has frequent cash flows.
- Recommend MWR: The measure does not need valuation every time a cash flow happens. If there is some control over the deposits/withdrawals, the measure is useful.
- Candidates may also suggest using the Linked Internal Rate of Return, which approximates the TWR by calculating the MWR frequently, and then chain-linking the returns

(b) Explain what an investment policy is and why it is important to portfolio design.

Commentary on Question:
The candidates performed above average on this section. Candidates were successful in indicating what an investment policy can include. Some did not explicitly state why an investment policy is important to portfolio design.

Acceptable Definition 1: The investment policy is the long-term asset allocation plan. It is the asset class and weights for a normal portfolio.

Acceptable Definition 2: The Investment policy is the documentation of the following items:

- Fund sponsor's attitudes toward important investment management issues, such as the fund's mission, the fund sponsor's risk tolerance, the fund's investment objectives, and so on
- Other responses that would have earned full credit:
    - Long-term strategic planning
    - Specific goals that the fund sponsor expects the fund to accomplish
    - Description of how the fund sponsor foresees the realization of those goals

Reasons why investment policy is important to portfolio design:

- The total return to a portfolio is dominated by investment policy decisions. The investment policy provides the bulk of return to a portfolio.
- The investment policy gives an investment program a sense of direction and discipline. Performance evaluation enhances the effectiveness of a fund's investment policy by acting as a feedback and control mechanism.

8. Continued

(c) Calculate the portfolio's return, attributed to each of the following dimensions:

(i) Investment policy

(ii) Timing

(iii) Selection

(iv) Other

	Investment Policy		Portfolio	
	Policy (Passive) Weight	Passive Return	Actual Weight	Active Return
Asset Class 1	60%	10%	50%	11%
Asset Class 2	40%	9%	50%	10%

Commentary on Question:
The candidates performed brilliantly on this section. Many were able to successfully calculate each attribution component. Partial credit was given to candidates for calculating the quadrants.

First, calculate the attribution quadrants.

Quadrant	Return Attribution	
I	9.60%	= Sum of (Passive weight x Passive return)
II	9.50%	= Sum of (Actual weight x Passive return)
III	10.60%	= Sum of (Passive weight x Active return)
IV	10.50%	= Sum of (Actual weight x Active return)

Attribution analysis

Policy	9.60%	= I
Timing	-0.10%	= II - I
Selection	1.00%	= III - I
Other	0.00%	= IV - III - II + I

(d) Describe the considerations of performance micro-attribution for fixed income portfolios.

Commentary on Question:
The candidates performed below average on this section. Most candidates were able to list some elements of active management. Many did not consider the external interest rate environment.

8. Continued

One needs to consider the effects of 1) the external interest rate environment and 2) active management.

The effects of the external interest rate environment include any one of:

- Return on default-free benchmark
- Return due to forward rate changes

The effects of active management include any one of:

- Interest rate management effect
- Sector/quality management effect
- Security selection effect
- Trading activity

(e) Identify potential drawbacks to using past performance data to evaluate portfolio managers.

Commentary on Question:
Candidates did below average on this section. Most candidates indicated that past performance does not predict future performance. However, many did not identify enough reasons to receive full points.

Potential drawbacks (at least 4 from the list below to earn full credit):

- Empirical evidence generally does not support that past performance is tied to future performance.
- Using performance data often ignores the stochastic nature of active management.
- In short evaluation periods, it is hard to tell between superior and inferior managers.
- The cost of transitioning managers and their portfolios is high when firing decisions are made, so Type II errors (wrongly firing a good manager) are costly.
- Data issues: Selection bias, survivorship bias, etc.
- Issues due to changing economic environment: market conditions are no longer the same, past strategies are no longer effective now, etc.

9. Learning Objectives:

1. The candidate will understand how to work with the variety of fixed income instruments and evaluate fixed income portfolios.

Learning Outcomes:

(1a) Demonstrate an understanding of various fixed income investments considering:

- cash flow characteristics,
- markets in which they trade, and
- underlying risks such as interest rate, credit and event risks

Sources:

Leveraged Finance Ch. 4

Commentary on Question:

This question tests CLO attributes, cash flow characteristics and underlying risks. To receive maximum points, the candidate needed to identify the features of CLO and demonstrate understanding of the mechanisms of cashflows and their corresponding risks.

Solution:

(a) Explain the four important attributes of CLOs.

Commentary on Question:

Candidates performed below average on this section. Most candidates were able to demonstrate that CLO assets are made up of leveraged loans with speculative grades and that their liability has different seniority. However, most candidates didn't clearly identify the four features of the CLOs, especially the purposes and credit structure.

The four important attributes of CLOs are: asset, liability, purpose and credit structure.

Assets are usually corporate loans, mostly leveraged loans with speculative grades. Some CLOs are comprised of defaulted or distressed loans, even investment grade loans.

The liability has detailed and a strict ranking of seniority, from equity, preferred shares, subordinated debt, mezzanine debt and senior debt.

The capital structure is usually labeled as Class A, B, and C from top to bottom. Rates ranks from AAA to unrated.

There are usually two purposes: 1) shrink balance sheet or reduce required regulatory or economic capital; or 2) arbitrage: an asset manager specializing in loans wishes to gain assets under management and the investor wishes to have the expertise of the asset manager.

9. Continued

Credit structure includes seniority and subordination of the liability, as well as credit protection such as cash flow or market value protection.

(b) Describe a cash flow waterfall with par coverage test.

Commentary on Question:
Candidates performed as expected on this section. Most candidates were able to describe the par coverage test and the order of cashflow distribution from senior to junior tranches. However, most candidates only discussed the interest cash flow waterfall without acknowledging the principle waterfall. Of those candidates that did acknowledge the principle waterfall, the majority failed to distinguish it from the interest cash flow.

Cash flow waterfall decides in which CLO creditors get paid based on seniority. There are interest and collateral principle waterfall.
Class x par coverage test = Asset par / Class x par.

Interest cash flow waterfall:
- Admin cost (to trustee and asset manager for base fee and expense)
- To Class A for interest expense
- If Class A coverage test are failed, to Class x for principle repayment until coverage test are met
- Repeat 2 and 3 for remaining debt tranches in the order of seniority.
- Reinvestment in additional collateral
- Additional fees to trustee and asset manager
- To equity tranche

Principle waterfall:
- Shortfall in the amount due in interest waterfall
- During the reinvestment period, purchase new collateral
- After reinvestment period, for principle payment based on seniority
- Amount due in step 5-7

(c) Describe the scenarios where CLO equity experiences the maximum and minimum returns.

Commentary on Question:
Candidates performed poorly on this section. Most candidates demonstrated that the CLO equity return depends on repayment of the debt obligation. However, most candidates failed to recognize that equity earns 10% at maximum and failed to recognize that no cash is paid to the CLO equity until all debt obligations are fulfilled. Further, many candidates also didn't use the numbers provided in the question to perform any calculations.

9. Continued

When asset return is 10%, CLO equity has the max return of [100*(1+10%) – 90*(1+5%)]/100 = 15.5%

Since no cash is paid to CLO equity until all debt obligation are fulfilled, to meet the debt obligation, the minimum return on asset is 90 * 1.05 /100 - 1 = -5.5%. When asset is earning -.5.5% or below CLO equity return is -100%.

10. Learning Objectives:

6. The candidate will understand how to construct and manage investment portfolios relative to a portfolio of liabilities.

Learning Outcomes:

(6a) Construct and manage portfolios of fixed income investments relative to the liabilities that they support.

(6b) Develop and critique asset allocation strategies appropriate to underlying liability profiles such as pension plans and long-tail insurance liabilities.

Sources:

Litterman, B., Modern Investment Management: An Equilibrium Approach, Ch.10

Liability Driven Investment Explained (QFIP-141-19)

Commentary on Question:

Candidates performed below average on this question. This question tested candidates' ability to construct and implement a portfolio of bonds and equities to support pension liabilities. Commentary is provided for each part.

Solution:

(a) Calculate the minimum duration of Bond Index X such that the pension plan's surplus risk requirement is satisfied.

Commentary on Question:

Candidates performed as expected on this part. Very few provided justification for why the bond index duration they calculated was a minimum. However, many candidates mistakenly tried to solve for Beta that resulted in the desired Alpha rather than solve directly for Beta. Some candidates also confused the prospective bond index with the existing bond index when applying the formula.

The equity allocation, α, that minimizes surplus risk is:

$$\alpha = \frac{(1 - \beta \frac{L}{A})(\sigma_B^2 - \rho\sigma_B\sigma_E)}{(\sigma_E^2 + \sigma_B^2 - 2\rho\sigma_B\sigma_E)} \qquad (1)$$

Rearranging for β:

$$\beta = \frac{A}{L}\left(1 - \frac{\alpha(\sigma_E^2 + \sigma_B^2 - 2\rho\sigma_B\sigma_E)}{\sigma_B^2 - \rho\sigma_B\sigma_E}\right)$$

10. Continued

Substituting in:

$$\beta = \frac{\$475M + \$200M}{\$500M}\left(1 - \frac{0.05(0.20^2 + 0.12^2 - 2(0.18)(0.12)(0.2)))}{0.12^2 - (0.18)(0.12)(0.20)}\right)$$
$$= 1.043571$$

and

$$\beta = \frac{Pension\ Plan\ Duration}{Bond\ Index\ Duration}$$

Thus $1.043571 = \frac{10}{Bond\ Index\ Duration}$, so

$$Bond\ Index\ Duration = \frac{10}{1.043571} = 9.582$$

Notice from (1) that α is increases as β decreases, or as the Bond Index duration increases. Hence the minimum bond index duration that satisfies the requirement is 9.58.

(b) The investment goal of the pension plan is to maximize the risk-adjusted change in surplus (RACS). Your client suggests the equity allocation should be doubled in order to achieve this goal.

Critique your client's statement.

Commentary on Question:
Candidates performed as expected on this part. Very few candidates attempted to calculate the equity allocation. However, quite a few did not recognize that the plan was overfunded, and even fewer realized that RACS peaked at about 30% for overfunded plans.

The plan is currently overfunded (assets are $675M vs. liabilities of $500M). The equity allocation is:

$$w_E = \frac{\$200M}{(\$475M + \$200M)} = 29.6\%$$

RACS generally peaks for overfunded plans at about 30%. The current allocation is close to that and is therefore appropriate.

10. Continued

(c) Explain the relative impact this uncertainty will have on the optimal asset allocations for

(i) domestic bonds

(ii) domestic equity

(iii) global equity

Commentary on Question:
The candidates performed poorly on this part. Very few provided reasons why the global equity allocation would increase relative to bonds and decrease relative to domestic equity. Most mistakenly prescribed an increase to domestic bond holdings, citing their high correlation with the liability which was incorrect.

Equities: In general, the allocation to equity will increase as noise increases in the underlying liability portfolio. This is because the benefit of a strong linkage between bond assets and liabilities is reduced, making the higher returns on equities more valuable from a RACS perspective. However, because the correlation between bonds and liabilities goes down, the correlation between equities and liabilities becomes more meaningful. Domestic equities are preferred for this reason. Therefore, the allocation to domestic equities will increase due to the additional value in returns and the allocation to global equity will increase relative to domestic bonds due to the additional value in returns but also decrease relative to domestic equity due to the lower correlation compared to domestic equity.

Domestic bonds: The benefit of having bonds in the asset portfolio is their correlation with the liabilities. The increased noise in liabilities reduces their value relative to equities. A lower allocation will be optimal.

(d) Your client wishes to maintain equity return levels with a lower direct investment in equities.

Design an investment strategy that will accomplish this.

Commentary on Question:
Candidates performed above average on this part. Most candidates recognized the equity returns could be replicated using synthetic equity positions. Those who did not earn full credit either did not recognize existing equity needed to be sold off, excess cash needed to be invested in bonds to hedge the liability, or both.

10. Continued

A synthetic equity position can be created to maintain equity return levels with a lower direct investment in equities. Owned equities can be sold to raise cash, which can be used to purchase relatively low-cost equity derivatives such as equity index futures or equity index total return swaps (just like owning the equity indexes, you get paid money if the index rises and lose money if it falls). The remaining cash can be used to purchase additional bonds or bond derivatives that contribute to the liability hedge.

(e) Describe three potential implementation approaches for your strategy, including the benefits and drawbacks of each.

Commentary on Question:
The candidates performed poorly on this part. Some candidates that correctly identified the implementation approaches, but few provided benefits or drawbacks. Many candidates discussed specific derivative strategies rather than implementation approaches. Some candidates merely identified the implementation methods without any description.

Single-tranche implementation:

- The trades required to implement the change are made as part of a single move or at a single point in time
- Benefits: quick, allows for quick reduction of risk or capitalization on a strong market view, appropriate for modest transaction sizes
- Drawbacks: execution prices subject to market highs and lows, may be difficult/expensive to find counterparties for large transactions

Phased implementations:

- Implements the desired portfolio gradually through a series of trades over a period of time
- Benefits: dollar-cost averaging of the positions, keeps dealing costs down through the execution of numerous smaller trades as opposed to a single large transaction, best suited for larger plans where there is less desire to de-risk immediately
- Drawbacks: more risk exposure, longer time to complete

Trigger-based implementations:

- Involves asking the manager to monitor a particular market metric and adding a pre-agreed amount of hedging if specified thresholds are reached
- Benefits: triggers can be set to meet risk management requirements, appropriate for schemes with specific buy thresholds in mind or that have a view on the future direction of markets

10. Continued

- Drawbacks: elevated trading costs, particularly in volatile markets, risk reduction is not realized until trigger is hit, requires more oversight to manage on an ongoing basis (a market view is required to determine the probability a trigger is hit, reassessment of the validity of trigger structures and levels on a regular basis)

11. Learning Objectives:

2. The candidate will understand the credit risk aspects of individual securities, portfolios, and sectors and be able to apply a variety of credit risk theories and models to the investment management process.

Learning Outcomes:

(2b) Demonstrate an understanding of and the ability to apply both the concepts and techniques used in the measurement of default risk of individual securities.

(2c) Understand and apply various approaches for managing credit risk in a portfolio setting, including the use of Credit Default Swaps

Sources:

Handbook of Credit Risk Management Chapter 13

Handbook of Credit Risk Management Chapter 20

QFIP-157-23 Quantitative ERM Chapter 12

Commentary on Question:

This question tests the candidate's knowledge of Credit Default Swaps (CDS). In particular, the question asks the candidate to analyze the relationship between the market price and the risks embedded in the credit derivative.

Solution:

(a) Explain how credit default swaps (CDS) provide protections to the buyer and why CDS is not an insurance product.

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates explained the payoff of the CDS in the event of a default and pointed out the fact that CDS is a financial instrument.

CDS pays the protection buyer when there is a defined credit event that negatively impacts the underlying asset of the CDS. It is useful as a credit risk mitigation strategy.

CDS is not an insurance product since the protection buyer and protection seller do not need to actually hold the underlying asset. The participating parties of the CDS do not have insurable interest in the underlying.

(b) Calculate the expected loss from the credit portfolio and the correlation between Y_n and Y_m,, for any n not equal to m.

11. Continued

Commentary on Question:
The candidates performed below average on this section. Most candidates calculated the expected portfolio loss correctly but did not calculate the correlation of the random variables.

Expected Portfolio loss:
E[L] = N * EAD * (1 – RR) * PD = 1000 * 100*0.1 = 10,000

Correlation between Yn an Ym:
$E(Y_n Y_m) = E\left[(\beta Z + \sqrt{1-\beta^2}\varepsilon_n)(\beta Z + \sqrt{1-\beta^2}\varepsilon_m)\right] = \beta^2$ = 0.01

(c) Explain why the Gaussian copula is not an appropriate method for calculating the market price of the credit derivative.

Commentary on Question:
The candidates performed poorly on this section. Most candidates explained that Gaussian copula is thin-tailed and symmetrical, and therefore is inappropriate to model the credit derivative in general. Few candidates considered the connection to the market price given in the stem of the question.

Given that β = 0.1, the creditworthiness between different loans is only loosely correlated.

The credit derivative covers the losses over 20000, which means that at least 20% of the underlying loans have defaulted.

Given the individual loan PD is 0.1, assuming a very low correlation between loans, the join probability of more than 20% of the loans defaulting is essentially 0.

The market price of the credit derivative is 10000. It is significantly higher than the price of the derivative calculated using Gaussian copula. With the recovery rate = 0, it implies that the market perceives that correlation between the loans are higher. i.e. the implied β >> 0.1.

Empirically, the market price shows that under tail conditions, the default probability of the loans is high correlated. The Gaussian copula has a thin tail and assumes no tail independence, which is inappropriate in the calculation of credit derivative.

12. Learning Objectives:

6. The candidate will understand how to construct and manage investment portfolios relative to a portfolio of liabilities.

Learning Outcomes:

(6a) Construct and manage portfolios of fixed income investments relative to the liabilities that they support.

(6b) Develop and critique asset allocation strategies appropriate to underlying liability profiles such as pension plans and long-tail insurance liabilities.

Sources:

QFIP-154-20: The Evolution of Insurer Portfolio Investment Strategies for Long-term Investing

Commentary on Question:

This question tests the concepts of fixed income investments relative to the liabilities that they support.

Solution:

(a) Critique the following statements with respect to risk for life insurance firms:

(i) Firm size has a significant impact on insurer risk.

(ii) Asset value can be used as a proxy for firm size.

Commentary on Question:

The candidates performed as expected on this section. Many candidates correctly critiqued on the statements and provided explanations for (i). Most candidates did not provide the proper proxy for part (ii).

(i) The manager's view is reasonable/correct.

List out either of the two reasons below can get the full credits:

Larger insurers generally hold relatively more diversified insurance productions and investment portfolios, which give large insurer greater latitude to control their risks.

On the other hand, size may be an important contributing factor for large insurers to take on more risks, particularly if there is a perception of "too big to fail", which could potentially result in a greater impact on the market and policyholders.

12. Continued

(ii) No/Incorrect/Not accurate. The size should not be solely defined by conventional measures, such just the assets.

The size should be defined by, for example, volume of transactions, exposure to off-balance sheet positions and use of derivatives.

(b) Describe additional factors that should be taken into consideration when assessing the systemic risk of insurers.

Commentary on Question:
The candidates performed poorly on this section. Most candidates listed general insurance risks (like interest rate risk) instead of the factors to consider when assessing the systemic risks. A few candidates were able to identify some of the factors, such as lack of liquidity.

Other than the size, there are other additional factors that should be taken into consideration when assess for the systemic risk. Such as interconnectedness, lack of substitutability, high leverage, lack of liquidity, complexity and opacity of the insurer, and the unintended consequences of financial safety nets should be taken into consideration when considering the systemic risk of insurers.

Full credits were rewarded to candidates who were able to list at least four of the correct factors.

(c) Explain four of the important external risk indicators for life/health insurers.

Commentary on Question:
The candidates performed below average on this section. Many candidates listed one factor, which is the interest rate related indicators. Some candidates identified the investment-related factor.

With respect to life/health insurers, important external risk indicators are: accident and health underwriting cycle, interest rate levels, investment-related products, long-term interest rates, personal income, and real estate returns

(d) Describe two types of immunization strategies, including any limitations associated with each.

Commentary on Question:
The candidates performed above average on this question. Many candidates correctly described at least one strategy. No candidate mentioned the currency matching strategy.

12. Continued

Candidates correctly described two out of three listed strategies got the full credits.

Immunization strategies consist of cash flow, duration and currency matching.

The cash flow matching strategy matches the maturity of each position in the liability portfolio with cash flows from assets. It aims to eliminate the effects of interest rate changes. However, there are several limitations to the cash flow matching strategy. First, when the timing and amount of claims are uncertain, which is particularly likely to be the case for non-life insurers, cash flow matching may not be precise. Second, cash flow matching can be costly, since this strategy requires insurers to select certain types of assets in which to invest for their cash flow needs, foregoing investing in alternative assets with higher yields.

The duration matching approach balances the duration of an insurer's assets with that of its liabilities. Duration matching aims to immunize the firm's value against interest rate changes. However, there are limitations to the duration matching strategy due to the underlying assumptions. For example, it only works accurately if cash flows are known with a high degree of certainty, only for small changes in interest rates (otherwise second order terms cannot be neglected), and only for parallel shifts of the entire yield curve. The portfolio will need to be re-immunized if further interest rates changes occur.

Currency matching approach is when asset cash flows are denominated in the same currency as the (expected) liability cash flows. This reduces foreign exchange rate risks although currency risks from unexpected cash flows will remain.

(e)

(i) Identify the factors that could lead to this false prediction.

(ii) Describe how the immunization strategy goal can be defined to help address this.

Commentary on Question:
The candidates performed below average on this question. Many candidates identified at least one factor such as the mortality deviations. Very few candidates identified all the factors. For part (ii), most candidates did not identify the correct strategy.

12. Continued

(i) Incidental deviations from mortality tables/ systematic changes of mortality not covered by the tables/ Options embedded in life insurance contracts also lower the predictability of cash flow due to the policyholder's discretion in when to exercise, for example, a surrender option or a paid-up option, that is, a possible exemption from premium payment.

(ii) The immunization strategies usually try to match the expected cash flows rather than the actual ones. Therefore, rebalancing can be helpful to close the gap between the actual and expected experience. Besides, life insures can also engage scenario analyses or stress testing with the immunization strategies to capture those risks. For part (ii), candidates need to describe immunization strategy related to either rebalancing or scenario/stress testing to receive the full credits.

13. Learning Objectives:

1. The candidate will understand how to work with the variety of fixed income instruments and evaluate fixed income portfolios.

2. The candidate will understand the credit risk aspects of individual securities, portfolios, and sectors and be able to apply a variety of credit risk theories and models to the investment management process.

Learning Outcomes:

(1a) Demonstrate an understanding of various fixed income investments considering:
- cash flow characteristics,
- markets in which they trade, and
- underlying risks such as interest rate, credit and event risks

(2a) Demonstrate an understanding of credit analysis.

(2b) Demonstrate an understanding of and the ability to apply both the concepts and techniques used in the measurement of default risk of individual securities.

Sources:

The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 1, Ch 4.

Leveraged Finance, S. Antczak, D. Lucas, F. Fabozzi, 2009, Ch 2, Ch 4.

Commentary on Question:

This question tests how an institution and all partners must deal with the exposure to credit risk of a portfolios of securities considering the rating and the risk of default.

Solution:

(a) Describe the exposure to credit risk and the source of credit risk for each party involved in the pension plan.

Commentary on Question:

The candidates performed below average on this section. Many candidates addressed credit risk associated with CLO's and bonds. Candidates that provided the list of all parties with some description of the source of credit risk involved received partial credit. A common error was not addressing the plan sponsor's responsibility to manage credit risk, even with funds outsourced.

Third party assets managed:

face credit risk exposure on behalf of their client (the pension plan), such as the loss of money from choice of investment by the asset manager.

The source of credit risk with government bonds is very low. With the CLO, the risk of credit is from lending and loss associate with repayment schedule.

13. Continued

Asset managers may be tempted to make investments that promise high returns with potential of higher risk of credit.

Plan sponsor:

The Pension plan sponsor must be an active manager of credit risk, even funds outsourced to third-party managers.
Pension funds may suffer loss of assets or poor return, which increases the unfunded liability and then the plan sponsor indirectly who may have to increase contributions.

Participants:

Credit risk borne by pension participants in the event that the plan sponsor cannot honour the fund's liabilities.

(b) The investment policy uses ratings from major rating agencies for its credit risk limits for all fixed income instruments.

Explain three drawbacks of relying on these ratings.

Commentary on Question:
The candidates performed below average on this section. Some candidates received partial credit for mentioning two elements: as the long time required to adjust the rating and the potential conflict of interest with clients rating. No candidate identified the negative publicity given to rating agencies regarding their contribution to the mortgage crisis before 2008.

These agencies are taking too long to react to adjust the ratings. Because their credibility relies on stability, they prefer to have time to fully analyze trends than react quickly.

Negative publicity for rating agencies toward the structure finance rather than corporate ratings after the 2007 crisis. The agencies recognized that they had lost their way.

These agencies are for profit and revenues which come from entities that want to be rated. These agencies are therefore under pressure to get fast and favourable rating, especially when mortgage market was booming before 2007.

(c) Explain the appropriateness of using CLOs to support pension plan liabilities.

13. Continued

Commentary on Question:
The candidates performed poorly on this section. Some candidates received partial credit by mentioning that CLO cannot go into bankruptcy or by focusing mainly on the seniority of tranches. No candidate identified that seniority with CLO's lead to lower return and its impact on the funding.

Even though CLO's cannot go bankruptcy, the cash flow structure of CLO's is dictated by subordination and seniority. This seniority translates into lower return which may affect negatively the funding.

The prepayment rate for CLO's does not match the cash flow of retired liabilities.

The recognized default of pool loans in CLO's is not stable across economic cycles. Given this variability, a rapid rise in interest rate or market downturn can result in significant losses and we can anticipate a negative impact on CLO's.

(d) To mitigate its risk exposure to asset default, ABC is considering entering into a contract with an insurance company. The contract pays the pension fund an income equal to the benefits of the members covered in exchange for a lump sum.

Describe the credit risk exposure created by the above contract for ABC.

Commentary on Question:
The candidates performed below average on this section. Most candidates received partial credit for mentioning the risk for ABC and the pension fund associated with the insurance company of defaulting on their obligation to pay the retirement benefits. A few candidates described that the plan sponsor remains liable to the funding of the pension plan. No candidate acknowledged third-party credit risk for the pension plan and sponsor for assets in the pension plan prior to lump sum payment to the insurer.

The insurer's credit risk is significant for the pension plan and the plan sponsor since the insurer guarantees payments to the pension fund for the retirees.

The insurance failing to make its obligations, then the plan sponsor remains responsible for the funding of the pension plan and liable for the payments to all retirees.

The third-party asset management risk remains only for the asset of active participants with CLO investments and government bonds prior the lump sum payment to the insurer.

14. Learning Objectives:

4. The candidate will:
   - Demonstrate an understanding of regulatory and accounting frameworks around investment governance.
   - Understand how to develop an investment policy including governance for institutional investors and financial intermediaries within regulatory and accounting constraints.

Learning Outcomes:

(4a) Describe the regulatory and rating agency contexts in which various institutions operate and how those contexts affect portfolio strategy.

(4b) Explain how investment policies and strategies can manage risk and create value.

(4d) Determine how a client's objectives, needs and constraints affect investment strategy and portfolio construction. Considerations and constraints include:
   - Capital and expected return on allocated capital
   - Risk appetite and risk-return trade-off
   - Tax
   - Accounting
   - Regulators
   - Rating agencies
   - Liquidity

Sources:

Managing Investment Portfolios chapters 1 and 3

Commentary on Question:

This question tests the candidate's ability to understand the investment policy statement and apply its principles to a given situation.

Solution:

(a)

(i) Explain what MGC's portfolio management documentation is missing that an IPS would add.

(ii) Explain how a formal IPS adds value to MGC

Commentary on Question:

Candidates performed as expected on this part. For part (i), partial credit was given for listing missing pieces of the IPS; most candidates did not explain how the missing pieces would add value to MGC. For part (ii), full credit was given to candidates who explained the value of an investment policy statement at a company level. Some candidates did not connect how the IPS adds values to MGC specifically.

14. Continued

(i) Compared to an IPS, MGC's current framework is particularly lacking around:

- Schedule for review of IPS and investment performance
  - It's important for MGC to have a schedule for reviewing its IPS and investment performance to ensure its meeting its clients goals effectively and to react to changing economic conditions
- Performance measures and benchmarks to compare performance against
  - MGC would gain from having defined ways to evaluate its performance such as performance measurement/attribution/appraisal
- Guidelines for rebalancing
  - Guidelines for rebalancing are critical to achieving investment objectives as deviation from the original investment policy can jeopardize success
- Considerations in developing the asset allocation
  - MGC may consider varying methods of constructing its asset allocation including Portfolio Optimization or tactical asset allocation. Discussing the methodology of construction in the IPS forces MGC to evaluate alternatives for the best solution

(ii) An IPS serves as a central governing document for investment decision making; this creates uniformity and agreement in how MGC will manage investment strategy reducing the risk that investment teams within MCG will act inconsistently

(b)

(i) Analyze the proposed investment strategy considering MGC's stated objectives

(ii) Construct a revised portfolio, starting with the "Current Allocation," and making exactly two 5% adjustments from one asset class into another that meets MGC's goals.

Commentary on Question:
Candidates performed below average on part (i) and poorly on part (ii). Some candidates recognized that the reallocation meets MGC's return objectives even though it is not acceptable from a regulatory and capital perspective. Few candidates arrived at the solution for (ii) with many deviating from the two 5% re-allocations that were instructed. A few candidates left this question blank.

14. Continued

(i) MGC does have a need for increased yield as its current investment portfolio is insufficient to support its inforce business (5% vs 4.53%). However, the proposed reallocation does not meet MGC's IPS objectives:
The reallocation would increase MGC's exposure into higher yielding asset classes (Private Equity and Common stock, in particular) which would help in meeting its liabilities (5% credited rate)
However, the reallocation significantly increases the surplus charge, and would require significantly more capital as it's above MGC's 950M current surplus amount. The current portfolio comes with a 7.4% surplus charge but that would more than double to 16.6% under the proposed allocation.
MGC is heavily regulated as a life insurer and must not overly expose its policyholders to risk. The suggested reallocation is too aggressive as it places a high weight into risky equity and Alternative asset classes.

(ii)

Asset Class	Surplus Charge	Yield	Current Allocation	**First +/- 5% Adjustment** (enter only +/-5% or 0% for no change)	**Second +/- 5% adjustment** (enter only +/-5% or 0% for no change)	**Final Allocation** (enter final allocation)
Investment Grade Bonds	2.00%	3.50%	65%	-5%	0%	60%
High Yield Bonds	10.00%	6.00%	10%	0%	-5%	5%
Structured Assets	2.50%	5%	5%	0%	5%	10%
Real Estate	5.00%	6.00%	10%	0%	0%	10%
Common Stock	45.00%	8.00%	10%	0%	0%	10%
Private Equity	50.00%	14.00%	0%	5%	0%	5%
Total			100%			

14. Continued

New Yield: 5%
New Surplus Charge: 9.45%
The proposed allocation increases the aggregate yield to 5% satisfying the first objective of meeting policyholder obligations which has an average credited rate of 5%. Also, while this re-allocation does increase the surplus charge to 9.45%, this is significantly less than the "proposed allocation" and is still within the regulatory surplus of 950M MGC has.

Alternatively, a few candidates proposed the following solution which also meets MGC's constraints and was given full credit:

Asset Class	Surplus Charge	Yield	Current Allocation	**First +/- 5% Adjustment** (enter only +/-5% or 0% for no change)	**Second +/- 5% adjustment** (enter only +/-5% or 0% for no change)	**Final Allocation** (enter final allocation)
Investment Grade Bonds	2.00%	3.50%	65%	0%	0%	65%
High Yield Bonds	10.00%	6.00%	10%	0%	0%	10%
Structured Assets	2.50%	5%	5%	0%	0%	15%
Real Estate	5.00%	6.00%	10%	0%	0%	10%
Common Stock	45.00%	8.00%	10%	-5%	-5%	0%
Private Equity	50.00%	14.00%	0%	5%	5%%	10%
Total			100%			

New Yield: 5.63%
New Surplus Charge: 8.18%

14. Continued

(c)

(i) (*1 point*) Explain how the current economic situation impacts MGC.

(ii) (*1 point*) Describe two actions MCG can take to mitigate its risk.

Commentary on Question:
Candidates performed as expected on part C. For (i) many candidates explained how rising inflation impacted MGC's businesses and portfolio; some candidates did not explain how the risk applied to MGC. For (ii) some candidates listed actions without any description or described two actions within the same category.

(i) MGC has an average credited rate of 5% but is now in a 7% interest rate environment; **disintermediation** risk is key here as policyholders are likely to surrender or borrow against their policy value to invest in the higher rates. This could put a strain on MGC's liquidity if there's a large surrender event.

Other acceptable solutions:

- Increasing interest rates will result in lower market values for existing fixed income positions; to the extent that MGC may experience higher liquidity needs during this period and be forced to sell positions, it would experience capital losses that could strain surplus
- While MGC is currently duration matched, a 4% interest rate movement will likely result in an Asset/Liability duration mismatch as second order (convexity) effects play out; this would result in a duration mismatch, exposing MGC to further interest rate sensitivity.

- In general, insurance companies benefit from rising rates as they reinvest at higher rates boosting margins; however, MGC has a heavy reliance on interest rate sensitive Whole Life which would incentivize policyholders to lapse under high interest rate environments. This could put a strain on MGC's liquidity

(ii) To mitigate this risk, MGC could consider expanding its life insurance line-up away from Whole life into something less interest rate sensitive i.e. Universal Life. The latter offers the policyholder greater flexibility in premium payments while allowing MGC to credit based on current market levels, reducing disintermediation risk.

Another recommendation is utilizing derivatives as a hedging strategy against liquidity/interest rate risk